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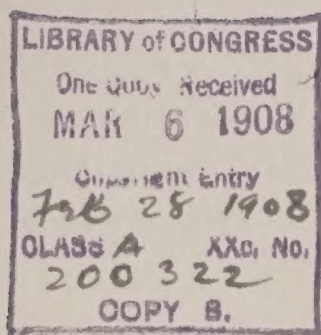
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## KEY TO PRONUNCIATION.

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ä	far, father	ñ	Span. ñ, as in <i>cañon</i> (căn'yôn), <i>piñon</i> (pēn'yôn)
ā	fate, hate	ng	mingle, singing
a or ă	at, fat	nk	bank, ink
ā	air, care	ō	no, open
ạ	ado, sofa	o or ố	not, on
â	all, fall	ô	corn, nor
ch	choose, church	ò	atom, symbol
ē	eel, we	ọ	book, look
e or ẽ	bed, end	oi	oil, soil; also Ger. <i>eu</i> , as in <i>beutel</i>
è	her, over: also Fr. <i>e</i> , as in <i>de</i> ; <i>eu</i> , as in <i>neuf</i> ; and <i>oeu</i> , as in <i>boeuf</i> , <i>coeur</i> ; Ger. <i>ö</i> (or <i>oe</i> ), as in <i>ökonomie</i> .	ö or oo	fool, rule
ẹ	befall, elope	ou or ow	allow, bowsprit
ẽ	agent, trident	s	satisfy, sauce
ff	off, trough	sh	show, sure
g	gas, get	th	thick, thin
gw	anguish, guava	th	father, thither
h	hat, hot	ū	mute, use
h or H	Ger. <i>ch</i> , as in <i>nicht</i> , <i>wacht</i>	u or ũ	but, us
hw	what	ù	pull, put
ī	file, ice	ü	between u and e, as in Fr. <i>sur</i> , Ger. <i>Müller</i>
i or ĭ	him, it	v	of, very
î	between e and i, mostly in Oriental final syllables, as, Ferid-ud-din	y	(consonantal) yes, young
j	gem, genius	z	pleasant, rose
kw	quaint, quite	zh	azure, pleasure
ñ	Fr. nasal <i>m</i> or <i>n</i> , as in <i>embonpoint</i> , <i>Jean</i> , <i>temps</i>	' (prime), " (secondary)	accents, to indicate syllabic stress







# THE ENCYCLOPEDIA AMERICANA

**P**aint consists of colors or dyes so mixed with oil, glue or water, as to spread easily over a surface, and retain its brilliancy after drying. It is usual to add a dryer, and a solvent or thinner to paints before using them. The vehicles employed in painting are various, but the principal oil used in oil-painting is that which is obtained from flaxseed. This linseed oil is purified by settling for about four months in tanks with a temperature of 70° F. Dryers are employed to harden the painted surface before it can become dimmed by absorbing the dust with which the atmosphere is charged. To make a successful dryer, lead and manganese compounds are dissolved in oil, which thus becomes oxygenated. They absorb oxygen from the air, and transfer it to the oil, which thus becomes solidified. The opposite agents to these dryers are the solvents, the best of which is turpentine. The advantage of using turpentine is that, as it is slow to evaporate, it keeps the paint long enough moist to allow of the brush marks sinking and flattening out into a smooth surface. Paints can be rendered to a high degree fire-proof by mixing with them boric acid or a soft and readily fusible glass. The heat melts the boric acid or the glass which forms an air-proof sheath to the wood or other substance so painted, and thus protects them pretty efficiently from the flames. The most permanent of blues is ultramarine, while Prussian blue and indigo are apt to fade. Cobalt, however, is the most lasting of all blues. Among the reds the only really unchanging colors are vermilion and the ochres; madders, carmines, and crimson lakes are likely to fade, the last two very rapidly. Oxide of chromium and terre verte are the only permanent greens; Naples yellow, raw sienna, cadmium, and yellow ochre the only stable yellows. Madder brown and Vandyke brown will fade, but raw and burnt umber and burnt sienna retain their tint forever. All the known blacks and whites are durable excepting when the latter are adulterated with chalk or other impurity. See COAL TAR COLORS; COLOR-

ING MATTERS; DYES; LUMINOUS PAINT; MINERAL COLORS.

**Paint, Oil, and Varnish Industry.** The art of mixing colors to produce the almost innumerable tints used in painting at the present time has been an evolution of the 19th century, and has developed with the increased demand for the article. In the making of paints there are two essentials, the pigment and the vehicle, the former composing the body or solid substance ground to a fine powder which is mixed with the latter, or the liquid component, which determines the character of the paint whether oil-paint or water-color. The mixing materials are varied according to the requirements of the work; for water-color drawings and for some kinds of decorative work, gum, glue, size, or other adhesive materials, dissolved in water, are more adaptable; while for oil paintings, the painting of buildings, or for any outside painted work exposed to all kinds of weather, linseed oil, boiled with the sulphate of lead or zinc, or with acetate of lead (sugar of lead), is found to be superior. For indoor work plain linseed oil and oil of turpentine are used; for artists' colors, fine linseed or nut oil is more commonly used, unboiled and in small quantities, and to dilute them, turpentine is generally employed. As before stated the most common vehicle used in oil paints is linseed oil because of its property of oxidizing to a resinous body, which holds the paint in a firm water-proof varnish.

Prior to 1850 all paints were mixed just previous to being used but later a system of mixing paints at a factory was introduced whereby the paints were put up in cans ready for instant use, at the same time the pigment was prevented from settling in the bottom of the can by the mixing in of an emulsion which held it at all times thoroughly mixed with the other ingredients. The first paints ready for use were made in 1852, and were tinted colors in paste form. About 1857 carmine was made from cochineal by D. F. Tiemann & Company, and in 1860 they followed this with a blue which was soluble in water, for use in laundries, and in the same year began the manufacture of quicksilver vermilion.



PAINTED QUAIL — PAINTING

In the making of water colors gum, glue, or size mixed with water are most generally used. Kalsomine, the most common of the water-colors, is a mixture of prepared chalk with a solution of glue and ultramarine to offset a yellow tint for white. Silicate of sodium (soluble glass) and naphthas and tars, both coal and wood, are used as vehicles for water-color paints.

The paint industry in the United States started in New York City, in 1715, when linseed oil was put on the market as an article of commercial value. This first mill was closely followed in 1718 by one in Connecticut, erected by John Prout, Jr. Later in 1750 the Dunkers, in Lancaster Co., Pa., started the industry and by 1786 had four mills in operation. While paint had been used many years before the linseed-oil industry was started, yet its manufacture added a great stimulus to the use of paints because it aided greatly in the manufacture of paints and varnish and later became a necessary adjunct to the business.

White lead was first successfully made and used commercially in 1804, by Samuel Wetherill, of Philadelphia. This was followed in 1806-7 by the manufacture of different colors, such as rose-pink, Dutch pink, blue, and French green, the inventions of Anthony Tiemann; in 1809 Prussian blue was first put on the market; and later William Guest, of Baltimore, started in to make chrome yellow. Many colors were added to the list in a short time, by 1811 as many as 22 being made in Philadelphia alone, and beside the firms which made these there were also three red-lead factories in Pittsburg, which annually produced goods valued at \$13,000. From that time the growth of the industry was rapid and healthy. Brooklyn and New York each had several large works turning out red and white leads, chrome, and various other colors; the manufacture of Prussian blue was started in Rensselaer Co., N. Y.; and during the next few years factories sprang up in all the large centres of trade, notably Albany, Boston, and Philadelphia.

In 1850 deposits of zinc ore were discovered in New Jersey, and this turned the attention of the manufacturers to an article, which though of an inferior body and opacity to the better qualities of white lead, was recognized as a valuable substitute for white lead as a body for paints. Mineral paints at this time also came into use, the demand for them being great because of their fire-proof and indestructible qualities. As a record of the progress of this industry the following figures are interesting:

	1900	1880
Number of establishments.....	419	244
Capital.....	\$42,501,782	\$13,555,292
Salaries, officials, clerks, etc...	2,512	.....
Salaries.....	3,077,318	.....
Wage-earners .....	8,151	4,483
Wages.....	\$3,929,787	\$2,132,255
Miscellaneous expenses.....	\$3,430,061	.....
Cost of material used.....	\$33,799,386	\$17,062,552
Value of product.....	\$50,874,995	\$23,390,767

The manufacture of oil and varnish necessarily developed along with the paint industry. The first factory established in the United States for the manufacture of varnish was founded by

P. B. Smith, in New York City, in 1828. This was followed in 1830 by Tilden & Hurlbert; in 1836 by the firm of Smith & Price of Newark, N. J.; and later by Christian Schrack, of Philadelphia. The quality of the varnish made by the American manufacturers soon became widely known and a large export business was built up, the increase in the manufacture of paint and varnish greatly affecting the oil-mills. Prior to 1836, domestic seed had been entirely used in these mills, but with the increased use of paints and varnish and with the introduction of new and improved machinery, outside markets were invaded by the American traders for the purpose of obtaining raw material for use in the mills of this country, and in 1836 the first cargo of flaxseed was imported from Sicily. Other trading points were rapidly opened up, Odessa, Alexandria, and Calcutta, being the most important. By 1860 there were several factories for the manufacture of varnish in the Eastern States and three had been established west of the Alleghanies and since that time the growth of this industry has been remarkable as shown by the following figures:

	1900	1880
Number of establishments ....	181	81
Capital.....	\$17,550,892	\$3,778,100
Salaried clerks, officials, etc...	1,198	.....
Salaries.....	\$1,939,333	.....
Wage-earners.....	1,546	573
Wages.....	\$995,803	\$366,716
Miscellaneous expenses.....	\$1,616,642	.....
Cost of materials used.....	\$10,939,131	\$3,699,684
Value of product.....	\$18,687,240	\$5,721,174

In 1900 the exports of paint amounted to over \$1,000,000, having risen from \$20,000 in 1835, and the varnish exported in 1900 amounted to over \$600,000, showing that American colors are found in many foreign markets. See PAINT; VARNISH; LINSEED-OIL INDUSTRY; COTTON-SEED-OIL INDUSTRY; COAL TAR COLORS; COLORING MATTERS; DYES; LUMINOUS PAINT; MINERAL COLORS, ETC.

Painted Quail. See QUAIL.

Painted Terrapin or Tortoise. See TURTLE.

Painting, in the fullest meaning of the word, signifies the application of color to any surface, for the purpose of making it more attractive to the eye, or as a preservative of the substance painted, but in this article the word is restricted to the art of painting, that is, the art of representing objects, real or imaginary, on a flat or nearly flat surface by the use of designs in line and color. The origin of this art, like that of several others known to civilization, is lost in the mists of those prehistoric ages on the banks of the Nile which the researches of modern Egyptologists have pushed back, apparently, to the distance of 80 centuries. Some few traces of it among the unknown autochthonous races who preceded the long lines of the dynasties of Upper and Lower Egypt have been but recently assigned to their proper sources; the art of the dynasties of the Pharaohs and the Ptolemies, notwithstanding their duration by centuries, presents certain striking characteristics which distinguish it from all others. It was strictly a conventional and symbolic art, largely



## PAINTING

an official art, devoted to the service of the monarch and of religion, and, within these limits, a decorative art. Sculpture was subservient to architecture, and painting—except on the walls of the tombs and in the papyri—to sculpture. Our knowledge of painting is derived from the very numerous examples preserved on the walls of the temples and the tombs, on the mummy cases and the sarcophagi, on the funeral tablets, and the illuminations and vignettes on papyrus and linen. The conventions in which the art remained bound—with but few exceptions—were established in the earliest ages; they embraced all design, religious and secular, requiring that human figures and those of animals should be represented in profile, defined by an outline, and in flat color; for landscape and architecture there was adopted a curious and ingenious combination of drawing, both in ground plan and in elevation, to express the scene in the simplest and clearest manner possible. The background was left blank, or filled with a flat tint; the required lucidity and directness of expression forbade the use of linear or aerial perspective, or any attempt at modeling or variation of the conventional local color. On the inner and outer walls of the temples the outlines were incised, sometimes very deeply,—the figure within these outlines frequently rounded down to the bottom of this incised outline; on the walls of the tombs the painter replaced this outline with one made by his brush. He worked directly on a coat of white stucco, applied over a rough-cast to conceal the joints and the roughness of the masonry wall; of colors—derived mostly from mineral sources—he had, at the most flourishing period of the art, as many as 18 or 20, as we know from wooden palettes of the 18th dynasty, which have been found. These colors were mixed with water and gum tragacanth, possibly with honey; some mummy cases of the later dynasties have been painted in encaustic, and in some cases the eyes and eyebrows of the mummy masks are in enamel. These colors have retained their brilliancy to a remarkable degree through the ages; very few of the paintings are cracked. The artist worked with brushes of reeds or rushes, the ends of which were soaked in water until their fibres separated, and they were adapted to the finest and most delicate work. In the papyri—as in the many hundred copies of the Book of the Dead extant—the illustrations stretch along the top of the page, like head-pieces, or are inserted as vignettes, or initials, or full-page pictures. In many cases they are merely outline sketches in black or red. In general, figures of men are colored a dull red and those of women a light yellow, the gods and the genii of the dead may be of positive greens and blues, and the animals are frequently spotted. The colors are always pleasing and harmonious, and on the largest wall spaces a comprehensive and well sustained color-scheme is frequently found, designed and carried out with true artistic skill. On the outer walls, exposed to full sunlight, and in the deepest recesses of the tombs, the colors are most vivid; in the intermediate chambers of the tombs they are more quiet and discreet, to suit the tempered light. (See EGYPT.)

*Greek and Roman Painting.*—In the middle of the 6th century before Christ Greek painting was technically no farther advanced than that

of Egypt or Assyria. Greek writers speak with the same enthusiasm of the works of their great painters as of those of their sculptors, but it is only by these descriptions, and by some supposed copies and adaptations in the work of the craftsmen, mural painters and mosaicists, of the decline of the art under the Roman domination, that we can form some definite conception of these masterpieces. It is noticeable that the rhetoricians are especially impressed by the ability of the painters to represent objects so naturally as to mystify the spectator. The development of the art through its various phases can be fairly well traced in the wall paintings discovered in Etruscan tombs; it practically embraced all subjects, mythology, history, scenes from daily life, landscape, marines, portraits, animals, tragic and satirical representations, still-life, ornament and decoration, and miniatures. Composition, order, linear and aerial perspective, chiaroscuro, a knowledge of the human figure extending to foreshortening, action, expression by gesture and by countenance, all were included. The color work was even extended to the tinting or painting of statues (though there seems to be no proof that the Greeks colored the nude parts of their marble statues) and to the moldings, triglyphs and other ornaments of their architecture. Praxiteles (q.v.) when asked which of his works in marble he valued the most, replied: "Those on which Nikias (the painter) has set his mark."

In Pompeii, the painted portions of the temples are always finished in stucco or plaster. Portrait painting was apparently more in favor among the Romans than among the Greeks. The long series of painted vases—from the earliest examples of the "Pelagic" or pre-Homeric period down to the disappearance of the art about 65 B.C.—was but one of the features of this comprehensive school of painting. The only examples of easel pictures which have been preserved are a few small paintings on marble and slate, found in Herculaneum and in Etruscan tombs.

Apelles introduced the use of a glaze or varnish over the completed tempera painting. In the latter, the colors were tempered with a glue, a gum, honey, white of an egg, juice of the fig, milk, or other glutinous substance, soluble in water, that served to bind them; or with wax or some resin, when these materials had been rendered by any means vehicles that could be worked in water. In tempera painting (see TEMPERA), colors were applied to the dry wall; in fresco (see FRESCO), to the wall while the plaster was still wet. Both methods are found in Pompeii; the backgrounds always in fresco and, generally, the architectural framing and ornaments; the small figure panels in the centre are generally painted in tempera on the fresco background. In fresco, no colors except earths were used, and these were protected by an encaustic varnish, which also served to give them more brilliancy. Encaustic painting was used only for pictures on tablets or on canvas; in this process naphtha, or spirits of turpentine, or any volatile, ethereal oil that will evaporate, leaving the wax colors firmly fixed, can be used as menstrua to liquify the wax. In the usual method, when the colored sticks of wax and resin have been melted over a fire the colors are applied broadly with a brush and then blended by means of a metallic



## PAINTING

instrument, a spatula or cestrum (generic name *cauterium*), at times used very hot. The same instrument is used to finish the painting by taking, while still hot, cold wax colors and blending and grading them on the first painting. The colored sticks of wax and resin, softened by the addition of an oil, may be applied from a hot palette with a brush and then melted and modeled with the cestrum. The same sticks, softened by the addition of an oil, may be used directly, like crayons of pastel; or, when dissolved in an essential or volatile oil, applied with a brush; but these two methods, not involving the use of heat, are not, strictly speaking, encaustic painting. In all cases, the ancients prepared their walls very carefully before painting, the final surface receiving a firmness and consistency almost equal to that of marble. Their colors were almost exclusively mineral, the only animal substance known being the slimy matter of the purple snail, mixed with chalk,—this purple unknown to the modern palette.

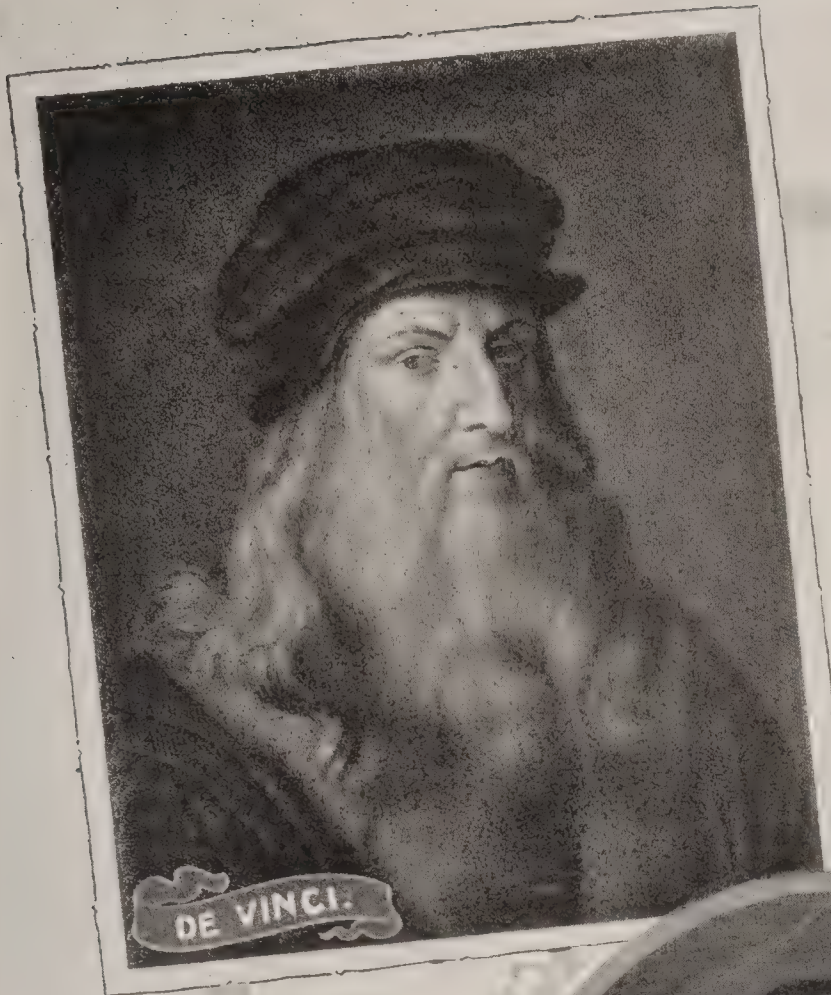
*Byzantine and Early Mediæval.*—The influence of ancient art on that of the early Christians was long in disappearing—notwithstanding the widely divergent tendencies of the new religion. Inheriting the Jewish aversion to idolatry, and to works of material imagery, the Fathers of the Church declaimed against all artists,—Tertullian denounced them as persons of iniquitous occupations. The paintings and decorations in the Roman catacombs—rediscovered at the end of the 16th century,—especially those in the earliest cemeteries, bear a great resemblance to the ancient wall paintings. Orpheus playing on his pipes reappears as the youthful and beardless Christ surrounded by his sheep, and Hermes Kriophoros, carrying a ram on his shoulders, as the Good Shepherd. The bearded type of the Saviour, with which we are familiar, was not generally adopted till later, in the earliest mosaics. As the Church increased in numbers and power the primitive prejudices disappeared, but early Christian painting shared in the general decline of all the contemporary art of the Empire. Occasional efforts were made by the emperors to check this decadence, by Constantine and by Valentinian, Valens and Gratian in the 4th century; and in the 5th, by Theodoric at Ravenna, the capital of the Ostrogothic kingdom in Italy. The first mention of church painting is found in a canon of the council held at Illiberio (Granada), Spain, about 305 A.D.; but the mediæval wall paintings have nearly all disappeared,—very largely by conflagrations. Our insufficient knowledge of the early mediæval painting is principally derived from the mosaics, the most important being at Ravenna and Rome, and from the miniatures and the illuminated manuscripts. In Byzantium, the mosaic wall decorations were not confined to the churches but were also employed to celebrate the deeds and the power of the monarchy, as in the Chalkê, the great state hall of Justinian's palace. With the establishment of the Lombards in Italy, the ideals, the freedom and spirituality of both the Church and its art, fell into even stricter bondage. The subject of the Crucifixion first appears in painting in the latter part of the 6th century, the figure of the Saviour frequently clad in a long purple robe, and sometimes wearing a regal crown. The classical period of early Christian art came to a

close with the outbreak of the Iconoclastic schism, in the beginning of the 8th century.

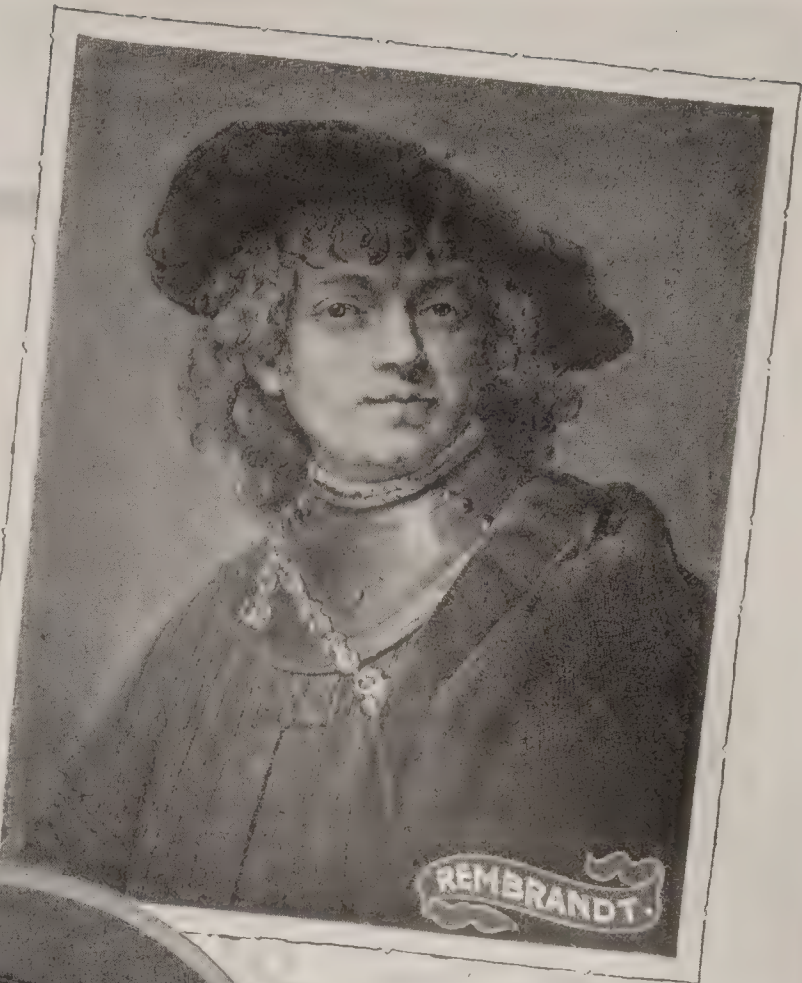
The mediæval style was formed by the gradual union of these classic traditions with the hereditary art of the Western barbarians conquered by the Empire or who overran it. Each of these races contributed an individual note,—the Irish monks excelled in illuminating manuscripts, their art being continued by the Anglo-Saxons; under Charlemagne mural painting, both sacred and profane, was greatly in favor, though nothing now remains save miniatures; but these primitive impulses did not extend south of the Alps until the Romanesque period, ending in the 13th century. The first indications of Gothic art appear in the miniatures toward the close of this period,—in the angular and broken folds of the draperies, indicating that tendency which was to “govern the human sense of form in all its modes of expression, down to handwriting inclusively.”

*Later Mediæval-Gothic.*—It was in France that Gothic architecture took its origin; and there, too, that the other arts took the lead in Europe, in the middle of the 12th century. Painting gradually escaped from the domination of the priestly order; the painters became specialists, working exclusively at mural paintings,—particularly so in the northern countries. Hence, a certain growth of individuality of conception, a tendency toward subtlety and mysticism, an attempt at realism, including study from nature,—the whole, as yet, much hampered by tradition. After the middle of the 14th century there appeared very definite signs of an appreciation of the full capacities of the art of painting and serious attempts to realize them. In this art, including miniature painting in books, France took the lead, as she had done in architecture. The development of Gothic architecture, as it diminished the spaces for wall paintings greatly increased that of the windows, and thus gave a great impetus to the noble art of glass painting (q.v.). In the 14th century, distinct schools of painting begin to appear, as, in Germany, those of Prague, of Cologne, of Westphalia, etc., and even the names of individual artists become known; the panel paintings of the French and the Flemings bear a general resemblance to those of the Lower Rhine; but in Italy the art, both in conceptions and in technical methods, followed distinct national lines,—preparing the way for the Renaissance. Foremost among these precursors were the Tuscans, Niccola Pisano (q.v.), the sculptor, and Giovanni Cimabue (q.v.), the painter. The first great epoch in modern painting is considered to have been that signalized by the mature works of Giotto di Bondone (q.v.) (1276–1336), a pupil of Cimabue, who was acclaimed by his contemporaries as the greatest genius in the arts of Italy. To their astonished eyes, Giotto's power of presenting objects naturally was so great that “the thing itself” was reproduced. With this he combined a great command of the arrangement and execution of monumental mural painting, and a freedom from the traditions both of the Byzantine manner and the Northern Gothic, while reproducing in his works many of the decorative ideas of the ancients. Chief among his followers was Andrea di Cione (q.v.), called L'Arcagnuolo, or, in the contracted form, Orcagna. The painters of the school of Sienna ranked almost in importance

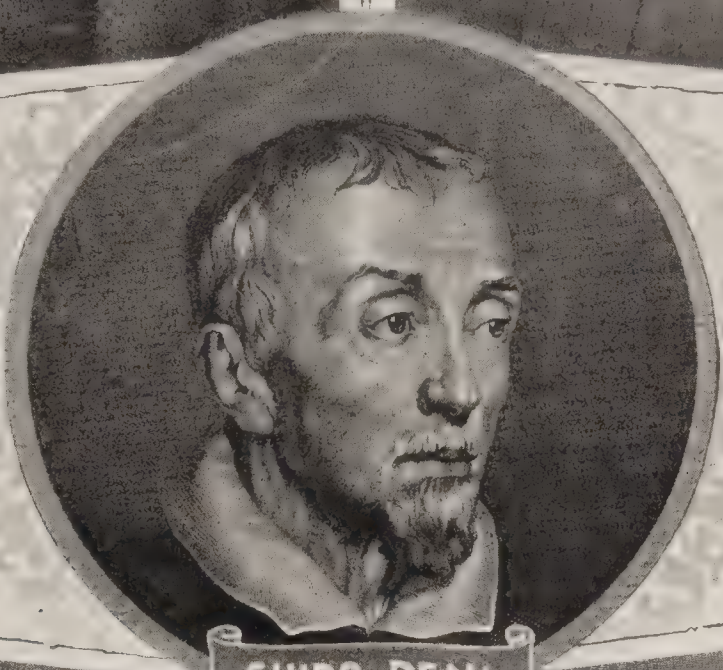




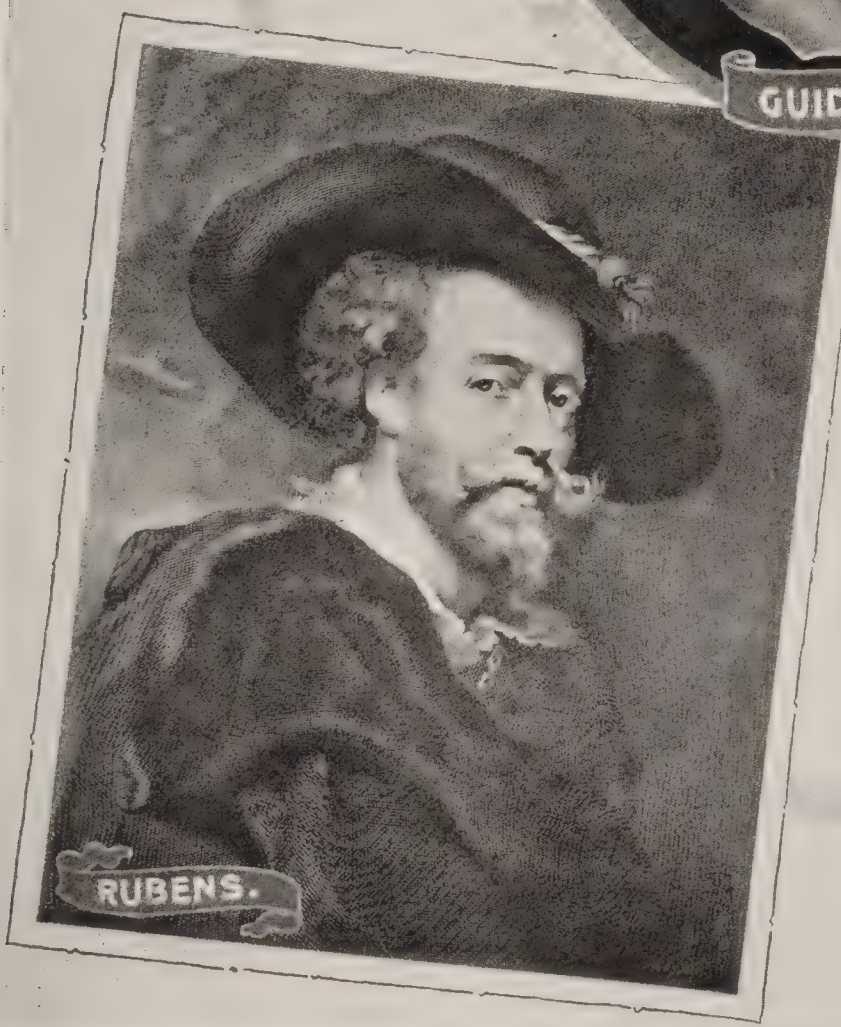
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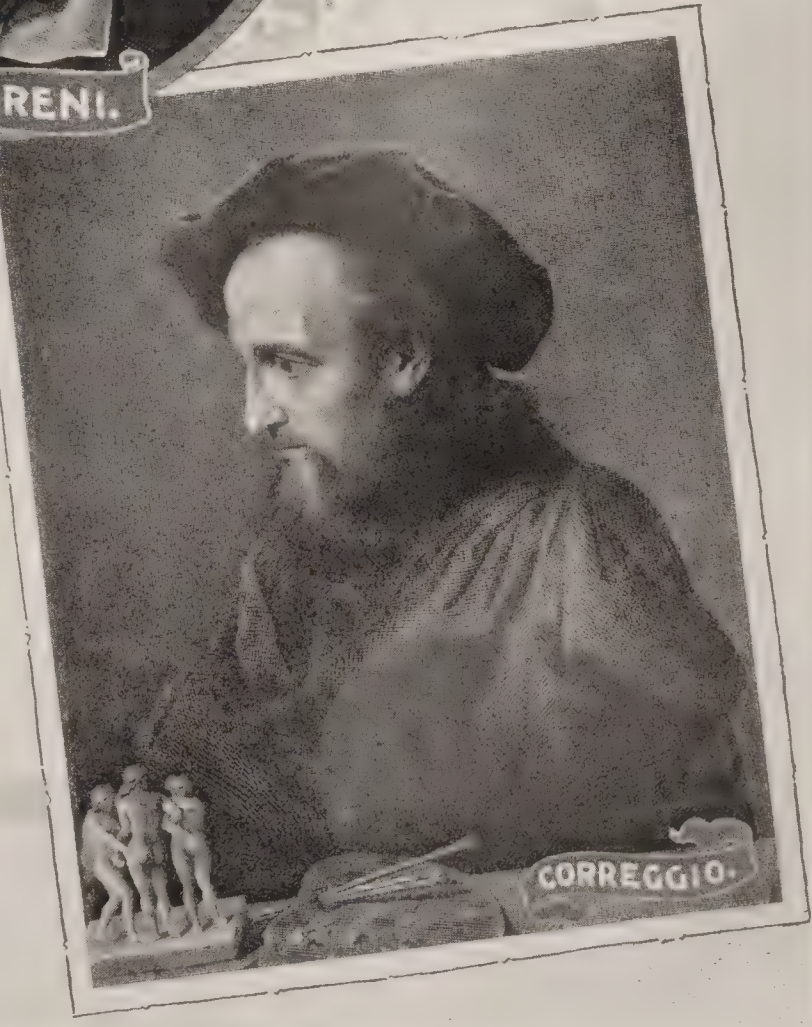
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## PAINTING

with those of Florence; and in the Campo Santo of Pisa are still preserved some of the greatest monuments of fresco painting, executed by various artists, of this closing period of the Middle Ages.

*China and Japan.*—The technique of the art of painting in China and Japan is founded primarily on the caligraphic dexterity which was the chief ideal of the older Chinese painters and their Japanese followers, and which is still held in high honor. The ancient art of handwriting was based upon a system of representing or symbolizing the thing indicated, and both it and the art of painting were fettered by traditions that were as binding as those of Egyptian art. Linear design has remained the important element even in painting, the outline being always retained. As an art primarily decorative and suggestive, and not realistic, its fundamental principles differ widely from those of all the European schools. The Japanese themselves compare their art of painting—which they consider the richest and most important, the most intimate expression of the national character—to “sketching.” (*La peinture japonaise a la caractere d’une esquisse*, says the official work published by the Japanese Imperial Commission at the Exposition Universelle of Paris, 1900.) As a *sketch*, or, rather, as a work in which only the essentials are retained—appealing to more artistic and more intelligent taste than the finished realistic picture,—these paintings dispense with careful definition, with chiaroscuro and perspective, qualities neglected by both the Chinese and Japanese masters in their search for idealistic design and decorative feeling. The care bestowed upon the line leads to a very skilful characterization and suggestiveness in design,—marred by the limitations and conventions of both national arts; the generally tempered and restricted color-scheme permits of the most subtle and beautiful tones, and of a very artistic rendering of aerial perspective in the landscapes, especially in the Japanese. The painter does not hesitate to leave his canvas or his paper untouched in spots so as to concentrate on the principal motif; he is in search of an abstract beauty, not of that of the individual—in accord with the Buddhist principle of the social development rather than of that of the individual. This is peculiarly true of the Butsu-yé, or picture of the true Buddhist school, which is distinguished from the works of the secular artists by certain distinctive qualities. In China, notwithstanding the number of epochs which the art of painting has traversed and the varying influences to which it has been subjected, it has retained throughout a general unity of principles. The Japanese claim that in deriving their art from the Koreans, the Chinese and the Hindus, they have bettered their instructions and given their own style to the art,—a greater charm and subtlety of line, a greater delicacy and beauty of tone in the color. Both nations refer the origin of their art to a legendary era, the Japanese claiming 13 centuries of duration, and the Chinese historians ascribing the invention of painting to Che-hoang, minister of the Emperor Hoang-ti, in the 27th century before Christ, contemporary with the introduction of writing by Tsang-hie—these two personages considered by some authorities to have been identical. No satisfactory record of an individual painter, however, appears before

the 3d century A.D., nearly 200 years after the introduction of Buddhist pictures and images from India. According to an ancient Japanese writing, the history of pictorial art began in that country in the reign of the Emperor Yuriaku (457–479 A.D.), introduced by a Chinese painter of royal descent, Nanriu or Shinki. It is probable that Japanese art took its real birth at the period of the introduction of Buddhism in the middle of the 6th century.

*Persia and India.* It was from China that Persia originally derived the arts of architecture, painting and ceramics; for the second of these, the general principles and the technical methods, even to the vellum upon which the paintings were executed, were Chinese. Later, many of the elements of the art were adopted from that of the Arabian Caliphate, an art which had been born in Egypt and developed in Syria. Under the dynasties of the successors of Genghis Khan (1199–1335 A.D.), painting in Persia assumed definite forms and characteristics; indeed, it is asserted to have been borrowed from Turanian, Dravidian, Greek, Sassanian, Mongol, and European sources. During the Mahommedan domination its influence was extended to India, where it succeeded the native traditions. The art of the two countries under the Mongol emperors was practically the same; in both, the ancient mural paintings having almost completely disappeared, it is preserved only in the miniatures. Modern Hindu painting and sculpture are both in lamentable decadence; the former, never having even undertaken to represent nature, is content with traditional and decorative formulas.

For painting of Europe after the close of the Mediæval epoch, see RENAISSANCE PAINTING; POST-RENAISSANCE PAINTING.

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*Author* ‘Chefs d’Œuvre Expo. Universelle 1889.’



## PAINTING, EDUCATION IN

**Painting, Education in.** The education of the painter is to-day altogether different from what it was in the Middle Ages and the Renaissance, and this difference is largely dependent upon a different conception of the social status of the artist. In the mediæval world the painter was a craftsman, like the carpenter or the smith. The individual artist might rise to some eminence and consideration, but as an artist he was a member of a mechanical trade which no one would have thought of putting on a level with the learned professions. To-day the painter, the sculptor, the architect, is a professional man, like the lawyer or the doctor, and his education is planned, as nearly as possible, on the lines of theirs. As long as the artist was considered a tradesman he was educated like a tradesman, that is, by apprenticeship to a master of the craft. In a modified form this apprenticeship system was in force as late as the 18th century, but its character can best be understood by considering it as it was practised in the 15th.

In the 15th century, then, the master painter kept a shop, a bottega, which differed in no essential particular from the shop of any other tradesman, and his business was to supply anything that was wanted in the way of painting, from the ornamentation of a chest or the painting of a sign to the production of an altar-piece or the frescoing of a palace wall. He maintained a force of journeymen and apprentices, and it was no more expected that he should produce with his own hands everything which left his shop than it was expected that the master joiner should saw every beam or the master mason lay every stone. To such a master a boy who showed any disposition toward art was bound out, at the age of 12 or 13, for a term of years. He was to give his services in any capacity in which they were available and a sum of money was paid the master, who, in return for this premium and service, engaged himself to teach the boy his trade. The apprentices swept out the shop, ran errands, waited on customers, ground colors, prepared canvases and panels, pricked cartoons and pounced them upon the wall, set the palette and cleaned the brushes of the master. At odd times they copied the master's studies, and always they watched his methods and learned how he did things and by what succession of processes a picture was produced. At the end of his term of apprenticeship the boy had learned enough to be useful and was worth a wage. He became a journeyman, and was free to stay with his master or to engage himself to another. At this stage of his evolution he was intrusted with more important work, painted backgrounds or draperies from the master's studies, made studies himself for the less important parts of pictures, finally painted entire pictures himself under the master's supervision and on the master's account—pictures which were almost indistinguishable from the master's own and were frequently signed by him before delivery to the customer who had ordered them.

If the young painter were unambitious he might remain at this stage all his life. If he were determined to be a master in his turn he probably traveled a little and engaged himself to this or that more celebrated master that he might study other methods than those he had

learned, pick up other traditions, and familiarize himself with the best work that was being done in his art. When he could do what his masters did as well as they did it, and hardly until then, he was ready to observe nature for himself, to allow his own temperament to influence his work, to become, perhaps, a creator and an innovator, and to teach others all that he had been taught and all that he had learned for himself, so that they might begin, as nearly as possible, where he left off.

The typical education of a modern painter is as different from this as possible. He begins his special education later than did the mediæval painter, having spent some years in ordinary schooling, perhaps, even, in securing a college training. He may have done a little desultory drawing during this time, but, about the age of 20 or later, he decides to become a painter and begins his serious education in art. He begins it not as an apprentice, but as a student; not in a shop, but in a school. If the school is a great state institution or one connected with a university it will afford lectures on the theory and history of art, to which, likely enough, he will pay little attention. It will be in a great city where he will be able to visit museums which have gathered together the art of many ages and many countries and to see exhibitions where almost as many methods of work are exemplified as there are individual exhibitors. Even in default of museums and exhibitions he will infallibly have access to many cheap publications which, by some of the applications of photography, will give him a fair idea of the results attained by the art of the past and the present; of its methods he will know nothing. Meanwhile, he will be set down before a plaster cast or a living model and bidden to draw. He will be more or less thoroughly grounded in anatomy and perspective and other sciences, above all in the science of aspects, but he will have practically no instruction whatever in his craft. His canvases and colors, like his brushes, he will buy ready made. His master he will see twice a week, for a few minutes, and that master's criticisms will be directed exclusively to the justness of his observation and the truth of his rendering of nature. The master's own work will be carried on in another place, in quiet and in solitude, and the student will know nothing of it except, now and then, to see the completed picture. The more intelligent and conscientious the master the less likely he will be to attempt real technical instruction, for he will feel that his own methods are tentative, suited to himself alone, and of doubtful validity or permanence, while he will be hampered by our modern respect for individuality and the fear of destroying something more precious than anything he can supply.

After three to five years work on this system our student will be able to draw with fair accuracy anything set before him, to distinguish its values, even to copy its color with some approximation to success. On the other hand he will have exercised little either his invention or his memory, will be entirely in the dark as to what he wishes to do with his acquired science, and will have practically no knowledge of the thousand and one processes that go to the production of a picture. Likely enough he will never have made a tracing or squared up



## PAIRING — PAISLEY

a sketch; almost certainly he will never have arranged a drapery; quite certainly he will, no more than his master, know anything of the proper management of oil colors, of the use of vehicles, or of the composition and permanence of pigments. For a time he will try to do outside the school what he has always done in it, and will be surprised that no one cares for the result. Then it will perhaps dawn upon him that he has learned a science, but not an art, he will flounder and experiment, and, if he is a man of force and originality, he will invent an art of his own and methods that will somehow serve his needs. If he is of a cool and logical mind he will recognize that his training was vastly better than none and will, in default of a better, recommend it to others or help to give it to them. If he is of a warm and emotional temper he will condemn it as useless or worse and tell those who consult him to get along without it.

It is obvious that the results of these two educations must differ as greatly as the conditions which produced them. The modern painter may readily be a man of broader culture and wider outlook than the painter of the Renaissance; with anything like the same original force he will probably be a more personal and individual artist; he will certainly know a great deal about the aspects of nature that the Renaissance painter never dreamed of. Just as surely he will be the inferior of the Renaissance painter as an efficient workman, will rarely attain complete mastery of his tools, and will try to substitute the charm of his personal sentiment and his individual view of nature for that assured rightness which comes of an accepted body of traditions and the possession of tried methods. What modern art has gained in variety and in the perception of new truths it has lost in weight and coherence. Each artist works in his own way for the attainment of self-expression and does little toward the building up of a great school.

It is easier to see the weakness of modern education in painting than to devise a remedy, and those who are most opposed to the modern academic system seldom suggest anything to take its place. There are many reasons why the old apprenticeship system could hardly be revived. There are such multitudes of students to-day that it would be impossible to find masters for them, and our masters have, in general, nothing for apprentices to do. They are no longer at the head of great workshops, turning out a multiplicity of diverse products. Each is engaged in a more or less narrow specialty, producing work which is valuable only as it possesses his personal quality and exhibits his personal touch, and his patrons would resent the intrusion of any hand but his own as little less than commercial dishonesty. The modern student, also, knows too much of the art of all times and countries to choose a single master and docilely follow his teaching. It is doubtful if modern conditions have not rendered forever impossible anything like a local school of painting.

The conditions of mural painting do, indeed, entail something like the old apprenticeship system, and in the growing demand for the decoration of public and private buildings there is a hope for the revival of older methods of education. It is recognized that a decorative

painter may properly have a corps of assistants, and while these assistants are not likely to be mere beginners, but will already have had an academic training, they are enabled to supplement it with the practical instruction of a master in the methods of creating a work of art. How far a similar instruction can be engrafted on our academic system is the problem that should most seriously occupy the directors of our schools of art. The rigid discipline in drawing and painting from nature need not be relaxed—in its way it is admirable and should be strengthened rather than weakened—but it should be pointed out that the ability to imitate form and color is a tool, not an end, and that the creation of a work of art is something different from the production of a life-study. The student should be encouraged to train his imagination and his memory as well as his eye, and it would be well if some knowledge of technical processes could be conveyed and the pupil encouraged, as soon as he is at all fit, to attempt the actual creation of a work of art, under the guidance of the master. Meanwhile it should be insisted upon that the education of eye and hand can hardly begin too early, if technical mastery is to be attained, and that we must be willing to sacrifice something of the education of a gentleman to the education of a painter. See, also, ARCHITECTURE, EDUCATION IN; SCULPTURE, EDUCATION IN.

KENYON COX.

**Pairing**, in legislative and other assemblies, a practice by which two members belonging to opposite parties or factions agree that both shall be absent for a specified time, or that both shall abstain from voting on a particular question. Thus a vote is nullified on each side. The terms pairs and pairing-off are also frequently used.

**Paisiello**, or **Pæsiello**, **Giovanni**, Italian composer: b. Taranto 9 May 1741; d. Naples 5 June 1816. After having received his musical education in the conservatory of Saint Onofrio at Naples in 1776 he went to Saint Petersburg, where he produced the opera 'Il Barbiere di Siviglia.' After remaining at Saint Petersburg for eight years he returned to Naples by way of Vienna, where he composed 12 symphonies for large orchestra, and wrote the opera 'Il Re Teodoro.' In Naples he remained for 13 or 14 years, from 1785 to 1799, and during this time he composed some of the operas which were produced at the Neapolitan Theatre, and he was also made chapel master to Ferdinand IV. In 1802 he went to Paris to organize the music of the chapel of Napoleon, and while there excited much jealousy, but it was not until 1804, when his opera 'Proserpine' had been produced and proven a failure that he returned to Naples. Paisiello produced between 95 and 100 operas, besides 100 masses, requiems, etc. Among the most prominent of his operas may be mentioned: 'Dal finto al vero,' composed in 1777; 'Il Marchese di Tulipano'; 'Nina, o la Pazzo d'Amore'; 'La Molinara.'

**Paisley**, pāz'li, Scotland, a manufacturing town of Renfrewshire, on the White Cart, about three miles above its confluence with the Clyde, and seven miles west-southwest of Glasgow. It consists of an old town on the west or left, and a new town on the east or right bank of



the river, communicating by three handsome bridges. The most noteworthy building is the restored Abbey Church of a monastery founded in 1163 by Walter, son of Alan, the first of the house of the Stewarts. Other noteworthy edifices are the new county buildings, the old county buildings and prison, a quadrangular pile in the castellated style; the town-hall, an imposing building in the classical style; the Neilson educational institution; the buildings containing the free library and museum; the Coats Observatory, and the Coats Memorial Church (Baptist). Paisley has been long noted for its manufactures, especially of textile goods. The shawl manufacture, introduced about the beginning of the present century, and long a flourishing industry, is not now a staple, but the textile manufacture is still large, though the chief industry is that of sewing cotton, for which Paisley is celebrated all over the world. Wilson the ornithologist, the poet Tannahill, and Prof. Wilson (Christopher North) were natives of Paisley, which possesses a bronze statue of the ornithologist and of the poet. Paisley, the mediæval *Passeleth*, is a town of ancient origin, having been at one time a Roman station under the name of *Vanduarda*. Pop. (1901) 79,355.

**Paixhans, Henri Joseph**, ōn-rē zhō-zěf pāk-sāns, or pāk'anz, French general: b. Metz 22 Jan. 1783; d. Jouy-aux-Arches 19 Aug. 1854. He entered the artillery after being graduated at the Ecole Polytechnique, fought under the Empire with great bravery, especially at the siege of Paris in 1814, and in 1848 became division commander. From 1830 to 1848 he was a member of the House of Deputies. Paixhans invented a howitzer called by his name, which carried hollow shot and cylindrical, conically pointed shells, also of his invention. His later years were particularly devoted to the improvement of floating batteries. He wrote several valuable studies of army and navy ordnance.

**Paixhans Gun.** See ORDNANCE.

**Pajou, Augustin**, French sculptor: b. Paris 19 Sept. 1730; d. there 8 May 1809. He became a pupil of Lemoine and won the Prix de Rome in 1748, after which he studied for 12 years at Rome. Upon his return he was elected to the academy and was employed by Louis XVI. to make statues of Buffon, Descartes, Pascal, Bossuet, and Turenne. In the Louvre may be seen 'Pluto Holding Cerebus in Chains,' 'Psyche,' and a bust of Madame de Pompadour, together with other works executed by him. The sculptures of the Salle de l'Opéra at Versailles and the ornaments of the Cathedral of Orleans and of the Palais Bourbon are typical samples of his work.

**Pakawa**, pä-kä-wä'. See PINTO.

**Pakenham**, päk'ën-am, SIR Edward Michael, British soldier: b. County Westmeath, Ireland, 19 March 1778; d. near New Orleans, La., 8 Jan. 1815. He was a lieutenant in the British army in 1794 and served with distinction under his brother-in-law, the Duke of Wellington, in the Peninsular and French campaigns. In 1814, after the death of Gen. Ross at Baltimore, he was appointed to the command of the British forces there. He led the expedition against New Orleans, where his forces were defeated by Gen. Jackson, and was killed in battle 8 Jan. 1815. See NEW ORLEANS, BATTLE OF.

**Palæobotany, or Fossil Botany**, the branch of palæontology which treats of fossil plants. Under this term is included the study of all dead vegetable matter which has become fossilized or has left its traces in any part of the earth's crust or in its superficial deposits.

*History.*—Fossil remains of vegetation, in the form of petrified wood, were described centuries ago by writers on natural history, and leaf impressions were described and figured by Johann Daniel Major, in his 'Lithologia curiosa, sive de animalibus et plantis in lapides versis,' published at Jena in 1664, and by Eduard Lhwyd, in his 'Lithophylacii Britannici Ichnographia,' published at London in 1699, but it was not until the early part of the 19th century, when Baron von Schlotheim issued his 'Abhandlung über die Kräuter-Abdrücke im Schieferthon und Sandstein der Steinkohlen-Formation,' and his 'Beschreibung merkwürdiger Kräuter-Abdrücke und Pflanzen-Versteinerungen, ein Beitrag zur Flora der Vorwelt,' at Leipsic in 1801 and Gotha in 1804 respectively, that the study of fossil plants was placed upon a scientific basis. Since then the subject has received constantly increasing attention, and it is now recognized as co-ordinate in importance with palæozoology, in interpreting the age or the succession of geologic formations, or in discussing the evolution of allied living organisms.

*Principles.*—The study of the extinct flora of the earth has shown that our living flora has been

Geologic Time Divisions	Geologic Periods	Plant Ages	
Neozoic	Modern Quaternary Tertiary	Age of Spermatophytes	Age of Angiosperms
Mesozoic	Cretaceous Jurassic Triassic		Age of Gymnosperms
Palæozoic	Carboniferous Devonian U. Silurian, L. Silurian, Ordovician. Cambrian	Age of Cryptophytes	Age of Pteridophytes
Eozoic	Huronian Laurentian		Age of Thallophytes

evolved from simple forms, low in the scale of life, through forms successively higher and more complex. Some reached a maximum of development far back in geological time and then retrograded or became extinct, while others have continued their upward development to the present day. The period of maximum development of any type is known as the "age" of that type, and thus it is possible to divide geologic time as a whole into a succession or series of plant ages and to designate each age by the name of the particular type of vegetation which was predominant at that time. Such a series, based upon the known facts of palæobotany, would be indicated in the preceding table.

In a similar manner other subdivisions of the vegetable kingdom could have their respective "ages" indicated and the table could be



## PALÆOBOTANY

made to show when each family, order or class of plants was in the ascendant.

The general character or *facies* of any fossil flora will always determine the time division to which it belongs; the identification of a few of its component genera is sufficient to determine the period, and the identification of certain typical genera or species will determine the exact or approximate stratigraphic position of the particular formation or strata of the period in which they occur. It is the recognition of these facts which has led to the acceptance of the broad principle that "great types of vegetation are characteristic of great epochs in geology, and it is impossible for the types of one epoch to occur in another."

The above principle, however, requires a modified application when floras of widely separated localities are under consideration, for the reason that evolution has not always maintained a uniform rate of progress in all parts of the world. In some localities it has been more rapid than in others, hence the same types may occur in different parts of the world in strata that are not quite contemporaneous; but the order of sequence of types, in all localities, has always been found to be the same.

*Botanical Development.*—On theoretical grounds plant life is assumed to have preceded animal life, not only for the reason that the latter is dependent upon the former for its existence and sustenance, but also because plants are lower in the scale of life than animals and are capable of existing under conditions that would be fatal to the latter. If the "nebular hypothesis" is accepted for the origin of our earth, there must have been a long period of time when its land and its waters were at a temperature too high to admit of the existence of any kind of life; but we know that some of the lowest forms of vegetation, represented by the lower thallophytes, can and do live in water at a temperature which is fatal to all other forms of life, hence it is assumed that these were the first to appear. This assumption is also strongly emphasized by the fact that the earliest recognizable fossil forms are thallophytes. Exactly what the primitive vegetation of the earth was like can not be determined, for the reason that its remains were either entirely obliterated, or so altered, by the metamorphism to which all the older rocks were subjected, that its original characters are lost. Its former existence, however, is indicated by the presence of carbon, in the form of graphite, in these rocks, and graphite is known in numerous instances to have resulted from the metamorphism of coal derived from vegetation.

*Thallophytes.*—The microscopic size of the lower thallophytes and the cellular structure of the others are factors which would make them poor subjects for preservation, and their comparative rarity as fossils is therefore to be expected. The schizophytes, representing the agencies of disintegration and decay, must have been present at the very beginning, but their assumed existence is purely theoretical. Fungi also play a very unimportant part in fossil botany. A few of the woody forms have been recognized and they are also represented by thallus and mycelium fragments, and presumably by certain indications of disintegration, in the tissues of higher plants, notably in those of the Carboniferous Period, and by spots or other

markings on leaves, bark, or wood, from more recent formations. About 400 species, included in about 70 genera, have been described. The lichens are also but little known as fossils, and such as have been discovered are fragmentary and unsatisfactory. They consist mostly of flakes, attached to pieces of fossil wood, or enclosed in amber, and have not been recognized in strata older than those belonging to the Tertiary Period. Seaweeds and fresh-water algæ are abundantly represented by casts, tracings, and markings of various forms, and occasionally by the remains of the stems, when they were of sufficient consistency for preservation. Many of these forms, originally described as algæ, are exceedingly problematic, and others have been subsequently shown to be mere inorganic markings or to be due to the tracks, trails or burrows of animals. Even if all the doubtful forms are eliminated, however, a sufficient number remain to demonstrate their existence as far back as the Cambrian Period, and they are represented in the rocks of every succeeding period. The diatoms are most abundantly represented, and they are also the most perfectly preserved of all the thallophytes, by reason of their silicious tests. They occur from the Cretaceous Period upward, forming beds of "tripoli," in various parts of the world, notably at Bilin, in Bohemia, and Richmond, Va. The genera and species are largely the same as those now living. The Characeæ have been identified, by means of their fruit cases, in rocks of Devonian age in North America, and also by stem fragments in those of the Jurassic and later periods.

*Bryophytes.*—Mosses and liverworts are but sparingly represented as fossils, and are practically unknown except in Tertiary and more recent deposits. All that have been identified are either the same as or very closely related to living species. Peat is largely composed of the remains of mosses, mostly belonging to the genus *Sphagnum*.

*Pteridophytes.*—The ferns, and their allies, lycopods and equisetums, compose the most interesting of any group of fossil plants. They had their origin far back in geologic time, probably in the Lower Silurian (Ordovician) Period. In the Devonian they had become well established and their maximum of development was reached in the Carboniferous, at which time they probably formed at least 75 per cent of the entire flora. After that they steadily declined, not only in numbers but also biologically, and their present living representatives are mere degenerate descendants of the gigantic forms which preceded them. The ferns certainly began as far back as the Devonian Period, and probably earlier. They are the best known of all fossil plants, and were the first to receive serious attention and study from palæobotanists. This was largely due to their extensive representation in connection with the coal of the Carboniferous Period and their discovery as an incident of mining operations, through which they were being constantly brought to light. They probably contributed 50 per cent to the entire flora of that period, but this proportion declined to about 30 per cent in Mesozoic time and in Neozoic to about 5 per cent. In general appearance the Palæozoic forms differed but little, except in size, from those of to-day, and many of the Mesozoic forms were apparently identical with living genera, while



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some Tertiary species are hardly to be separated from living ones. Equisetums, or plants very closely related to them, are definitely recognized in rocks of Devonian age, and, like the ferns, they rapidly developed in the Carboniferous Period. These Palæozoic forms are represented by the extinct genera *Calamites*, *Calamodendron*, etc., the genus *Equisetum* not appearing until later on, in Mesozoic time. The lycopods probably had their beginning as far back as the lower part of the Upper Silurian Period, and reached their maximum of development in the Carboniferous, at which time they were, next to the ferns, the most important element in the flora. Their gigantic trunks and limbs are known under the generic names, *Lepidodendron*, *Lepidophloios*, etc. These genera became extinct at the close of Palæozoic time and were succeeded by others closely related to or identical with the living *Lycopodium* and *Selaginella*. Other types of doubtful botanical relationship, but apparently closely related to one or another of the above groups, were the genera *Sphenophyllum* and *Sigillaria*. The rhizocarps are known, to a limited extent, as fossils; but like their living representatives are small and inconspicuous. Well preserved species of *Salvinia* have been found in rocks of Cretaceous and Tertiary age and remains of questionable relationship in rocks considerably older.

*Spermatophytes*.—The time of origin of this sub-kingdom of plants is more or less obscure, but it probably dates as far back as the Upper Silurian Period, and they are definitely known to have been in existence in the Devonian. Their development was slow and they did not assume any degree of prominence until Mesozoic time, when they became the dominant type of vegetation and have continued as such up to the present time.

The gymnosperms, of which our coniferous trees and cycads are the best known representatives, are the oldest type. The extinct genus *Cordaites* is known in the Devonian Period, but as a class they were of little numerical importance until Mesozoic time, when, in the Triassic and Jurassic Periods they reached their maximum of development and became the dominant type of vegetation, forming perhaps 60 per cent of the flora. Since then the cycads have almost disappeared, except in the warm parts of the world, but the coniferous trees, although in diminished numbers, are yet an important element in the living flora of all sections. Several ancient genera, such as *Sequoia*, to which the giant trees of California belong, and *Ginkgo*, represented only in our living flora by the maidenhair tree of Japan, were formerly of world-wide range, but are now restricted to limited localities and unless protected are liable to become extinct in the near future.

The angiosperms may have had their origin in late Palæozoic time, but the earliest remains which have been satisfactorily identified are not older than Mesozoic. Toward the close of the Jurassic Period they appeared in considerable numbers and subsequently developed so rapidly that in the Cretaceous Period they had become the dominant type and they have maintained this position ever since. The Monocotyledones are relatively not well represented as fossils and their origin is obscure. On theoretical grounds they probably antedated the more highly devel-

oped Dicotyledones, but satisfactory evidence on this point is lacking. Fan palms are known from the upper Cretaceous and these were probably preceded by grasses or sedges, but their remains are mostly found in deposits of Tertiary age. The Dicotyledones are first recognizable in certain archaic forms, from the Jurassic or lower Cretaceous horizons of North America and Europe, to which Saporta gave the name "proangiosperms." In some of these the dicotyledon type, as we know it in our living flora, is merely indicated rather than expressed, and it is almost impossible to classify them satisfactorily with any living allies. From these, however, the modern generic types of the dicotyledons developed so rapidly that it was essentially a modern flora, in all except its species, by the middle of the Cretaceous Period, and what are apparently living species began to appear in the early Tertiary. At the close of the Tertiary Period it is probable that nearly all the species were identical with living ones, as all the remains which have been found in Quaternary deposits are identifiable or referable to species now in existence.

*Relation to Botany*.—If the general development of the vegetable kingdom in the past is broadly viewed it becomes at once apparent that this development or phylogeny follows very closely the modern conceptions of the interrelations, or taxonomy, of plant-life as it now exists, and it is significant that all the changes which have been made from time to time in taxonomic arrangement have constantly brought it closer and closer into harmony with the known facts of phylogeny, until, at the present time, all scientific systems of classification are based upon the principle of development from lower to higher forms, and nearly all catalogues or lists of plants and manuals or text-books of botany are arranged in accordance with this principle. Palæobotany has thus been of great assistance to botany in placing it upon a sound and philosophic basis.

The demonstration of the fact that the vegetation now in existence is merely the remnants of that which formerly existed, has resulted in solving, or at least in throwing a flood of light upon, many of the problems that puzzled the early botanists. Wide gaps between living genera were bridged by the discovery of extinct forms, and isolated or monotypic genera, such as *Liriodendron*, of which our tulip tree is the sole living representative, *Sassafras*, which also contains but the one species, etc., were shown to have been composed, in the past, of a large number of species, and that the present generic isolation is due to the extinction of all but one of their former component species. Many of the apparent anomalies in connection with the geographical distribution of certain living plants have also been cleared away by the discoveries of palæobotany. A number of genera, for example, are known to be restricted to the two widely separated regions of Eastern Asia and Eastern North America and impossible theories of migration were proposed in order to account for such phenomena, until the fossil representatives of the genera were found, and the fact was demonstrated that they were once of world-wide distribution but have become extinct in the intermediate regions. The presence of abnormal or apparently useless organs in living plants has also been explained on the theory of atavism or



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reversion to former ancestral characteristics and the changes in form through which all plants pass, from youth to maturity, have frequently been shown to be identical with, or closely similar to, ancestral changes in the development or evolution of the types to which they belong. These and numerous other phenomena would have been impossible of rational explanation without the aid of the facts made known by palæobotany.

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**Palæog'raphy** (Gr. *πάλαιος*, old; *γράφειν*, to write), the science of ancient handwriting. It is occupied with the materials, the characters and use of written documents with a view to determine their date, authenticity and place of production. As a general term palæography proper includes neither epigraphy nor diplomatics. Epigraphy is the science of inscriptions found on stone, metal or pottery. Diplomatics is concerned only with legal documents, and although it perhaps gave the first impulse to the study of palæography it lost its main importance after the French Revolution, and the science of handwriting is now chiefly occupied with manuscripts of literary or historic interest.

*Materials.*—In the most rudimentary stage of civilization leaves, bark, or woven cloth were employed for the pages of books or material on which to write matter of any kind. Wax tablets on which letters could be stamped or cut with a stylus, or needle of metal or bone, were used in ancient Italy and through the Middle Ages in France. The black wax was poured on to a rimmed quadrangular piece of wood, or tablet, and many such pages were often bound together so as to form a codex or volume. Codices of this sort have been discovered among the ruins of Pompeii and elsewhere. A species of paper called papyrus was also employed; it was made of the pith of an Egyptian sedge. This pith was cut into strips which were laid side by side on a flat surface, and a second layer of strips superimposed at right angles. This was then subjected to heavy pressure and the natural gluten of the substance caused the two layers to adhere and form a smooth sheet which, when dried, was ready for use. Many rolls of this paper have come to light in old Italian towns, notably at Herculaneum and Ravenna, but papyrus was extensively used in Egypt and Greece as well as in the Asiatic cities on the coast of the Ægean. It was also employed during the Middle Ages, and the popes regularly wrote on papyrus until the end of the 11th century. Parchment took the place of papyrus about the 1st century A.D., taking its name from Pergamos—*papyrus Pergamenus*, or paper of Pergamos—where it was first made in perfection; although skins of animals were used for writing upon as early at

least as 500 B.C. Parchment manuscripts are found in square pages, and take the form of the modern book; they are not rolled so as to make what the Romans called *volumen*, a scroll or volume, but bound together in consecutive pages like wax tablets in the codex. It is of course from Egypt that the earliest papyri come. The 'Papyrus Prisse' was found in a tomb of the 11th Dynasty and antedates Exodus by several centuries.

*Characters.*—It is impossible within the limits of the present paper to discuss Egyptian palæography (see *HIEROGLYPHICS*) and the hieratic or demotic papyri, much less the Chinese, Pali, Indian, Syriac, Hebrew, Persian or Arabic handwritings and manuscripts. The principles of palæography may be seen in their simplest form from an examination of Greek and Latin alphabets, and a consideration of some of the most interesting palæographical remains written in those letters. The first obvious variety which we meet with in both Greek and Latin manuscripts of the same period, is what we may call the book hand, and the cursive hand, which correspond roughly with our modern printed and written lettering. The book hand is that of the professional scribe or amanuensis and is stiff and regular but thoroughly legible. The cursive hand is irregular and careless, as if rapidly produced. The one is employed by those who write out what is to be permanent and readable by anyone; the other is for private memoranda, letters, and accounts. For convenience, the letters in a book hand may be divided into two classes, majuscule and minuscule. The majuscule comprise capital and uncial letters. The letters employed in epigraphy or inscription writing furnish the pattern for these capitals, which are square and stiff. The word uncial means inch-high, and is a term of exaggeration used by Saint Jerome in the sense of tall or handsome. The uncial letter is of the same proportions as the capital but is boldly curved, and is clear to the eye as well as often extremely elegant in appearance. The other book hand, the minuscule, was a combination in its principles of the cursive and uncial; it derived its name from the fact that it was never as large as either type of the majuscule. The Latin and Greek uncials very much resemble each other, but in the cursive hand the distinctions are very noticeable.

*Greek Palæography.*—Greek papyri may be divided into three classes according to their period. The Ptolemaic manuscripts were produced 323–30 B.C.; the lettering is bold and flowing. The Roman papyri were written in the period between Augustus and Diocletian (31 B.C. to 284 A.D.) and their lettering was fluent and finely rounded. Equally recognizable by the expert is the large and showy style of the Byzantine manuscript, which belongs to the period between 360 and 640 A.D. The early uncials of the Ptolemaic period are the oldest Greek manuscripts which are extant and have been found in tombs where the papyri have been buried. Perhaps the earliest was produced in the first half of the 2d century B.C. Greek papyri earlier than the Christian era are not uncommon. Among them are fragments of Homer and Hyperides, the Athenian orator. The earliest Greek cursive manuscript which is



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extant consists of letters and memoranda made by Ptolemy, son of Glaucias, who lived as a recluse in the Serapeum or precinct of Serapis 170 B.C. There are extant about 300 vellum codices, the oldest of which may be set at 506 A.D. The three great Biblical codices are considered the production of the 4th century, the Codex Alexandrinus of the 5th. The earliest minuscule script yet discovered is found on the private papers and business memoranda of Aurelius Pachymius, a purple dye merchant 592-616 A.D. Ligatures began to invade cursive calligraphy at the beginning of the 13th century, and were imitated in the earliest printed books.

*Latin Palæography.*—In Latin manuscripts there were four scripts employed in books, these being, capitals, uncials, semi-uncials and minuscules. Capitals are either Square, having their lines at right angles, or Rustic, in which the ends are twisted and the cross bars oblique and curved. Of the Square capitals the Saint Gall Virgil of the 4th century affords the best example. The character of the Rustic is well exhibited in the four great manuscripts of Virgil, the Codex Vaticanus (4th century), Codex Palatinus (5th century); Codex Romanus (6th century) and the Medicæan Virgil (5th century). The Uncial Latin character was a modification of the angular and rigid epigraphic lettering on tombs and monuments. This is especially apparent in E, M, V, H. The tails of P, F, Q, and R hang below the line, while the upright of h rises above it. Good examples of Latin uncials of the earliest type are the Vescelli Gospels, as early as the time of Eusebius the historian; the Codex Bezae (6th century) at Cambridge, England, and the palimpsest Cicero in the Vatican, also the Vatican Cicero (4th century) over which is written in smaller uncials (7th century) Saint Augustine *In Psalmos*. The large, regular uncial is supplanted in Latin manuscripts of the 8th century by semi-uncials, sometimes larger in size than uncials, but modified in form by the influence of the old Roman cursive. The Hilary (6th century) of Chapter library of Saint Peter's, Rome, is a good example of this script.

The Latin cursive was unknown to palæographers, though they had long suspected its existence, before 1875, when specimens were found in the shape of wax-tablets (55 A.D.). This script is hard to decipher, and exhibits forms out of which arose modern lower-case G, B, F, M, N, D, R, H. It was employed in a modified shape as well for civil as public uses during the Middle Ages, and many of its forms survive to-day in German script. The official Roman handwriting arose in the 16th century and the last degeneration of the old cursive is seen in the crabbed and illegible lettering of what was styled *litteræ Sancti Petri*, the official script of the popes.

The national alphabets of Europe were modifications of the Roman cursive and uncial. The Irish semi-uncial is the basis of the modern "Roman." Good examples of the Irish alphabet are St. Chad's Gospel at Lindisfarne, and Saint Cuthbert's Gospels; it passed from Ireland to Northumbria where Alcuin of York, tutor of Charlemagne, introduced it into the famous calligraphic school in St. Martin's monastery at Tours, whence it was rapidly diffused over all

Europe. In the 13th century it was twisted and deformed into the Black Letter or Gothic, still seen in Germany, but after the Renaissance and the invention of printing a return was made to the beautiful minuscule of Charlemagne, improved in the middle of the 16th century by the refining influence of Italian calligraphy.

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**Palæontology**, the science of the ancient life that inhabited the earth during the vast periods of time which have antedated the age of man. This science dates back only to the beginning of the 19th century, when William Smith, Cuvier, Brongniart, Lamarck, Blumenbach and Schlotheim initiated the study of fossil life as a distinct branch of scientific research. It was christened "palæontology" by de Blainville and Fischer von Waldheim in 1834. Erroneous and fantastic ideas regarding the nature and origin of organic fossils had prevailed till the last decade of the 18th century, interesting accounts of which, as well as of the later history of the science, may be read in the works of Zittel, Lyell, Marsh and Weller. Since the early days this science has made rapid progress until now its devotees are numerous, and they attempt to solve some of the most important problems bearing upon the origin and evolution of organisms, and upon the ancient life-history of the earth. The study of palæontology is carried on by means of fossils (q.v.) which, defined in the words of Zittel, are "all remains or traces of plants and animals which have lived before the beginning of the present geological period, and have been preserved in the rocks," and hence the successful pursuit of this science is in large degree dependent upon intimate knowledge of the closely allied sciences, geology and biology. This affiliation of palæontology to the two sciences mentioned is easily traced in the literature. The early works were descriptions of fossils, often arranged, as in Sowerby's 'Mineral Conchology,' 1812-45, without reference to their biological classification or to their relation as members of the fauna of a particular formation. In later works the tendency to diverge along two distinct lines is very apparent and at the present day we have two more or less widely separated schools of palæontologists: (1) those whose work is more intimately associated with that of the geologist; and (2) those who are essentially biologists. The former (stratigraphers, palæontologic geologists, geological biologists) are more interested



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in unraveling the relations of fossils to the rocks in which they are found entombed, in studying the order of succession, the evolution, and migration of fossil faunas in the stratified rocks, in developing the use of index fossils, that is, of particular genera and species of fossil plants and animals as indicators of particular geological formations; and, by the study of the geographic distribution of fossil faunas, in solving the problems of "facies development," and of palæogeography or ancient physical geography. The second group of palæontologists confine their attention almost wholly to description of the morphology, embryogeny, and phylogeny or genealogy of fossil organisms, and give only incidental notice to the geologic associations of the fossils they handle.

Palæontology has been of great aid to zoology and botany in clearing up mooted questions of classification, in explaining the origin of various obscure structures seen in modern plants and animals, and in adding to our knowledge of the determining factors of geographic distribution. The strictly utilitarian side of palæontology, involving the application of a knowledge of index fossils to determination of the proximity of beds of ore, coal or building stone, or to ascertainment of the depth of oil, gas, or water-bearing strata, has not yet been accorded due recognition by those most interested in the exploitation of such economic materials, with the result that large sums of money have been expended in fruitless search for non-existent treasures.

The rocks of the earth's crust are classified according to their periods of origin into four great groups, each of which represents an era of immense duration, measured in millions of years. These eras are again divided into periods, represented by systems of rock formations, of which 13 are generally recognized, and the periods are again subdivided into epochs, ages, stages, and episodes, each of these smaller elements being represented by its corresponding rock-unit. With exception of the Archæan and Algonkian systems at the bottom of the scale, from which no satisfactory fossil remains have yet been obtained, each of the systems has been found to contain an assemblage of fossil organisms quite peculiar to itself, and not found in its entirety in any other system. This assemblage of fossil organisms in any system or in any geological formation constitutes its fossil fauna, which is an imperfect synopsis of the ancient life that formerly inhabited the vicinity of the ocean, lake or land basin in which the particular system or formation originated.

The faunas of two formations of consecutive age have as a rule many species in common, and on the other hand the faunas of two formations representing widely separated periods of time are found to be quite unlike, and to have few species and even few genera in common. The two extremes of such dissimilarity are naturally seen in the Cambrian and Pleistocene faunas at opposite ends of the geologic time-scale.

While formations of different ages contain diverse faunas, it is found that a single formation presents essentially the same fauna in all portions of its area of distribution, whence it follows that the fossil contents of a formation are, in general characteristic of that formation, and that they serve as a means of identifying it in widely separated districts.

TABLE OF SYSTEMS, PERIODS, AND EPOCHS, WITH DOMINANT TYPES OF LIFE.

Eras	Periods and Systems and Dominant Types	Epochs
Cenozoic Era of Vertebrates 3 million years	Quaternary (Man, Lamelliibranchs)	Recent Pleistocene
	Tertiary (Mammals, Gastropoda, Insects, and land plants)	Pliocene Miocene Oligocene Eocene
Mesozoic Era of Reptiles 7 million years	Cretaceous (Pterodactyls, Dinosaurs, Echinoids)	Upper Lower
	Jurassic (Dinosaurs, Crabs, Ammonites)	Upper Middle Lower
	Triassic (Amphibia, Ammonites)	Upper Middle Lower
Palæozoic Era of Invertebrates 18 million years	Permian (Amphibia)	Upper Lower
	Carboniferous (Land plants, Crinoids)	Coal measures Subcarboniferous
	Devonian (Fish, Goniates, Corals)	Upper Middle Lower
	Silurian (Crinoids, Corals, Eurypterids)	Upper Middle Lower
	Ordovician (Graptolites, Orthoceratites, Trilobites)	Upper Middle Lower
Eozoic 18 million years	Cambrian (Trilobites)	Upper Middle Lower
	Algonkian	Life not well known
Azoic 10 million years	Archæan	No evidence of life.

These general laws are subject to certain exceptions due to the influence of "facies development," the variations of faunal expression consequent upon changes in the physical and biotic conditions of life. These facial changes, when understood, assist rather than render more difficult the correlation of distant faunas, and their elucidation greatly aids the restoration of the ancient physiographic conditions.

Comparison of the successive fossil faunas with each other and with the modern fauna shows that there has been a slow but continuous progress in the expression of each fauna from that of Cambrian age with its unfamiliar lowly primitive types, to the highly organized animals and plants that form the dominant types of the modern fauna and flora. This progress is manifested in the successive members of the different races of animals that have descended from Cambrian ancestors, by their passing through a particular stage of evolution in each successive period, epoch, and stage. Recognition of this stage of evolution enables the palæontologist to correlate entirely new faunas or species with the known faunas of standard sections or scales.

It must not be inferred that all races living at the present day have descended from Cam-



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brian ancestors. Many of our well differentiated forms of modern life can be traced back only to the beginning of the Tertiary, or into the Mesozoic, or perhaps late Palæozoic, where they are represented by species whose distinguishing characteristics are less well developed so that they can scarcely be separated from contemporaneous ancestors of other races. Such early ancestral types which seem to possess in potential state the characters of two or more later descendant races are known as "generalized types."

There are also numerous groups of fossil organisms that appeared during early days, multiplied, attained their climax, during which they were for a time perhaps the dominant forms of land or sea, and then declined and eventually became totally extinct. Such extinct groups, like the nummulites, graptolites, cystoids, blastoids, long-hinged brachiopods, orthoceratites, ammonites, belemnites, and trilobites among invertebrates; ostracoderms, stegocephalians, mosasaurs, ichthyosaurs, dinosaurs, pterodactyls, uinatheres among vertebrates; and the lepidodendrids, calamites, sigillarias, tæniopterid ferns, and cordaites among plants, are eminently characteristic of the periods in which they lived.

*Facies Development and Faunal Changes.*—Facies is the peculiar expression of the physical and faunistic characters of a formation at a particular point, and it is determined by the combination of climatic, physiographic, bathymetric and other conditions reacting upon the organisms of the neighborhood. Some formations, like the Devonian, present several varied facies in a limited area; others, like certain deep-water limestones of Ordovician and Carboniferous age, spread with scarcely any change over vast spaces. The chief types of facies are the littoral, corallitic, sub-littoral or pelagic, abyssal, estuarine, fresh-water, and terrestrial. The characteristics of each of these, with the organisms peculiar to it, are here passed in review.

A "littoral" facies is represented by deposits formed at the shore and in the shoal water contiguous to it. It comprises conglomerates, sandstones, shales, and marls, and its organic contents consist of the remains of animals and plants of beach and shallow water habits. Such are the heavy-shelled mollusks, notably those that feed on marine plants, also abundant worms, heavy-shelled crabs, acorn barnacles, and hydroids. This facies is more common than any of the others, for the larger part of the sedimentary rocks have been made up of the products of continental erosion deposited near the coast.

Fossil coral reefs have been recognized in formations of nearly all ages and constitute a "corallitic" facies. They are in all cases of shallow water origin, and their presence in ancient rocks has been generally accepted as evidence of the uniformly warm temperature of the seas in which they flourished. In the ancient reefs the coral structure has usually been obliterated by a metamorphic process called diagenesis, and the coral rock has become a dolomite. Such are the Guelph dolomites of the Silurian of New York and Ontario. Fossil coral reefs often afford faunas of many species and abundant individuals. The corallitic facies of a formation is always associated, on its landward side, with a sparsely fossiliferous lagoon or saltmarsh phase, represented by red shales,

containing gypsum and salt, by water-limestone, etc., as in the Salina beds of New York, and on the seaward side by a series of highly fossiliferous beds, usually limestones or calcareous shales, which correspond to the deposits of the open ocean. These latter deposits usually abound in fossils of distinct pelagic type, such as cephalopods, brachiopods, sea-urchins, crinoids, crustaceans and thin-shelled mollusks.

"Sub-littoral" or "pelagic" facies comprise the deposits laid down in the deeper water of the continental shelf, and form an intermediate phase between the littoral and abyssal types. The rocks are mostly of organic origin (limestone and lime shales), with fine-grained sandstones and clay shales. As a rule they contain an abundance of well preserved fossils, including the remains of all kinds of animals that inhabit the open sea, together with some members of the littoral fauna. Deposits of this class, with their characteristic faunas, such as graptolite shales, ammonite and pteropod limestones, have often very wide distribution, and are hence of great value for determination of geologic horizons.

"Abyssal" facies is the type characteristic of the greatest depths of the ocean. It is represented in modern time by the foraminiferal and radiolarian oozes, and by green and red muds. It is recognized among ancient rocks by radiolarian cherts of Palæozoic and Jurassic age of Europe and Australia, by the chalk of Cretaceous age of Europe and North America, and by the Pliocene Barbados earth, which latter is evidence of upheaval of great ocean-depths in comparatively recent times.

The three remaining types of facies, "estuarine," "fresh-water," and "terrestrial," are associated with spread of continental conditions. The estuarine or brackish water facies presents lagoon, bayou and estuary deposits of sandstones, conglomerates, and clay shales, sometimes alternating with limestones formed during temporary transgression of the ocean. The fossils of such deposits are species of animals that lived in brackish water, mingled with remains of the fresh-water and land fauna and flora that were carried down by river waters and entombed in the estuarine deposits. The nodular shale of Carboniferous age at Mazon Creek, Ill., is a renowned example of this type of facies. Its varied fauna comprises amphibians, fish, clams, river-snails, land-snails, scorpions, spiders, myriopods, insects, and crabs, together with abundant ferns.

"Fresh-water" and "lacustrine" facies are deposits formed in fresh-water swamps and lakes, important in the Devonian, Carboniferous, Jurassic, and Tertiary systems. The Devonian deposits, known as Old Red Sandstone in Europe and as Catskill sandstone in the United States and Canada, consist mostly of red and gray sandstones and shales containing fish and plant remains. The swamp deposits of Carboniferous and later times are represented by beds of coal, lignite and clay shales, all containing abundant plant remains, and rarely relics of the insect, crustacean, and vertebrate life. During the Cretaceous, Jurassic, and Tertiary Periods, extensive lakes existed upon the several continents, and their sandstone, shales, and limestone deposits have afforded hosts of vertebrate and vegetable remains, specially those of the Rocky Mountain region, and Europe. Occasional beds of this



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facies abound in fresh-water snails and insects, as notably at Florissant, Colo. Angular breccias, conglomerates, sandstones, shales, and clays comprise the deposits of the terrestrial facies, a type which has not yet been satisfactorily investigated in all its phases. The various deposits originated either as the residuals from denudation, or as flood-plain, desert and prairie deposits. They are important sources of fossils in some cases (flood-plain and prairie phases) but as a rule their mode of origin has not been conducive to preservation of organic remains.

All of these facies are being developed in different parts of the world at the present day, and geologists find that they have been developed more or less completely during all periods of geologic time. It is, however, worthy of note that the various marine facies greatly predominated in the older Palæozoic, that the estuarine and swamp conditions were markedly developed during Carboniferous time in most parts of the world when they were associated with a remarkable increase of swamp vegetation, and that the lacustrine or fresh-water deposits were prominent during the Devonian and again during the Tertiary Periods. Each of the above mentioned types of facies has its peculiar faunal or floral aggregation of fossils, and study of these features of any formation enables the palæontologist to determine the distribution of the land and water bodies, and even to form some imperfect ideas regarding the nature of the climate, the topography of the land areas, and the character and distribution of the fauna and flora of each successive epoch and episode of time.

*Palæontology and Evolution.*—The researches of palæontologists upon the order of succession of fossil organisms, and upon the various modes of development of certain types from their embryonic to their adult stages, have brought to light many facts supporting the doctrine of evolution, and have also demonstrated the origin and mode of evolution of many races of living and extinct organisms. The results of these investigations along lines of profound interest may be found in the works of Beecher, Bernard, Clarke, Cope, Hyatt, Jaekel, Jackson, Koken, Neumayr, Packard, Schuchert, Scott, Smith and Williams whose more important contributions are cited in the bibliography at the close of this article. See EVOLUTION.

*Periods of Geologic Time and their Faunas.*—The following sketch of the series of extinct faunas that have succeeded each other as inhabitants of the waters and lands of the earth involves an elementary knowledge of the most important types of animals and plants. (See preceding Table of Systems, etc.) The history actually begins with the close of pre-Cambrian (Algonkian) time when the distribution of land and water was very different from what it is now. Regarding the life of the Archæan we know nothing and of that of the Algonkian very little. Many rocks of the latter system were originally of sedimentary origin, but they have been so thoroughly metamorphosed that few traces of their organic contents remain. The remnants discovered are of types similar to those of the succeeding Cambrian fauna, and include worms, linguloid brachiopods, and arthropod remains, some of which are referred to the *Eurypterida*. The extensive graphite deposits of the pre-Cambrian rocks are by some authors

considered as evidence of original organic deposits.

Those genera and species marked with an asterisk (or italicized) are indicial, that is, characteristic of the formations under which they are mentioned; fossils not so marked may be understood to occur in other periods as well.

*Cambrian.*—The Cambrian system is represented mostly by littoral and shoal-water deposits containing an abundant fauna, which, while of primitive type, is remarkable on account of its high degree of differentiation. Some of the Cambrian rocks, notably the calcareous shales, in regions of slight metamorphism (New Brunswick, Newfoundland, and Scandinavia) abound in fossils. Elsewhere the sandstones, conglomerates and limestones are poor collecting grounds. This fauna, estimated to contain 1,000 species, comprises representatives of all the seven sub-kingdoms of invertebrate animals, and of 12 out of 30 classes. The entire fauna is marine, and the dominant types were trilobites, inarticulate brachiopods, and hyolithoid shells usually referred to the pteropods. The trilobites form the most interesting elements of the fauna. Compared with those of later times they are more loosely built, and they present many features indicative of primitive types; characters which are seen only in the embryos of later forms. Among the more important are the minute blind *Agnostus* and \**Microdiscus*; the spiny \**Olenellus*, \**Mesonacis*, \**Holmia*, characteristic of the lower Cambrian; \**Paradoxides*, which contains some of the largest known trilobites, indicial of the middle Cambrian; and the flat-shelled \**Dikellocephalus* of the upper Cambrian. The brachiopods, of which 120 North American species are known, are almost entirely of the inarticulate type, with thin, rounded or spatulate, phosphatic shells, while there were a few members of the articulate group with transverse, calcareous shells. The hyolithoid shells, with triangular elongate form, are abundant. Sponges of the hexactinellid type with net-work of silicious spicules are recognized in Protospongia. The corals are doubtfully represented by \**Archæocyathus*, and the echinoderms by a few rare cystoids. Among the gastropods there are coiled shells referred doubtfully to *Platyceras* and *Raphistoma* in the upper Cambrian, and limpet-like forms, \**Scenella*, and \**Palæacmæa* in the middle and upper horizons. The lamellibranchs have a single minute genus \**Fordilla*, and the cephalopods likewise the minute \**Volborthella*. Worm trails and burrows are abundant, and various forms of ostracods (\**Hipponicharion*) are found in the finer grained sediments. Radiolarians and foraminifera have been found, some of the latter (*Orbulina universa*) being indistinguishable from modern species. The only probable plant known is \**Oldhamia*, referred to the coralline algæ.

The Cambrian fauna in its entirety shows a very advanced stage in the differential evolution of organic types, and there is good reason to believe that long ancestral lines of fossil organisms originally existed in the pre-Cambrian sediments, and further to anticipate that continued search in the less metamorphosed deposits of that remote age will eventually bring to light some of those much sought for initial types.

*Ordovician.*—The fauna of the Ordovician, or age of graptolites, shows a marked advance in development of all its types over those of the



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Cambrian. It also shows a more distinct separation into facies, of which the pelagic, embracing orthoceratite, brachiopod, and trilobite limestones, and the graptolite shale facies are the more prominent. Most of the groups of animals which were initiated in the Cambrian, enjoyed a rapid evolution in the Ordovician time. During that period the trilobites attained their climax in respect of variety and numbers, and were represented by \*Asaphus, \*Trinucleus, \*Remopleurides, \*Pterygometopus, and by others that extend up into the Silurian. The Ordovician trilobites present considerable advance over their Cambrian ancestors in respect of increased compactness of structure, perfection of the eye-structure, and elevation of the visual surface above the head, whereby the efficiency of these organs must have been much increased. The cephalopods are represented by numerous orthoceratite genera, with straight or slightly curved shells, some of which were of great size. Orthoceras, \*Cameroceras, \*Gonioceras, \*Piloceras, \*Nanno, etc., are associated with closely coiled genera \*Trocholites, and other related types that closely resemble nautilus shells.

Among the brachiopods the inarticulate types, so common in the Cambrian fauna, occupy a subordinate place, and are represented by numerous species of Lingula, \*Trematis, and \*Siphonotreta. The articulate order attained so great an expansion that 325 species of North American Ordovician brachiopods are known. The Polyzoa appear first in the lower Ordovician and are abundant and varied in the upper zones. Gastropods are common, and all have holostomatous shells. Lamellibranchs are common, with several genera of generalized type; corals of various types are common. The hydroid corals (Stromatoporids) formed extensive reefs during Chazy and Trenton time. Echinoderms include abundant cystoids, several crinoids, and rare starfishes and ophiurians. The cystoids are specially abundant in the lower Ordovician, where their fragmentary remains form solid limestone beds of several feet thickness. Sponges allied to Protospongia, and to the modern hexactinellids, are common in a few localities, and in the Trenton limestone of the Mississippi Valley are found the curious digitate \*Brachiospongia, the nodulose \*Strobilospongia, and the much discussed \*Receptaculites. A pelagic facies is recognized in the radiolarian cherts of Great Britain, France, and Germany. The graptolite facies of the Ordovician, by some authors considered to be an abyssal facies, occurs in the form of gray and black bituminous shales and slates, in which numerous genera and species of graptolites are found arranged in definite zones that occupy the same relations to each other in widely separated parts of the world. This great dispersion, and regular succession of genera and species render the graptolites the most important index fossils for the Ordovician, an advantage which is, however, somewhat negated by the difficulty attending their study. The group began in the upper Cambrian, attained wide distribution and various evolution during the Ordovician, and declined during the Silurian. These graptolite beds are well demarcated from the molluscan and brachiopod limestones and while they occur between the latter at various horizons throughout the general Ordovician and Silurian formation scales of Europe and America, they are best developed in basins

where little of the other facies seem to have existed. The faunas of latest Ordovician time are known in only a few regions, since that period was one of comparatively sudden uplift of continental masses, accompanied in many parts of the earth by formation of mountains. But the few late remnant faunas that found shelter in protected basins present a transitional phase between the normal Ordovician and the succeeding Silurian faunas. Late Ordovician time is represented in most parts of North America by a marked hiatus of unconformity indicating wide land areas.

*Silurian.*—The earliest Silurian fauna of North America, that of the Clinton group, contains a few relicts of the Ordovician fauna lingering on among a host of new species and genera, which were introduced with the return of marine conditions over the interior sea basin. The American rocks and faunas of Silurian time indicate: first, muddy waters of the Clinton epoch, followed by clear seas of Niagara time inhabited by a luxurious fauna, and in which pure organic limestones were deposited. Subsequently the shallow mediterranean Guelph sea of America became dotted with extensive coral reefs, and toward the end of Silurian days the epicontinental seas were again largely drained to form lagoons, tidal mud-flats, and salt lakes of Salina time. Then ensued a short period of wide land-emergence before the early Devonian transgression began. Facies development is well marked and it is worthy of note that the various facies occur in the same relative order and at equivalent horizons in widely separate regions; evidence that the causes which influenced their development in Silurian time acted simultaneously during successive epochs over the entire northern hemisphere. The mollusk-trilobite limestone of Niagara age in North America, is duplicated by that of similar age in England (Wenlock), Sweden (Gotland), and central Europe (Bohemian). The Eurypterus fauna of the Salina group of New York is duplicated by the contemporaneous water-limestones of the English Ludlow, and the Baltic Rotziküll beds. The coralline facies of the American Guelph is of the same age and character as that of the English Dudley, Swedish Gotland, and Bohemian dolomites; and finally the Monograptus shales of Great Britain, Bohemia, Brittany, Scandinavia, and New York are all of lowest Siluric age. Another interesting feature of the Siluric fauna is its division into two well-marked types—a northern or Baltic-British-American type, and a southern Bohemian-Mediterranean phase, the species of which are quite distinct. All of the Siluric faunas of North and South America and of Asia are of the northern phase, and the Bohemian-Mediterranean type appears to be merely a local facies. It is of interest that the Silurian fauna of Australia contains representatives of both types.

The chief characteristic of the Silurian fauna is the great evolution of the crinoids, corals, and spire-bearing brachiopods, and Eurypteridæ. Protozoa are rare; sponges and corals attain a remarkable variety and abundance, and in many districts the latter formed extensive reefs. The principal genera are: Favosites, Alveolites, \*Halysites, Heliolites, Cystiphyllum, Acervularia, Omphyma, Zaphrentis, Cyathophyllum, \*Palæocyclus, and the operculate pyramidal genus \*Goniophyllum. The graptolites begin to de-



cline. Cystoids take second rank after the crinoids, whose sudden expansion is expressed in the ratio of about 450 Silurian species to less than 50 from the Ordovician. The brachiopod fauna, while no larger, differs from that of the Ordovician in the increase of the spire-bearing types, and in the remarkable development of inarticulate types with large solid shells. Lamellibranchs offer no important changes, all the genera being still of integripalliate types. Gastropods are numerous. Tentaculites, usually referred to the pteropods, occur by myriads associated with ostracods. The Silurian Cephalopoda comprise straight-shelled Orthoceras, curved Cyrtoceratites, turreted Trochoceras, and coiled Nautilus; also Gomphoceras and Phragmoceras with their restricted apertures, and the aberrant genus Ascoceras.

The Arthropoda are represented by rare barnacles, numerous ostracods, some phyllocarida, rare scorpions, spiders, and insects, as well as by the trilobites and eurypterids. The trilobites show a slight decrease in numbers, but a greater diversity of form over their Ordovician ancestors. The water limestones (of mud-flat origin) of the Salina of New York and equivalent European deposits afford abundant remains of Eurypterus (q.v.), Pterygotus, and \*Hughmilleria, some of which grew to be six feet long. These creatures resembled in habits and structure the modern horseshoe crab (*Limulus*). Rare scorpions, spiders, and insect remains have also been found in these uppermost Silurian lagoon deposits, and they show no very great differences from similar types of the Carboniferous. Their presence indicates the existence of terrestrial life on the extensive continental areas that emerged toward the end of Silurian time. In these highest Silurian rocks, specially in the Ludlow beds of England, Scotland, and Podolia, are found the earliest remains of vertebrate animals in the shape of primitive fish-like creatures of the order Ostracodermi (q.v.).

*Devonian.*—The Devonian Period was one of constant local physiographic changes, and accordingly its formations and faunas present a greater variety of facies than is seen in any of the older Palæozoic systems. There are two prominent types of the Devonian, each with its distinctive fauna: (1) The marine deposits, of limestones, marls, shales, and sandstones; (2) the continental or terrestrial phase, known as the Old Red sandstone in Europe and as the Catskill shales and sandstones in the eastern United States and Canada. This two-fold aspect of the deposits is more or less prominent in all the geological systems above the Devonian. The Devonian fauna as a whole is distinguished by the development of land vegetation, by rapid evolution of fishes, lamellibranchs, and of goniatite cephalopods, and by the decline of trilobites, and practical extinction of the graptolites and cystoids. Other groups expanded. Hexactinellid sponges (\**Dictyospongia*), comparable with the modern Venus-flower-basket, flourished in shallow seas, corals are abundant and formed reefs in many regions. The Hydrozoa are represented by numerous reef-building stromatoporas, and by straggling survivors of the graptolites. Among echinoderms, the cystoids are rare; starfish and ophiurians occur commonly at a few localities; and the crinoids are the dominant types of this

class, though not so abundant as in the Silurian. The blastoids are represented by *Elæacrinus*, characteristic of the Onondaga limestone. Worm-trails are common in the shales and sandstones of the middle and upper Devonian. A host of new brachiopods appears, while many Silurian genera run on. The spirifers manifest a marked tendency to develop forked plications and to lengthen the cardinal lines of their shells. Lamellibranchs show a great advance over those of the Silurian, and in certain shale and sandstone formations they outnumber all other types of organisms. Gastropoda of the family Capulidæ are abundant, and minute pteropod shells (*Styliolina* and *Tentaculites*) often form solid limestone beds. Among cephalopods a new type of closely coiled shells, *Goniatites*, with slashed sutures, appears in the lower Devonian, evolves rapidly and reaches its climax before the close of the period. An extinct group of crustaceans, the Phyllocarida, with long strong caudal spines, reach a considerable development, especially in the Hamilton epoch. Eurypterids are rare, though represented by the gigantic *Stylonurus* in the Catskill beds. The trilobites have many large and bizarre members, as well as a number of small, degenerate forms, during the early and middle Devonian, when they manifested a strong tendency to develop spines along the margin and on the surface of the carapace.

The Devonian is aptly termed the "age of fishes," for within its limits this class enjoyed a great expansion. The lowest Devonian fish fauna is like that of the upper Silurian with numerous Ostracoderms. This is succeeded by a fauna with \**Holoptychius*, \**Pterichthys*, *Bothriolepis*, \**Coccosteus*, *Dinichthys*, *Dipterus*, and a large number of acanthodian sharks, which are indicated by their spines. No remains of any vertebrates higher than fishes are known in the Devonian.

Plant remains in the form of marine algæ are found throughout the Devonian. Some of these, like *Nematophyton* of gigantic size, were long supposed to be the trunks of coniferous trees. Others with delicately branching fucoid leaves are common, especially in the Hamilton, Portage, and Chemung groups. The continental phase of the Devonian has afforded the earliest examples of land vegetation, all prophetic of the succeeding Carboniferous types. Both the fauna and flora of the upper Devonian show marked affinities by gradual transitions to those of the Subcarboniferous. See PALÆOBOTANY.

*Carboniferous.*—The early part of the Carboniferous period was marked by a continued recession of the sea, which had begun in late Devonian time, and during the Carboniferous the land areas seem to have reached a greater expansion than they have at the present day. These Carboniferous land masses were of very different form and situation from the present day continents. An Arctic continent occupied the greater part of the Arctic zone and extended by broad peninsulas southward toward the equator, over what are now eastern America, eastern Asia, central Europe, and the eastern Atlantic Ocean. Another, Indo-African continent, covered that part of South America east of the Andes, extended across the south Atlantic, Africa, the Indian Ocean, and Australia. An ocean spread over the present Pacific basin and also over Alaska, all of the United States west



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of the Mississippi River, Central America and the western part of South America; while a great mediterranean sea of irregular form encircled the globe and communicated at both ends with the Pacific Ocean. There was also a small Antarctic sea. Toward the close of Carboniferous time the ocean again transgressed and the land masses became for a time somewhat reduced in size. The Carboniferous formations consequently present two well-marked facies: a marine facies with deposits of limestones and shales with mollusks, brachiopods, corals and foraminifera, more widely spread in the lower and upper Carboniferous; and a continental phase of sandstones, shales, and coal-beds, holding abundant plants, and in some localities numerous insects, fish and amphibians. These facies as a rule occupy different basins, but occasionally they are found dovetailed into each other in such manner that their relative ages can easily be determined. The lands of Carboniferous time and especially the coastal swamps supported a dense and rank vegetation comprising more than 1,500 species of plants. Ferns, some of great size, were the most common type. Calamites with fluted many-branched stems and variform foliage, were giant predecessors of our modern horse-tail rushes (*Equisetum*). *Lepidodendron* and *Sigillaria*, related to clubmosses (*Lycopodium*), with trunks often five feet thick and 75 feet high; *Cordaite*s with sword-shaped yucca-like leaves on a solid trunk 25 to 30 feet high; and other great tree-like plants intermediate in nature between the ferns and cycads, formed the bulk of the forest growth. In the shelter of these forests lived numerous insects, mostly primitive cockroaches, also dragon-flies, one of which (*Meganeura*) had wings over 20 inches across; primitive forms of locusts, crickets, grasshoppers and also scorpions that were much like those of modern type. On the shores of the swamps lived large amphibious myriopods whose bodies were armed with branching spines. Some land snails like modern *Pupa* and *Zonites* have been found. The fresh-water facies also contain remains of lizard-like amphibians (*Stegocephalia*), many of which have been found in hollow *Sigillarian* stumps.

The marine phase of the Subcarboniferous contains the first abundant foraminiferan deposits. Minute *Endothyra* shells form the bulk of the Indiana oolitic limestone; *Fusulina*, like grains of wheat, and *Schwagerina*, a globular form, build great limestones in the upper Carboniferous. Corals are not so abundant as in the Devonian and coral reefs are rare. *Lithostrotion* is the characteristic American genus. The *Stromatoporan* hydroids are wholly wanting. Crinoids were locally very abundant, especially in the Subcarboniferous beds at Burlington, Keokuk and Crawfordsville in the Mississippi Valley, where about 650 species have been found. The blastoids, with *Pentremites* as their most abundant type, attained their climax in the Subcarboniferous of America. Among the abundant bryozoa, one genus *\*Archimedes*, with its screw-like axis, is a good index fossil of the Subcarboniferous. The characteristic brachiopods of the Carboniferous are *\*Productus*, *Chonetes*, *\*Derbyia*, *Spiriferina*, *Marginifera*, *Meekella*, *Enteletes*. Lamellibranchs are abundant; Gastropoda present a number of heavy-shelled forms; among the Cephalopoda the

orthoceratites have greatly declined; nautiloids abound, and the goniatites show great advancement over those of the Devonian, and toward the end of the period transitional types suggestive of the Triassic ammonites appeared.

The arthropod fauna of the Carboniferous is poor in trilobites, eurypterids are common in some coal measure shales, the malacostracan crustaceans show some progress, and the phyllopods *Leaia* and *Estheria* are found in fresh-water deposits between coal beds.

The Carboniferous vertebrate fauna is of interest by reason of the sudden expansion of amphibian types in the upper part of the system. The *Stegocephalia* (labyrinthodonts) are represented by several genera, and consist of generalized types suggestive of the later crocodiles, lizards and snakes. The fish-fauna is abundant, comprising sharks and ganoids. The Waverly shales of Ohio have afforded numerous large lungfishes (*Dinichthys*) and some fine examples of acanthodian sharks (*Cladoselache*). Over 600 species of fish have been described from the Subcarboniferous limestones of America.

*Permian*.—During Permian time the continental conditions were even more prevalent than during the Carboniferous, and accordingly the marine phase is much restricted in distribution and its fauna diminished in numbers. Both plants and animals are transitional between those of the Carboniferous and Triassic. Many types characteristic of the Palæozoic have their last representatives, some of them, it is true, occurring abundantly, in the rocks of this system. *Productus*, *Bellerophon*, *Orthoceras*, *Cyrtoceras*, goniatites, trilobites and the fenestellid bryozoa, which latter formed extensive reefs in Europe, all become extinct with the close of the Permian. Other types, some of them initiated during the Carboniferous or earlier and continued into the Trias attain a considerable expansion, and give to the fauna a decided Mesozoic aspect. These are found among the lamellibranchs as well as among the ammonoids, fish and amphibians. The Ammonoidea attained a great expansion, and we see together with the simpler goniatite genera the forerunners of the more complex ceratites and *Arcestidæ* of the Trias, and also the eminently characteristic genus *\*Medlicottia*. The fish fauna of the Permian consists mainly of heterocercal ganoids. Acanthodian sharks reached the climax of their evolution. The stegocephalian amphibians, among which *\*Branchiosaurus* and *\*Archegosaurus* are the best known, were varied and common, and were the dominant types of life. There were also snake-like members of this group, one of which, *Palæosiren*, was nearly 45 feet long. A new type of vertebrate appears in reptiles of land and fresh-water habits. Rhynchocephalians are represented by lizard-like *\*Palæohatteria*, and the peculiar spiny *\*Naosaurus*, and *\*Dimetrodon*.

While the Permian flora is in general the same as that of the Carboniferous it contains some types not seen in the latter—broad-leaved ferns, *Glossopteris*; the conifers *Walchia* and *Voltzia*, and the cycad *Zamites*, which give to the flora a strong Mesozoic expression.

*Mesozoic*.—The Mesozoic fauna and flora are distinguished from those of the Palæozoic by the absence of trilobites, graptolites, orthoceratites, long-hinged brachiopods, tetracorallic and tabu-



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late corals, cystoids, palæocrinoids, blastoids, phyllocarid crustaceans, eurypterids, palæoconch lamellibranchs, goniatites, acanthodian sharks and placoderm fishes, and the great lycopods. On the other hand this era is marked by the introduction of numerous new types and by the expansion of many invertebrate groups, land and marine reptiles, multituberculate mammals, and cycads and conifers. During the era a great change in the expression of the life is apparent, in that the early Triassic life presents close analogies with that of the late Permian, while during the era an almost complete change takes place, and that of the upper Mesozoic, especially the vegetation, affords considerable resemblance to the early Tertiary. The wide extension of continental areas continued from Permian into Triassic time with perhaps a slight increase, and in North America marine Triassic fossils have been found in only a few places in the far West. The fauna as a whole is an impoverished one. The continental Trias, consisting of red beds in America, Europe and Asia, contains abundant remains of ganoid fish (\*Semionotus) together with some cycads and conifers. In some regions these beds have afforded also numerous remains of often gigantic stegocephalian Amphibia, which attained their climax during this period. Small amphibious precursors of the large marine Jurassic ichthyosaurs and plesiosaurs are found in \*Lariosaurus, \*Nothosaurus and others. The Theromorpha, reptiles exhibiting remarkable affinities with the carnivorous mammals, attained a great development in South Africa. The first turtles, crocodiles, and dinosaurs occur here. The earliest mammalian remains consist of fragmentary jaws and multituberculate teeth of small animals supposed to be allied to the modern monotremes: Microlestes, Triglyphus in Europe, and Dromatherium and Microconodon in North America.

The marine Trias is found well developed in the Alps with extensions into Asia Minor, India, Arctic regions, Pacific States and Australia. The number of species is comparatively small, though individuals are abundant. Foraminifera and calcareous sponges abound. Corals of perforate and aporose genera formed extensive reefs in some regions. Crinoids are represented by the eminently characteristic \*Encrinurus liliiformis, and echinoids by the regular sea-urchin Cidaris. Among the brachiopods are a few remnants of Palæozoic genera, while the families Terebratulidæ, Rhynchonellidæ, and Koninckinidæ are surprisingly developed. The lamellibranchs begin to show considerable expansion, and the first true fresh-water unios appear here. The marine gastropod fauna is abundant, with some old types and others of later Cretaceous and Tertiary aspect. The ammonites, which began in the Permian, show a wide differentiation of form and complexity, and attain the culmination of their evolution in the upper Trias. Over 1,000 species have been described. Ostracods are abundant, and a true macruran decapod, Pemphix of the Muschelkalk, reminds one of the modern crayfish.

*Jurassic.*—The facies development of this system is very varied; the continental phase predominates in America as the Newark or Connecticut River sandstones, while the marine phase is most prominent in Europe and Asia. The Jurassic flora is quite similar to that of the Trias, made up of cycads and conifers which are fore-

runners of the recent pines. Among marine invertebrates the sponges and corals, largely of modern type, were so abundant as to form great reefs. Crinoids were abundant in individuals, though genera and species were few; echinoderms and Bryozoa were common, while the brachiopods were restricted to a few families. The lamellibranchs and gastropods include the first representatives of a number of modern families. The ammonites are by far the most abundant and characteristic forms of mollusks, and by means of them the marine Jurassic of Europe has been subdivided into some 15 zones, each characterized by its particular species. Belemnites, the solid cigar-shaped internal shell of squid-like dibranchiate cephalopods, are very abundant and varied, and the fossilized ink-bags of these creatures are common in some formations. The crustacean fauna shows a great increase of long-tailed decapods allied to prawns, shrimps, and crayfish, and the earliest true crabs. Insects include dragon-flies, May-flies, termites, grasshoppers, crickets, walkingsticks, and some beetles; also occasional bugs, flies and ants. The ganoids with heterocercal tails take a subordinate role, while those with homocercal tails and scaly rhombic plates predominate. Sharks and rays and the first teleost fishes complete the Jurassic fish fauna.

The reptiles form the most interesting group of the Jurassic fauna, for during this period they reached the highest stage of their evolution both in variety and abundance. The Triassic stegocephalians and Theromorpha give place to the terrestrial dinosaurs and the marine ichthyosaurs and plesiosaurs. The latter held somewhat the same relation to reptiles that the whales of modern time hold to the mammals. Those sea lizards swarmed in the Jurassic seas where they preyed upon the fish. The dinosaurs held sway upon the land, not only during the Jurassic Period, but also during the greater part of the succeeding Cretaceous. Another type of reptile prominent during Jurassic time, and continued into the Cretaceous, was the group Pterosauria or flying lizards, of which the pterodactyl is the best known example. Other types of reptiles, as turtles and crocodiles, are more or less common. At the same time when the reptilian stock developed flying creatures there appeared the earliest known bird. (See ARCHÆOPTERYX.) The mammalian remains of Jurassic time are known only by isolated teeth and jaws of small size and very rare, and all are related to the marsupials and monotremes.

*Cretaceous.*—The flora of the lower Cretaceous is like that of the Jurassic, but gradually the cycads diminish in importance and a host of angiosperms appear, very similar to the trees and shrubs of to-day. Many genera of recent tropical and temperate zone plants occur in the Cretaceous rocks of Greenland and northern Europe, facts cited as evidence of the mild climate of those parts during Cretaceous time. The ammonites begin to decline and we see numerous degenerate types, last members of various races, with shells loosely coiled, turreted, hook-like, or even straight, many of which are characteristic index fossils. The group becomes entirely extinct with the close of the Cretaceous.

The close of Cretaceous time terminated the middle or Mesozoic period of the history of organic life, and marked the extinction of a number of types of animals which had for long



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epochs dominated the lands and seas. This extinction is perhaps more evident here than at the end of the Palæozoic, and its causes are wholly unknown. It is true that some groups (Ammonites) had already begun to show marked degenerate tendencies attendant upon race senility, but the majority of the groups became extinct at the height of their evolution, when they were represented by their most highly specialized types. It is possible that this very specialization rendered them more liable to injury by slight though abrupt climatic changes or by sudden variations in the depth of the seas in which they lived. The great land and marine reptiles, the flying lizards, the mesosaurs and toothed birds all became extinct. Likewise the ammonites, belemnites, rudistæ, and the pharetrone sponges, so characteristic of the Mesozoic, have not been found above the upper limits of that system.

*Cenozoic.*—The life of this era is like that of recent time, particularly the marine life, for the terrestrial mammalian life of a large part of the system is very dissimilar to modern animals. The early classification of this system was based upon the increasing percentage of still living species found of both plants and animals fossil in the deposits. (See PALÆOBOTANY.) Some of the distinctive types of invertebrates were of larger size than usual. Sponges and corals are abundant only in restricted localities. Foraminifera, Radiolaria, echinoderms, Bryozoa, lamelli-branches, and gastropods are present in great variety while crinoids, brachiopods and cephalopods are comparative rarities. The preponderance of crabs, with a number of extinct genera, over the long-tailed, lobster-like decapods is very marked. Acorn barnacles, often of large size, are common, and fresh-water snails and mussels, all of modern types, are abundant in the fresh-water deposits of both Europe and America. Insects of all kinds have been found in the Oligocene and Miocene deposits, especially at Florissant and White River, Colo., and in the amber of the Baltic provinces, which latter has furnished about 2,000 species.

But the greatest interest attaches to the vertebrate fauna of the Tertiary, for during the early days of this period the placental mammals outstripped the marsupials and monotremes, and became the lords of the land, and toward the end of the period appeared man. The reptiles, which held so prominent a place during the Mesozoic, are reduced to the true lizards, snakes, crocodiles, and turtles. The amphibia which, as Stegocephalia, had become almost extinct during the middle Mesozoic were resurrected in the Eocene as salamanders, toads, and frogs, and continued thence till the present day. The fishes included numerous large sharks and a preponderance of bony fishes of which many belonged to modern genera, such as perch, herring, carp, pike, catfish, eels, breams, and mackerel. Birds exhibit a continuously expanding evolution during the Tertiary and they are still expanding. See MAMMALIA; TERTIARY PERIOD.

*Conclusion.*—The dominant types of the consecutive periods present on the whole an increasing degree of perfection of structure, and the dominant types of one age are, as a rule, not related to the dominant types of the preceding age. These dominants are usually the most highly specialized members of the classes or orders to which they belong, and it is further to

be noted that dominance and high specialization have in most cases been soon followed by decline and extinction. The small primitive forms of one period may evolve into the large dominant types of the next epoch and in their turn decline and disappear. In the invertebrates and lower vertebrates (fish, amphibia, and reptiles) the rate of this evolution, and consequently the destiny of the race, is almost wholly dependent upon the presence and continuance of favorable conditions of existence, for these types have little or no ability to surmount physical difficulties. Among the higher vertebrates, enlargement of the brain mass and of the mental faculties enables the animals to circumvent unfavorable conditions to some extent, but they also are comparatively helpless. It is in man, with his highly developed intellect, and mechanical skill, that we see the only organism able not only to circumvent unfavorable conditions of life but actually to nullify them, and to practically subjugate all other organisms or render them useful to him in his affairs. We have said that high specialization indicates approaching decline and extinction. That is true in respect of structural evolution, but as regards intellectual evolution, and the directions in which it may differentiate, we know next to nothing beyond the fact that intellectuality has up to the present time evolved with remarkable acceleration. In view of this it seems impossible to conceive otherwise than that man, under strong physical, moral and religious control, can have before him any other than a future longer and more brilliant than his comparatively brief existence.

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**Palæozoic, Paleozoic,** the third great division of Geologic time and the first one in the sediments of which well preserved organic remains have so far been found. It is preceded by the Proterozoic or Eozoic (first life or dawn of life) and by the Azoic (no life) divisions in descending order, and succeeded by the Mesozoic (Mediæval life) the Cenozoic (recent life) and the Psychozoic (mind life) time divisions, in ascending order. The name signifies ancient life and has reference to the character of the plant and animal life of the time, which was markedly unlike that of the present. As a time division, the Palæozoic is generally called an Era, this term meeting with the recommendation of the International Geological Congress at its Bologna convention in 1881. Dana in his 'Manual of Geology' (5th edition) however uses the expression "Palæozoic Æon or Palæozoic Time," and applies era to the next smaller subdivision. In this he has been followed by several authors. Though in its modern sense primarily used for a time division, the term Palæozoic is also applied to that division of the earth's crust which was formed during that time. And indeed this is the original use of the term, when it was coined for the reception of the fossiliferous rocks below the so-called Secondary or Mesozoic formation. The rocks thus named were formerly included with the crystalline rocks of all ages as "Primary," but later on they were separated at least in part, as "Transition rocks." Lyell, to avoid confusion, spoke of them as the "Primary fossiliferous rocks." The following parallel columns express perhaps as nearly as possible the correlation between the older and newer terms.

OLDER	NEWER
Quaternary	Psychozoic
Tertiary	Cenozoic or Cainozoic
Secondary	Mesozoic
Transition (or Primary fossiliferous)	Palæozoic
Primary	{ Eozoic (or Proterozoic) { Azoic

In the formation scale the term "group" was recommended by the International Congress as coordinate in rank with that of Era in the time scale. This recommendation has not been very generally adopted in America, where the term group is commonly used for a smaller formation and "series" used for such rock divisions as that corresponding to the Palæozoic æon.

The following subdivisions of the Palæozoic are recognized:

- Permian (or Permian) era and system.
- Carbonic (Carboniferous or Carbonian) era and system.
- Devonic (Devonian) era and system.
- Siluric (Silurian, Upper Silurian) era and system.
- Ordovician (Ordovician, Lower Silurian or Champlainic) era and system.
- Cambric (Cambrian) era and system.

*Characteristic Life of the Palæozoic.*—The characteristics of Palæozoic life were very marked and stamp the æon as boldly contrasted with the succeeding Mesozoic. The Hydrozoa were represented by the group of Graptolites, and by *Dictyonema*, both of which are wholly confined to the Palæozoic. Among corals the group of rugose corals, or Tetracoralla (so-called from having four primary radiating lamellæ or septa with reference to which the others are arranged), the honey-comb corals, *Favosites*, and the tube corals, *Aulopora*, *Syringopora*, *Halysites*, etc., are characteristic types practically unknown in post-Palæozoic time. Among the Pelmatozoa or stemmed Echinoderms, the two groups of Cystids and Blastids are wholly confined to the Palæozoic, while the Crinoids with the exception of the family Articulata, and the genera *Marsupites* and *Uintacrinus* are likewise restricted to the Palæozoic. Asterozoa, or star-fish and brittle stars, and Echinozoa or sea-urchins and holothurians, while represented in Palæozoic rocks, especially the Echini, are more characteristically known from Mesozoic and later strata. The Bryozoa are well represented by such types as *Ceramopora* and *Fistulipora* and their congeners among the Cyclostomatous Bryozoa; by the Monticuliporoids and related types constituting the sub-order Trepostomata of Ulrich; and by the Fenestelloids and related types constituting the sub-order Cryptostomata of Vine. These often constructed extensive reefs, and in the Ordovician especially, gave rise to extensive limestone deposits.

Brachiopods are perhaps the most important Palæozoic types, no less than 2,600 species having been described from the Ordovician and Silurian deposits alone. Several archaic families, that is, the Lingulidæ, the Discinidæ and the Craniidæ, and the family of the Rhynchonellidæ, range from the Ordovician to the present time while modern types such as some of the Terebratuloid families and the family Thecidiidæ among the Strophomenoid shells begin in the middle or late Palæozoic. By far the largest number, however, end with the Permian or before, while a few others run on into the Trias. The Spirifer family, so characteristic of the Palæozoic horizons, is represented in both Triassic and Jurassic beds by a few genera.

Leaving out of consideration the persistent archaic families before mentioned, the post-Palæozoic brachiopods belong chiefly to the Rhynchonelloid and Terebratuloid families of the most specialized order of Brachiopods, the



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Telotremata. The only prominent exception is the modern family of Thecidiidæ of the Protremata, which makes its appearance in the Carbonic rocks.

Turning to the Pelecypods or bivalve mollusks, we find that their principal representatives belong to post-Palæozoic time. The primitive order of Prionodesmacea, represented by such modern types as the oyster and scallop (*Pecten*), alone has a prominent representation in the Palæozoic, where about thirty families are found. Of these more than one half continued to exist beyond Palæozoic time, with few exceptions indeed down to the present time. Only thirteen out of forty families of this order (as now understood) are confined to the Palæozoic. On the other hand post-Palæozoic time is characterized by about eighty-six families. The gastropoda are likewise essentially post-Palæozoic Mollusca, those of Palæozoic time being essentially primitive or archaic in character. Among the most typical Palæozoic forms are the Pleurotomariidæ, Bellerophontidæ, Euomphalidæ, Trochonematidæ and the Platyceroids. The group of the Conularida with *Hyolithes*, *Tentaculites* and *Conularia*, are also typically Palæozoic, only a few representatives of the latter continuing into the Lias.

The tetrabranchiate cephalopods were well represented during the Palæozoic by the Nautiloidea. Of forty families belonging to this class, only three originated in post-Palæozoic time, and only one of these, the family of the true *Nautilus*, continued to the present time. Of the thirty-seven Palæozoic families three have representative genera in the Trias and one is represented by a single lower Jurassic genus. The straight-coned nautiloids (orthoceracones), the bent cones (cyrtoceracones), and the loose-coiled cones (gyroceracones) are practically confined to the Palæozoic rocks, the close-coiled nautilicones alone characterizing later horizons as well. The ammonoids on the other hand are represented in Palæozoic rocks only by their more primitive types. The Goniatitoids and Climenioids belong exclusively to the Palæozoic (Devonic to Permian), while the other groups are only represented by the order Phyllocampyli.

Among crustacea, the Trilobites are wholly confined to the Palæozoic rocks, of which they constitute in many respects the most characteristic type of fossil. Their greatest development was during Cambrian and Ordovician time. The remarkable order of Eurypterid crustaceans is also confined to the Palæozoic, constituting the most characteristic type of certain formations. The only other type of crustaceans abundantly represented in the Palæozoic rocks is that of the small bivalve ostracods.

*Palæophysiography of North America.*—The physiographic changes which the North American continent suffered during Palæozoic time may be summarized as follows: In early Cambrian time the greater part of the interior of North America was out of water, the eastern shore being probably a short distance east of the present Appalachians, and the western shore on the western flanks of the rocky mountains. The southern shore was not far north of the present southern boundary of the United States. A narrow gulf extended northward along the western flank of the Appalachian protaxis, and probably connected with a similar gulf extending southward from the present Saint Lawrence gulf.

The fauna of this Appalachian trough was mostly distinct from that of the Atlantic border. In the succeeding periods there was a continuous subsidence of the land, and a transgression of the shore-line, which closed in upon it, especially from the southwest. As the sea in each succeeding epoch reached farther up onto the land than it did before, the deposits of later date lapped over the earlier ones. This encroachment continued with many interruptions through the early part of Ordovician time, when the great Appalachian Valley, bounded by two parallel folds, came into existence. This separated the interior or Mississippian sea from the Atlantic, until, with the final emergence of the land, this sea was transferred to the Great Plains region of the west.

Coincident with the formation of these folds, the interior sea retreated southwestward, only to readvance again during middle Ordovician time, when it reached far up onto the old Canadian land. Though generally distinct from the Atlantic, periodic communications were established across the barriers, allowing the ingress into the eastern area, of the European graptolite and trilobite faunas, in middle Trenton and in Utica time. At the close of Ordovician time, the Taconic revolution caused the formation of an effectual eastern barrier, and at the same time the waters of the interior sea were largely withdrawn. A gradual resubmergence in Silurian times, re-established the Mississippian sea. In mid-Silurian time it was probably entirely enclosed by land, only the region between the Appalachians and the Mississippi River being covered by water. This water body extended northwestward over what is now Hudson Bay and the arctic regions beyond. It probably communicated with the European continent by a channel traversing the north polar regions, the north Atlantic being then replaced by a continuous land area which connected New England with Scandinavia by way of Labrador and Greenland. This northern channel was later on closed for a period, so that all that portion covering the eastern United States became a saline sea in which life became extinct. In this North American dead sea, the great Silurian salt and gypsum beds of New York, Ohio and Michigan were deposited. At the close of the Silurian the whole of the North American continent became dry land, and the Mississippian sea was reduced to a narrow channel along its former eastern border. In this channel the Helderbergian rocks of the New York and the Appalachian region were deposited. Toward mid-Devonian time this sea spread westward again to Michigan and southward to Indiana, and the great Palæozoic coral reefs began to flourish. The westward transgression of the Mississippian sea continued, until finally a northwest channel was established, by which the Eurasian faunas could enter across what is now northwestern Canada. Many fluctuations and adjustments took place, the eastern border of the sea growing shallower, and the western deeper. In early Carbonic time, the sands deposited in the eastern part of this Mediterranean sea permitted the existence of only a sparse fauna, while in the region now known as the Mississippi Valley, great reefs of crinoids flourished. In mid-Carbonic time, the interior sea extended to the foot of the Rocky Mountains, while the greater part of the region east of the present Mississippi



River was converted into the fresh water morasses, in which the extensive coal beds of eastern North America were deposited. This condition continued with slight changes through Permian time, and was terminated by the great physiographic changes which accompanied the formation of the Appalachian Mountains. This resulted in the permanent elevation of the North American continent. Marine deposits of the early Mesozoic are known only in the northwest. Later in Cretaceous time, the Great Plains region and the Atlantic border were resubmerged, but eastern North America remained continuously above water, with the exception of a slight submergence in the Hudson and Champlain valleys in late Pleistocene time.

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**Palæstra** (Greek, "wrestling-school"), originally a school for the training of Greek youth in gymnastic exercises. At first private, such schools were afterward supported by the state, and in the most comprehensive sense a palæstra was a public place set apart, and under official direction, for exercises in wrestling and various forms of athletics. In these schools or gymnasiums special privileges were given to athletes training for contests in the public games. The name palæstra is also applied to wrestling and athletics themselves.

**Palafox y Melzi, DON JOSÉ de, dōn hō-sā' dā pā-lā-foh' ē māl'thē**, DUKE OF SARAGOSSA, Spanish patriot: b. Aragon 1780; d. Paris, France, 16 Feb. 1847. When very young he was appointed an officer of the royal bodyguard and in that capacity accompanied Ferdinand VII. to Bayonne in 1808. Palafox escaped the capture which befell his royal master and fled to Saragossa which he defended in two sieges in 1808-9, but was captured by the French and imprisoned (1809-13) at Vincennes. He then returned with the king to Spain, and was confirmed as captain of Aragon. Later he turned against Ferdinand VII. and in 1833 joined the forces of Queen Isabella. He was created Duke of Saragossa in 1836.

**Palaihnihan, pā-līh'nī-hān, or Pit River Indians**, an American family comprising numerous tribes living in the northeastern part of California, in the basin of the Pit River, hence the local or common name of Pit River Indians. Seven distinct tribes of these people were known in the days of 1849, but they are now almost extinct. They are of a low type of the American aborigines.

**Palais Royal, Fr. pā-lā rwā-yāl**, a collection of buildings in the Rue Richelieu in Paris, composed of a palace, public gardens, shops, cafés, and restaurants. The palace was built in 1634. (See PARIS.) Here Napoleon installed the Tribunate. At the restoration it was repurchased by the Duke of Orleans. He formed the Cours de Nemours, and built the Galerie d'Orléans. At the revolution of 1848 the Palais Royal was appropriated as the domain of the state, and called the Palais National. On 23 May 1871, during the struggle between the army of Versailles and the Communists it was set on fire. The left wing and part of the central pavilion were destroyed, but the galleries and the Théâtre Français were preserved. The destroyed wing has been rebuilt, and other portions

of the palace have also been restored. The Théâtre Français and the Théâtre du Palais Royal form part of the buildings.

**Palamedes, pāl-a-mē'dēz**, in Greek mythology, a hero, the son of Nauplius and Clymene. Although figuring prominently in the later accounts of the Trojan war, he is not referred to in the Homeric writings. Having discovered that the madness of Odysseus was only feigned, and having brought him to the leaders before Troy, Palamedes is said to have become an object of hate to that hero, and to the vengeance of Odysseus, according to some of the varying stories, the death of Palamedes was due. He is represented as skilled in learning, and his name is connected with the invention of letters, numbers, money, weights and measures, checkers, and dice.

**Palanan, pā-lā'nān**, Philippines, a pueblo of the province of Isabela, Luzon, on a river, five miles from the Pacific coast, at the foot of the Sierra Madre Mountains, 36 miles east of Ilagan. A mountain trail begins at this point, and Palanan is the trade centre for the surrounding region. It was here that Aguinaldo was located and captured. Pop. 1,140.

**Palanpur, pā-lan-poor', Pahanpur, or Pahlumpur**, native state of India in the province of Gujarat, Bombay division, south of Rajputana. The state is crossed by the Rajputana-Malwa railway, on which the town of Palanpur, capital of the district, is, a junction for the British cantonment of Deesa. The native state has an area of 3,177 square miles and population (1901) of 222,627. A political agency including this and other surrounding states contains 4,775 square miles and has a population of 467,691. The town, with a population (1901) of 17,799, like the state and the agency, suffered terribly from plague, so that the population is one quarter less than 10 years ago.

**Palanquin, pāl-an-kēn', Palankeen, or Palki**, a vehicle commonly used in India and Oriental countries. It is a sort of litter or covered carriage, borne on the shoulders of four porters, eight of whom are attached to it, and who relieve each other. It is usually provided with a bed and cushions, and a curtain, which can be dropped when the occupant is disposed to sleep.

**Palate, the roof and the superior aspect of the mouth or oral cavity toward its hinder or posterior portions.** Anatomists are accustomed to speak of the hard and the soft palate. The former is constituted by the palate and superior maxillary bones; the latter is the more or less mobile prolongation of the hinder part of the roof or lining membrane of the mouth which is attached to the posterior border of the hard palate. The hard palate supports the tongue when that organ is employed in tasting, in the production of articulate sounds, in mastication, and in swallowing. The membranes and tissues which cover the bones forming the hard palate are of thick conformation, and are closely bound to the surface of the bones. The tissues are thinner toward the middle line of the palate. The palatine glands exist in a row on each side of the hard palate, and are most numerous and of larger size as the hard palate is continued backward to form the soft palate. The mucous



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membrane of the hard palate is of a whitish color, this appearance being produced by a thick layer of epithelial cells covering the membrane.

The soft palate exists only in the crocodiles out of the class *Mammalia*. In the *Cetacea* it forms a muscular canal, which prolongs the hinder nostrils downward and backward, and is thus adapted to the breathing-process of these aquatic forms. In the ant-eaters the soft palate is nearly eight inches in length. It consists in all of mucous membrane and muscles, and forms a semi-partition between the mouth and the hinder nostrils. In front it is attached to the hard palate. Behind it is free, and in the middle a pointed process, the uvula, is situated. Its upper surface, or that next the nasal passages, is convex, and is prolonged to form the floor of the nose. The lower or under surface is concave, so as to adapt it to receive the back of the tongue; and on this surface the soft palate bears a median ridge, showing the early stage of its formation, when it consists of two halves. Non-union of these halves and of those of the hard palate produce the deformity known as cleft palate. Mucous glands are abundantly distributed in the membrane forming the soft palate, these structures secreting the mucus which serves to lubricate the throat during the passage of food. Above these glands muscular tissue is found, and the upper surface is formed of mucous membrane of the nasal passages already alluded to. The uvula, depending in the middle of the soft palate, gives to the latter the appearance of a divided or double arch. This structure, the uses of which are undetermined, consists of numerous mucous glands, and a muscle known as the azygos uvulæ. The uvula varies in length in different subjects and at different times in the same person. Its permanent elongation gives rise to an irritant cough produced by its tickling the throat, and for the relief of this complaint its lower border is frequently excised.

In front the soft palate becomes continuous with the tongue and pharynx or back part of the mouth through two mucous and muscular folds on either side known as the anterior and posterior pillars of the fauces. The anterior arch of each side exists as a curve from the uvula to the side of the tongue. The posterior arch begins at the uvula, follows the free edge of the soft palate, and ends at the side of the pharynx. The pillars of each side separate or diverge in a triangular manner from their point of origin, and within the triangle of each side a tonsil is contained.

The muscles of the soft palate number five pairs. These are the levatores palati, which raise the soft palate and bring it to the horizontal position in swallowing. The tensores palati draw the soft palate downward and tighten it, and their action also includes the keeping patent and open of the Eustachian tube. The palatoglossi and palato-pharyngei muscles form the bulk of the arches of the soft palate; and the azygos uvulæ muscle constitutes the last structure of this description included in the soft palate. The tonsils or amygdalæ ("almond-like") are placed between the palatine arches. The substance of each tonsil contains numerous follicles, which open externally by 12 or 15 openings, and more deeply placed are masses of adenoid or lymphatic tissue similar to the Peyer's

patches (q.v.) of the intestine. The tonsils are liable to inflammatory affections, and are excised for disease without leaving any bad effects. (See TONSILLITIS.) Both the hard and soft palate are supplied with blood by the descending palatine branch of the internal maxillary artery, and with nerves by the palatine branches of the superior maxillary nerve. The use of the soft palate is chiefly to close the posterior nares or nostrils, and so to prevent the escape of the food by the nose in swallowing; during which process the palate is elevated by the levator muscles from its usually dependent position to the horizontal position. In the latter position it lies upon the back of the pharynx, and so closes the nares. The arches of the palate assist in swallowing. The anterior arches during deglutition contract, so as to prevent the food from returning into the mouth; while the posterior arches contract at the sides, and so preclude the escape of food into the nose. The whole process of swallowing is performed firstly by the mass of food being brought to the back of the tongue. The lower jaw being next closed to afford a fixed point for the action of the muscles which raise the larynx, the food is sent into the elevated pharynx by the pressure of the tongue on the palate. The posterior palatine arches and soft palate prevent the escape of the food into the nose at this stage; the anterior palatine arches and tongue prevent it returning to the mouth; the epiglottis is shut over the upper opening of the larynx so as to prevent the food entering the windpipe; and by the action of the constrictor muscles of the pharynx the food is finally shot into the œsophagus or gullet, along which tube it is propelled to the stomach by the peristaltic or vermicular contraction of its muscular walls. See MOUTH; NOSE AND THROAT; PHARYNX; TONGUE.

**Palat'inate, The,** (1) a comprehensive term for two states of the German Empire, which, until 1620, were united. The name Palatinate (German, *Pfalz*) was originally given to the imperial castles dispersed over the German Empire, in which the emperors resided alternately, with a view to maintain order by their presence, and to administer justice impartially in all the provinces of the empire. The palatine or count palatine was the highest civil and judicial officer in these castles. Finally, the title was retained by only two of the territorial magnates of the empire, whose states were distinguished as the Upper and Lower Palatinate, or as the Palatinates of Bavaria and the Rhine. The Upper Palatinate was included in the circle of Bavaria, and was bounded north by the county of Baireuth, east by Bohemia, south by the county of Neuburg, west by Bavaria and the territory of Nuremberg. Its capital was Amberg. The Lower Palatinate (Palatinate of the Rhine) was contained in the electoral circle of the Rhine, and was situated on both sides of the river. It was bounded by the territories of Mainz, Katzenellenbogen, Würtemberg, Baden, Alsace, Lorraine, and Trèves. It was composed of the Palatinate proper or Electoral Palatinate on the right bank of the Rhine, one of the most fertile countries in Europe, and of the Principality of Simmern, the Duchy of Deux-Ponts (Zweibrücken), the half of the county of Spannheim, and the principalities of Veldenz and Lautern. The counts-palatine of the Rhine,



## PALATINE HILL—PALAWAN

whose original seat was Aix-la-Chapelle, in the 11th century were already in possession of the office, and of the lands pertaining to it, and were among the most powerful princes of the German Empire. In 1227 the entire Palatinate fell into the possession of the house of Bavaria and underwent a series of successions until 1619 when Frederick V., of the Simmern line, who had succeeded in 1610, was put to the ban of the empire for aspiring to the crown of Bohemia. (See GERMANY; THIRTY YEARS' WAR.) His Electorate and estates were given in 1623 to Maximilian, duke of Bavaria. Charles Louis, son of Frederick V., recovered the Lower Palatinate by the Peace of Westphalia (1648), and a new electorate, the eighth, was created for him, with the office of high-treasurer. The Upper Palatinate and the former rank of the elector-palatine in the electoral college remained with Bavaria. In 1742 the electorate fell to the Sulzbach line, represented by Karl Theodor, and in 1777 he succeeded to the Electorate of Bavaria, a portion of the estates of which, however, fell to Austria. This was accompanied by the recovery of the old electoral office of the Palatinate, and the transference of the grand-treasurership to Brunswick. Toward the close of his reign the Palatinate was conquered by the French. He died without issue in 1799, and was succeeded by Maximilian Joseph, duke of Zweibrücken. At the Peace of Lunéville (1801) he was compelled to surrender the Palatinate. The possessions on the left bank of the Rhine were annexed to France, a considerable part of the remainder was given to the Grand-duke of Baden, and the rest was distributed among other princes. At the Peace of 1814 Germany recovered her possessions on the left bank of the Rhine, and the Palatinate was redistributed among Bavaria, Baden, Hesse-Darmstadt, and Prussia. The portion belonging to Baden is included in the circles of Mannheim, Heidelberg, and Mosbach; the Darmstadt portion constitutes the provinces of Starkenburg and Rheinhessen. Bavaria received the whole of the Upper Palatinate and the portion of the Lower Palatinate, forming the Bavarian circle of Rheinpfalz. The Prussian portion was added to the Prussian province of Rheinland.

(2) The term palatinate or county palatine came into use in England during the 13th century, the counts or earls-palatine ruling over entire counties, acting as independent princes, exacting feudal rights and contributions, and simply swearing homage and fealty to the king. The principal counties palatine were Lancaster, Chester, and Durham. In the colonial days of the United States Maryland was granted to the Baltimore family as a county palatine on the model of Durham.

**Pal'atine Hill** (Lat. *Palatium*, later *Mons Palatinus*), the most central, the earliest settled, and (save for the Capitoline) the most famous and important of the seven hills of Rome. About 150 feet above the Tiber and 15 more above the sea-level the hill is an irregular quadrilateral, and to this shape is due the mythical *Roma quadrata*, the primitive city built by Romulus. The name *Palatium*, which the Romans connected with the Arcadian city *Palantium*, is probably related with *Pales*, an Italian rural divinity. On the Palatine the *Lupercalia* was celebrated in honor of Romulus;

there were the ancient temples (of Victory, Jupiter Stator, and the Magna Mater) in the days of the early republic, the residences of Cicero, Marcus Scaurus, and others in the last period of the republic, and at the beginning of the principate Augustus' own home (to which fact the use of the word "palace" from *Palatium* is due), the temple of Apollo dedicated in 28 B.C., and the Latin and Greek library. Tiberius and Caligula built additions to Augustus' palace; the latter emperor bridged the Capitoline to the Palatine. The Palatine was no longer used as an imperial residence after the time of Alexander Severus, and there was no more splendid building there until Pope Paul III. built the villa called *Orti Farnesiani*. Excavations of the hill began in 1762 under Bianchi's superintendence, and was renewed a century later by Rosa at the expense of Napoleon III. The Italian government purchased the Farnese Gardens in 1871, and now has charge of excavations.

**Palatka**, pā-lăt'ka, Florida, city, county-seat of Putnam County; on the St. John's River; and on the Florida E. C., the Florida Southern, the Georgia S. & F., and the Jacksonville, F. & K. W. R.R.'s; 47 miles in direct line south of Jacksonville. It is the centre of a prosperous agricultural and fruit region, is in daily steamer communication with Jacksonville, and exports large quantities of oranges, sugar, and cotton. It is also popular as a winter resort. It is the seat of the Putnam County High School, and of the St. Joseph's Academy and Day School (R. C.). Pop. (1890) 3,039; (1900) 3,301.

**Palawan**, pā-lä'wän, Philippines, the most southwestern island of the archipelago, lying west of Mindoro, Panay, and Negros; it is bounded on the west by the China Sea, which it separates from the Sulu or Mindoro seas; area 4,368 square miles, with dependent islands 4,726 square miles. It is one of the largest islands of the Philippines, and from its geographical position one of the most important, as it lies in the trade route between India and China and Manila.

*Topography and Climate.*—The island is long and narrow in shape; the greatest length from northeast to southwest is 278 miles, and the width averages only 17 miles, and is nowhere more than 30 miles. The coast is indented with numerous sounds, gulfs, and bays, most important among them Malampaya Sound (q.v.). A mountain system which divides Palawan into two watersheds, extends the length of the island following the general direction of the coast; the highest summit of this system is *Mantaliñgahan* in the south (6,843 feet); the average height is from 2,500 to 3,000 feet; between the summits are high table-lands. There are a number of rivers, which are all short; in the northern part there is a lake which opens into the ocean by a subterranean river. The climatology of the island shows two seasons, the southwest monsoon or wet season and the northeast monsoon or dry season; the heat is not extreme; malarial fevers are common on some parts of the coast.

*Forests and Fauna.*—The mountains are very heavily wooded, the forests contain valuable building, dye, and medicinal woods, including ebony, sandal, logwood, bamboo, ipil (a very hard wood), apiay, camphor, gum mastic, mo-



## PALAWAN PASSAGE — PALEMBANG

lave; a number of the trees found in Palawan exist nowhere else in the Philippines. Dammar, a gum which exudes from a large tree, is found in many places in deposits in the earth, which have, however, never been fully worked. The nipa palm grows luxuriantly along the rivers, and rattan is an important article of export. There are also numerous plants of varied character, including orchids and pitcher plants; among the latter is a trailing variety, the pitchers of which will hold a pint and a half of water.

The wild animals of Palawan are not very numerous; there are several varieties of the monkeys, also the pakdá or big ape, and porcupines; the birds are mostly of unusual species. Reptiles are abundant; alligators are commonly found in the lakes and swamps, and the pythons are unusually large, specimens over 22 feet long having been found.

*Industrial Resources.*—The resources of the island are as yet poorly developed. The chief industry is the raising of cattle, hogs, and goats; goats and fowls are bartered with the ships along the coast. Rice, tobacco, nutmegs, sweet potatoes, and other food products are raised for home consumption, and there are a few primitive manufactures also for domestic use. Edible birds' nests are found in large numbers in the rocky caverns of the coasts; they are of excellent quality, being considered second only to those of Peñon de Coron (q.v.), and have brought twice their weight in silver in the Chinese market. Honey and wax are also collected and brought to the coast for trade. There are no roads, except a few portages, but a number of trails; the rivers also afford means of transportation near the coast.

*People and History.*—The dominating race of the northern and central parts of the island are the Tagbanúas (q.v.), a peaceful and docile race; the Moros predominate in the southern part, south of the 10th parallel of latitude. Previous to the 18th century Palawan was a part of the sultanate of Borneo; in the early part of that century the Spaniards established several garrisons in the northern part of the island for the purpose of protecting their dominions on the north from the Moro pirates, and the island was soon afterward ceded to Spain. In 1885 a special attempt was made by the Spanish government to colonize Palawan by offering settlers free transportation and other privileges, but this failed. An attempt to establish a convict settlement was also unsuccessful, and Spanish authority was recognized only along the coast. The United States troops occupied Palawan in the early part of 1902, and in June of that year civil government was established in that part of the island lying north of the 10th parallel of latitude; the part south of this parallel, known as the Country of the Moros, is as yet (1904) without civil government. The most important town of Moro Palawan is Puerto Princesa, which has not 2,000 inhabitants. The island of Balábac, lying south of Palawan, is governed in accordance with the terms of the treaty with the Sultan of Sulu. Population of the island 50,000.

**Palawan Passage**, the route through the Balábac Strait and along the east coast of Palawan, used by vessels in the trade between China and Manila during the latter part of the southwest monsoons, because more sheltered

than the China Sea route to the west of Palawan. This route was first explored in 1850 by Captain Bates of the British navy, and soon afterward generally adopted.

**Palay'**, an Indian climbing plant (*Cryptostegia grandiflora*) of the milkweed family. Its stalk-fibres, which are strong and white, are spun into a very fine yarn; and its milky juice forms a kind of caoutchouc.

**Palazzo Pitti**, pä-lät'sō pīt'tē, a palace in Florence. See FLORENCE.

**Pale, The**, or the **English Pale**, Ireland, a name applied in the 16th century to that part of Ireland which was completely under English rule, to distinguish it from the parts where the old Irish laws and customs prevailed. It varied in extent at different periods, consisting of Dublin and more or less of the neighboring country.

**Pa'lea**, plural **Paleæ**, the bracts, usually membranous and colorless, on the receptacle of a composite plant between the florets; the chaff. Also the bracts immediately surrounding the fertilizing organs in grasses. See BRACTS; FLOWER.

**Paleario**, pä-lā-ä'rē-ō, **Antonio**, more correctly, ANTONIO DEI PAGLIARICI, and according to his Latinized title AONIUS PALEARIUS, Italian religious innovator: b. Veroli, Roman Campagna, 1500; d. Rome 1570. He was a teacher of rhetoric, whose reputation had spread over all Italy and abroad, and made his home especially at Sienna, but in 1567 was brought before the Holy Inquisition at Rome and three years later suffered at the stake. His principal work is a long Latin didactic poem, 'De Immortalitate Animarum.' Famous as his poetic and theological writings were, equally popular was the work attributed to him, 'Del Beneficio de Giesu Christo Crocifisso' (1543), which was translated into several languages, but in 1549 was suppressed by the Inquisition. It was published at Cambridge, England (1853), and at Leipsic with a German translation by Tischendorf (1856). Ranke maintained it to be the work of a Benedictine monk, Benedetto of Mantua. Consult: Young, 'Life and Times of Antonio Paleario' (1860); Bonnet, 'Aonio Palerio' (1863).

**Palembang**, pä-lēm-bäng', Sumatra, Dutch residency in the southeastern part of the island; also the capital city of the residency. The country is drained by the Musi (or Moesi) River, along the banks of which there are valuable supplies of petroleum. An alluvial plain and plentifully watered, it is very fertile. Its native inhabitants are Moslem Malays, except a race called Orang-Kubu, living by the chase in the thickest jungles and exhibiting a very primitive culture. Palembang residency has an area of 53,497 square miles and a population (1900) of 692,317, of whom 373 were Europeans, 1,876 Arabs and 6,451 Chinese.

Its capital city of the same name lies on both banks of the Musi, 44 miles from its mouth in a swampy region, the houses being sometimes built in the very stream. The old Javanese name for the city seems to have been Malayo, so that it may be the Malajour of Marco Polo and the Mo-lou-yu of the Chinese geographers. An attempt has been made to prove that the town was once held by Hindus, an occupation



## PALENQUE — PALERMO

like that in Java. The main building is an 18th century mosque. Coffee and pepper are exported; and there is some trade in silks, carvings, and goldsmiths' wares. The Dutch built a factory here in 1618, but the country remained independent until 1812 when it was occupied by the English, from whom it passed to the Dutch in 1821. Pop. about 55,000.

**Palenque**, Mexico, ruined city in the state of Chiapas, on the Chacamas River, about 60 miles northeast of Ciudad Real, discovered in 1746. The tropical vegetation of the district makes it impossible to know the exact extent of these ruins. Those which have been visited show great artificial terraces or truncated pyramids, forming the level resting place for temples or palaces of calcareous stone, covered with stuccoed decorations, colored carvings in relief and undeciphered hieroglyphics. These buildings have a slightly sloping, mansard-like roof. Five of the edifices have been styled temples, though it can not be considered at all certain what their use was. They, like the largest of the buildings, which is called the Palace, are divided into two vaulted rooms, there being only the two in each "temple," where, however, the rear chamber is divided into several smaller rooms, whereas in the "Palace" there are many series of these paired rooms. The vaults of the rooms are corbeled and have a triangular arch, commonly but loosely called Mayan, as if to connect the unknown builders with the people of the Mayan empire. The external architecture is too elaborate for brief description and everywhere is covered with stucco figures in alto relievo and brilliant colors, black, blue, reds, yellow, green and white. An arched bridge 30 feet wide and 40 long and an arched waterway 10 feet high, 500 feet long and 7 feet wide have also been found and are typical of the massive architecture of "temples" and "Palace"; some of the walls of the latter are 2 and 3 feet thick. Some valuable remains of early implements and personal decorations have been found in graves on the site. But they throw no light on the question as to the identity of the builders, who have been thought by some to be the semi-mythical Toltecs or the Olmecs. Consult: Holmes, *Ancient Cities of Mexico* (1895); Charnay, *Ancient Cities of the New World* (1887); and Morgan, *Houses and House Life of the American Aborigines* (1881).

**Palermo**, pä-lër'mō, Italy, (1) a seaport town, capital of Sicily, beautifully situated on the northern shore of the island on the Gulf of Palermo, surrounded by a fertile plain and partly enclosed by lofty hills. Its numerous spires, domes, and towers give it a very imposing appearance when approached from the sea. Two main streets, the Via Vittorio Emmanuele and Via Macqueda, intersect the city at right angles to each other. Near the centre is an octagonal space, the Quattro Canti, lined with elegant buildings in different styles of Grecian architecture and adorned with numerous statues. The two principal streets are opened into by a great number of others, mostly narrower and of an inferior description; but all well paved with blocks of lava. There is now an extensive system of electric tramways. Admirable places of resort are provided by the Marina and the Flora—the former a superb terrace about 80 yards wide, stretching about a mile along the

bay; the latter, commencing in the east where the terrace terminates in a magnificent public garden regularly and beautifully laid out, and adorned with statues, fountains, and rustic temples. Here is also a botanic garden of some extent, and there are several other public gardens. The public edifices are numerous, but do not in general display much taste. The most important are the cathedral, the church of San Giuseppe, the church of San Salvatore, La Martorana, and other churches; the royal palace, finely situated and surrounded by beautiful gardens, a large and irregular pile of buildings, among which the only great attractions are the chapel of King Roger (or Palatine Chapel), rich in mosaics, "perhaps the most beautiful palace-chapel in the world," and the observatory; the archiepiscopal palace; the national museum and picture-gallery; the communal library, with about 220,000 volumes; the national library, with over 150,000 volumes; the university, attended by 1,200 students; the barracks, arsenal, courts of justice, theatres, hospitals, and several literary and charitable endowments. Palermo has a good roadstead and harbor, which has been recently improved, and a well-equipped shipbuilding yard and dry dock have been constructed. The principal articles of export are sumach, wines, oranges and lemons, sulphur, tartar, olive-oil, citrate of limes, tomatoes, tomato paste, asphalt, hides, dried vegetables, macaroni, etc.; and among the imports are coal, grain, wood, petroleum, tobacco, iron, and steel rails, sheets, bars, etc., cement, machinery, sulphates, fish, etc. The total number of vessels that cleared from the port in 1900 was 3,732, with a tonnage of 1,677,234. The manufactures of the town include gloves, marble works, etc., and there is a foundry. The fisheries on the coast are productive, and give employment to numerous hands. Palermo is the see of an archbishop, and the seat of a supreme court with jurisdiction over the whole island; of a criminal court for the province, of a commercial and several other inferior courts, and of several important public offices. Its foundation is attributed to the Phœnicians. From them it passed to the Carthaginians, who made it the capital of their Sicilian possessions and the centre of an extended commerce. The Romans obtained possession of it in 254 B.C., made it a free town, and conferred upon it many important privileges, in consequence of which it increased rapidly and became very prosperous. After the fall of the Roman Empire the Saracens became its masters, and kept possession of it till 1072, when it was taken by Roger the Norman, who founded the kingdom of Sicily. Since then it has always continued to be the capital. It has repeatedly suffered from earthquakes. This and the other vicissitudes which it has undergone is probably the reason why so few remains of antiquity are to be found within it. Some, however, still exist in its environs, which, both on this account and their own intrinsic beauty, are in many respects more attractive than the town. During an insurrection which took place in January 1848, the town was bombarded; and Garibaldi seized it in 1860. Pop. (1901) 310,352. (2) The province has an area of 1,948 square miles. Its coast consists of a series of extensive bays and bold promontories. Its interior toward the south is traversed, east



to west, by a branch of the Neptunian Mountains. The streams are numerous, but small. The soil is fertile. Pop. (1901) 785,016.

**Pales**, pā'lēz, in ancient Italy, a divinity who presided over fields and meadows, and was worshipped, sometimes as a god, sometimes as a goddess, in which latter character Pales was identified with Vesta or Anna Perenna. The festival of Palilia was celebrated 21 April, the anniversary of the founding of Rome, when milk and cakes of millet were offered. Cognate with Pales are "palatium," a palace, and "Palatinus," one of the seven hills of Rome, and this divinity, as protector of property, and home, is among the earliest figures that occur in Roman mythology.

**Pal'estine**, also called **The Holy Land**, **Canaan**, **Judea**, and **The Land of Israel**, a classic region of Asiatic Turkey, southwest of Syria, corresponding approximately with the modern mutessarifats of Lebanon and Jerusalem. Its western shore forms the eastward boundary of the Mediterranean Sea and its north, east, and south boundaries respectively, are the Mountains of Lebanon, the Arabian Desert, and Arabia Petræa. It is situated between lat. 31° 30' and 33° 30' N.; lon. 34° 30' to 36° E.; has a length north to south of about 140 miles, a breadth of about 80 miles, and an area of about 10,000 square miles.

*Topography and Physical Features.*—The surface generally is mountainous, traversed by branches from the chain of Lebanon, one of which stretches south in a direction nearly parallel to the coast of the Mediterranean, forming the watershed between its basin and that of the Dead Sea; while another, turning more to the east, stretches along the left side of the valley of the Jordan. The mountains attain their greatest height, of about 9,100 feet, in Mount Hermon, where they first become detached from the principal chain. None of the other heights exceed 4,000 feet; but many are celebrated from the frequent mention made of them in the Bible, and from the events of which they have been the theatre. The most remarkable are Carmel, forming a promontory in the Mediterranean, on the southwest side of the Bay of Acre; Tabor, or the modern Jebel Tur, at the northeast extremity of the plain of Esdraelon; Ebal and Gerizim, in the valley of Samaria; Gilead and Nebo, or Pisgah, on the east side of the Jordan; and Zion, Moriah, and the Mount of Olives, in and near Jerusalem.

Of limestone formation, the mountains abound in caves of all varieties of size and form, many of them of Scriptural importance. The earliest mention of a cave in Scripture is in the history of Lot (Gen. xix. 30). The next is at the death of Sarah, when Abraham bought the cave Machpelah for a burying-place. This is now contained within the limits of a mosque, at Hebron, and remains in all probability just as it was when the patriarchs were buried in it. The Moslems can give no real information regarding it, for they will not enter it, dreading immediate death at the hand of Abraham's spirit, which they believe to reside in it. Caves are frequently mentioned in the books of Judges, Joshua, and Samuel, but the only one specified is that of Adullam, which has been identified with the cave of Khureitûn (the ancient

Hareth), some five miles south of Bethlehem — a singular cave, or rather series of caves and chambers, extending for miles, to which the one entrance is an orifice not larger than a door, half-way down the almost perpendicular face of a precipice; this orifice is reached by a shelf or ledge of rock, along which one has to find the way cautiously to the cave. The interior is quite a labyrinth, with vaulted chambers remarkably dry and warm, but with no impure air. It could accommodate hundreds of men, all hidden in these far-extending chambers. There are caves at Deir-Dubban, not far from Khureitûn, about half-way between Jerusalem and Eleutheropolis, but these do not correspond with the scenes in David's history; although these western ones are reputed to be David's cave, and the eastern (Khureitûn), near Tekoah, Saul's caves or cave. That these huge caves or grottoes at Deir-Dubban were used both for hiding-places and dwelling-places, both in Jewish and Christian days, is pretty evident; but whether this is the place of the Adullam cave of David is not so plain. There were caves in Galilee also. The "cotton cave," or "Kotton-Megharah," under Jerusalem, is a wonderful cavity, extending under a large portion of the city. But though called a "Megharah," it is an old quarry, out of which Jerusalem was partly built, and therefore interesting, especially as the traces of the quarrymen are still visible in every recess.

Palestine has comparatively few plains, but has numerous valleys; it is the country which Moses describes, "a land of hills and valleys." The small plains are numerous, the large few; among them are the maritime plains of Phœnicia and Philistia, the river plain of Jordan, the inland plain of Esdraelon, and the mountain plain of the Bekâ, between the two Lebanons. These are widely different from each other, though within a small territory. The sea plains from Gaza to Beirût are well peopled and tilled. The Jordan plain is nearly a waste of sand, that river making no further impression upon the levels on each side than merely to fringe itself for some 20 yards with verdure. The Esdraelon plain, or "valley of Jezreel," is a fine plain of considerable extent, fertile and well cultivated. In the district of El Huleh or "the Waters of Merom," and in such low-lying districts as Merj-Sanur, between Samaria and Jenin, are marshes and at certain seasons wide tracts rendered almost impassable by the overflow of streams. The heat during the greater part of the year, from April to November, dries up most of the marshes, and scorches both hill and plain. In later ages this is more especially true, as formerly the extensive woods, orchards, vineyards, and olive-yards which clothed the country shut out the heat, cooled the soil, and retained the moisture.

*Hydrography.*—In Palestine from time immemorial, wells and springs have been held in such veneration, that it is as much sacrilege to destroy a well as to defile a mosque or injure a tomb. The places named from the Enspring (or fountain) and the Beer (well), are very numerous. Among these are "the Fountain of Two Calves," En-Eglaim, near the Dead Sea; the "Fountain of Gardens," En-gannim, of which name there were two cities, one in Judah and another in Issachar; the "Fountain of the Goat,"





PALESTINE

SCALE OF MILES

Population of places is indicated by different lettering, thus:

- 25,000 and over
- 10,000 to 25,000
- 5,000 to 10,000
- 1 to 5,000
- Smaller Places
- Railroads
- Travel Routes

- JERUSALEM
- Ghuzzeh
- En Nasirah
- El Katani
- Dawainieh







## PALESTINE

Engedi, now Ain Jiddi, on the shore of the Dead Sea, one of Judah's rocky springs; the "Fountain of Sharpness," or Swiftmess, En-Haddah, one of the springs of Issachar's plains; En-Rimmon, in the southern extremity of the land; the "Fountain of the Fuller," En-Rogel, the spring of Jerusalem, known in early ages; etc. Besides these there were many other fountains all over the land. There was Hagar's "Fountain" or "Well," Beer-la-hai-roi, in the southern desert, near Beersheba; the "Fountain in Jezreel," by which Israel pitched in the battle between them and the Philistines; and others. There are the "wells" of the patriarchs in different places—the Well of Abraham at Beersheba, now represented by two, still well filled and surrounded by large stone troughs; the wells of Isaac, south of Gerar, Sitnah, Esek, and Rehoboth, of which only the last can be said to have a representative, at Ruhaiben on the great Roman road; the Well of Jacob, dug out of a spur of Gerizim, and close by Joseph's tomb; the Well of Bethlehem, which David knew so well, as no doubt the well of his shepherd-boyhood; the Well of Sirah near Hebron, where Abner was overtaken by Joab's messengers. There are a good many modern wells in use, which, though probably the remains of ancient ones, are unmentioned in Scripture. Few of these wells are properly kept, though none are gratuitously destroyed. Some have become quite unserviceable; and even Jacob's Well is in such a state of disrepair (the masonry in the upper part having fallen in) as to require almost a redigging before it can be of use. Elisha's Fountain still pours out its clear current, though little care is apparently bestowed on it.

There is but one river worthy of the name in Palestine—the Jordan, one of the most tortuous of streams; always supplied with water, though often so considerably beneath the verge of its banks as to be invisible from any distance. The Jordan originates in streams that come from Lebanon and Hermon, and unite in the Waters of Merom. It falls into the Dead Sea after a course of about 70 miles direct, or 200 including windings. Numerous streams find their way westward to the Mediterranean from Libanus and its prolongations or offshoots as far as the Hills of Judah. Equally numerous streams flow eastward from the same range into the Huleh, Sea of Galilee, Dead Sea, and Jordan. Antilibanus, sending its offshoots down the east of Jordan, and forming the Mountains of Golan, Gilead, Ammon, and Moab, is the watershed for a large tract of country between itself and the Ghor or Jordan Valley. Though the rivers are in general small, yet they are not mere summer brooks as many suppose. That but few of the innumerable wadys or water-courses are filled throughout the year is true; but still there are several permanent streams which do good service in the districts through which they pass. Passing by what we may call "Lebanon streams," which are always vigorous, there is the Zerka, a few miles north of Cæsarea; the Aujeh, a little north of Jaffa; and the Rubîn, a little south of this last town; and the Mukutta or Kishon (Kutta-Kishon), which is sometimes, however, low enough, so low that when it reaches the sea it is lost in the sands. None of these are navigable, but they are rivers all the year round, and wide enough to allow

boats to ply on them for some little distance. There is a vast number of water-courses in every part of the land, which would make its irrigation minute and complete were the rain sufficient to fill these, or rather sufficiently regulated and distributed over the year to keep these always filled; and were the land properly covered and its soil protected by wood, so as to moderate the heat and prevent the excessive evaporation. The words of Moses were true words when he called it "a good land, a land of brooks of water, of fountains and depths that spring out of valleys and hills." The whole land bears marks of having been better watered than at present, and contains everywhere the remains of artificial appliances, such as terraces, cisterns, and wells, by which the rain was regulated and distributed.

The lakes of Palestine are three in number, Merom, Tiberias, and the Dead Sea, the first seven feet above, the last 1,250 below sea-level. For quiet beauty the Huleh, or "Waters of Merom," with the adjoining vale, are remarkable, and for subdued attractiveness the Sea of Tiberias; but for brilliance there is nothing to be compared to the Dead Sea—the ancient Asphaltis. Whatever of tameness there may be about the former two, about this last all is grandeur, notwithstanding the aridity of its shores, and the discomforts of its exceptionally hot climate. The silvery sparkle of its waters arising from their saline and bituminous composition gives a brightness to the scene which is enhanced, not neutralized, by the dark shadows of the Mountains of Moab. These lakes form three singular depressions or troughs in the great natural groove or gorge extending from the Bekâ to the Arabah, about 200 miles. This extraordinary hollow, so far below sea-level, is kept in its present state mainly by its own heat. Were the climate to become temperate, the Sea of Tiberias would rise greatly, and transform the Jordan into a Rhine, in parts of the Ghor into a lake; the Dead Sea would swell up and overflow into the Arabah, producing changes in the whole of the southern region which it is impossible to calculate upon. The length of the Dead Sea is 45 miles; its greatest breadth 12. The density of its waters varies between 1,160 and 1,230 (pure water being 1,000). There are ancient shore-lines at a height of 1,200 feet on the surrounding hills.

*Geology.*—From the southern border of Palestine, where the hill-country of Judah begins, to the extreme north, there is almost unvarying limestone. In passing from Sardinia, Italy, Greece, or Asia Minor, there is an interesting resemblance, in color, feature, and composition, between the rocks of these regions and those of Syria. Syria is, as a whole, a rugged, hilly region composed of limestone of the Secondary period; a country seamed and torn by volcanic action from one end to another; long stripes of depression and ridges of upheaval running parallel; the latter broken across and across into wide districts of table-land interspersed with hollows and valleys, with solitary hills or little groups of clustering peaks. The great masses of rock which constitute the mountains of Palestine and Lebanon are Jura limestone; compact, hard, not rich in fossils, and full of caverns and grottoes. This rock is everywhere the basis on which have been deposited in some parts extensive tracts of volcanic products; as also chalk



## PALESTINE

and chalky limestone. magnesian limestone (dolomite), sandstone, conglomerate, marl, etc. On the west of the Jordan and Arabah the chalk formation which prevails through the southern desert terminates with the desert; and the Jura limestone, beginning with the mountains south of Hebron, holds its course northward, forming the mass of the western hill-country of Carmel and of Lebanon. East of the Jordan and Arabah, where, around Petra, large masses of porphyry, sandstone, and limestone lie in close proximity, the same Jura limestone extends northward through the Belkah and the mountains of Ajlûn; and is likewise the basis on which rest the vast volcanic tracts of Haurân, Jaulân, and Lejah.

*Flora and Fauna.*—The flora of Palestine is large and varied; about 1,000 species have been noticed, and the whole number is probably at least 2,000. Among the trees are the cedar, oak, ash, olive, palm, sycamore, oleander, walnut, etc. Wheat, barley, and other grains are cultivated; the vine is almost neglected now, though there is no country better suited to its cultivation than Palestine.

The number of mammals inhabiting Palestine is large for the extent of the country, amounting to about eighty in number. Of the wild animals mentioned in the Bible, the lion and the *reém* or unicorn, that is, the aurochs, are no longer found in Palestine. Among carnivorous animals are the wolf, the hyæna, the jackal; the leopard, on the sides of Carmel and Gilead or in the forests of Galilee; and the bear, in Hermon and Lebanon. The wild boar is common, and much dreaded by the husbandmen on account of the ravages it commits. Other Mammalia are the wild goat, the gazelle, the coney, hare, jerboa, rat, mouse, bat, etc. Of the birds of Palestine there are over 350 species; chief among them are the roller, bee-eater, hoopoe, Smyrna kingfisher, belted kingfisher, sun-bird, great shrike, and bulbul. More noticeable than these brightly-clothed birds is the immense number and variety of the larger birds of prey—the vultures, eagles, falcons, griffons, kites, peregrines, and buzzards, which abound in every part of the Holy Land, and are at first sight its ornithological characteristic. Reptiles are numerous. They include the land and the water tortoise, the crocodile (leviathan), the chameleon, and a variety of lizards and serpents. Fishes are abundant in the Jordan and its affluents, and in the Sea of Galilee are found in immense shoals. The most numerous species are the barbel and the bream. Lower in the scale of animals are the scorpion, the locust, hornet, bee, and grasshopper.

*History.*—The name Palestine, derived from the Hebrew *Pelescheth*, and meaning the land of the Philistines, occurs in this sense in several passages of the authorized version of the Bible, and in several others in the Hebrew, where it is translated *Philistia*. It is properly applicable only to the southwest part of the country, stretching along the shores of the Mediterranean. It appears to have been first used in its more extended sense by Greek authors, and derived additional currency from its adoption by Josephus and Philo. The ancient name of the country was Canaan, which it evidently owed to the descent of its inhabitants from Canaan, the

fourth son of Ham, and a grandson of Noah. When thus named, in the time of the patriarchs, it was parceled out among a number of independent tribes or nations; the Kenites, Kenizzites, and Kadmonites, on the east of the Jordan; the Hittites, Perizzites, Jebusites, and Amorites, in the hill-country of the south; the Canaanites proper, in the centre, from the Jordan to the coast; the Girgashites, on the east shore of the Lake of Tiberias; the Hivites, in the north, among the ramifications of Lebanon; the Philistines on the south, and the Phœnicians on the north coast. In the time of Moses the country east of the Jordan was conquered and divided among the tribes of Reuben and Gad and the half tribe of Manasseh. Under Joshua the work of conquest was carried on to the west of the Jordan; and the whole territory, though not to the extent originally promised, allotted to the remaining half tribe of Manasseh and the other ten tribes (1445 B.C.); the larger portion of the south falling to the tribes of Judah and Benjamin. Under Solomon the work of conquest appears to have been completed, and all the land which was originally promised was included within the limits of his kingdom. Under his son Rehoboam the kingdom was rent in twain, and subdivided into the separate kingdoms of Judah in the south, and Israel in the north (975 B.C.). The latter kingdom was often designated by the name of Samaria, its capital. The division of the country into tribes was completely broken up by the Captivity, which carried away ten of them to Assyria, and supplied their place by a new colony; and by the subsequent transportation of the remaining tribes of Judah and Benjamin to Babylon (584 B.C.). After the destruction of the Babylonian empire Palestine fell under the dominion first of the Persians and then of the Macedonians. When Palestine became the cradle of Christianity with the birth of Jesus Christ, the Romans had established their ascendancy, and divided the region into the four provinces of Galilee in the north, Samaria in the centre, Judea in the south, and Perea, which included all the country east of the Jordan. Under Constantine Palestine, now regarded as the Holy Land, acquired new interest, and recovered in some degree from the calamities by which it had been laid desolate; and in 396 A.D., on the division of the empire by Theodosius, and the formation of two empires, a Western and an Eastern, Palestine became a province of the latter. This was its condition at the time when Islamism began to make its conquests. Palestine, unable to offer any resistance, soon fell a prey; and Omar, in 636, after taking possession of its capital, converted it into one of the provinces of his caliphate. The severities exercised toward the Christians having roused the indignation of Europe, gave rise to the Crusades, and Jerusalem became for a time the capital of a Christian kingdom. Ultimately, however, Mohammedanism prevailed, and Palestine sunk into a degraded state; from which it is only now recovering. It is only within the latter half of the 19th century that the exploration of Palestine was first carried out systematically. The most valuable results have been those achieved under the direction of the "Palestine Exploration Fund," a society organized in 1865 for the purpose of making an exhaustive exploration and an exact survey of the Holy Land. The trian-



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## PALESTINE — PALESTRINA

gulation of Western Palestine was begun in 1871 and finished in 1877. A large and detailed map of the country has been published and an immense mass of valuable information regarding topography, natural history, its interesting ruins, archæological remains, and holy places, etc., accumulated. A German society for the exploration of Palestine has existed since 1877. The present population of the country is estimated at 650,000, the Arab element being the prevailing one, and the Arabic language generally in use. The people consist partly of the fellahin or settled cultivators, artisans, etc., partly of the nomad Bedouin, who live by rearing cattle or by less reputable means. The country exports some grain, olive-oil, oranges, etc. Jaffa, Haifa, and Acre are the chief ports, Jerusalem and Nablus the largest towns. Chapels and monasteries belonging to Greek Orthodox, Roman Catholic, and various Protestant churches, abound throughout the land, and especially on and near the sites where the principal events connected with New Testament history were enacted. A railway has been constructed from Jaffa to Jerusalem and other railways in different parts are projected or in progress. Since 1850 colonies of Jews and also of Germans have been established in the country and are engaged successfully in viticulture and wine-making, notwithstanding the opposition and oppressive taxation to which they have been exposed. A feature of interest is the great amount of property acquired by the Sultan since 1885 in the Jordan Valley and other places, and administered on progressive agricultural principles. The following paragraph from a consular report of 1901, summarizes present economic conditions: "There can be no doubt that the establishment of the Jewish colonies in Palestine . . . has brought about a great change in the aspect of the country, and an example has been set before the native rural population of the manner in which agricultural operations are conducted on modern and scientific principles."

See BETHLEHEM; CRUSADES; JERUSALEM; JEWS; NAZARETH; other localities mentioned; and for *Bibliography*, PALESTINE EXPLORATION FUND.

**Palestine**, Texas, city, county-seat of Anderson County; on the International & Great Northern railroad; about 135 miles north of Houston. It was settled in 1846, and in 1870, under a State law, was incorporated. It is in an agricultural region in which cotton is one of the principal products. In the vicinity are salt mines and deposits of iron ore. The chief manufactures are cotton products, iron products, and packed-beef. There is considerable trade in grain, cotton, fruit, and vegetables. The prominent buildings are the railroad offices and shops, the Y. M. C. A. building, the churches and schools. A point of interest is Fort Houston. The government is vested in a mayor who holds office two years, and in a council composed of the mayor and aldermen. Pop. (1890) 5,838; (1900) 8,297.

**Palestine Exploration Fund, The**, an organization founded in London 22 June 1865, for the purpose of investigating and studying the archæological and other remains of the Holy Land. Excavations were commenced in 1866 and the work has been carried on almost con-

tinuously since. Since 1869 the Society has issued a 'Quarterly Statement,' and maintains a Palestinian Museum at 38 Conduit Street, London. The Society has published Conder, 'Survey of Eastern Palestine' (1900); Clermont-Ganneau, 'Archæological Researches' (1896); Hull, 'The Geology of Palestine and Arabia Petræa' (1886); Tristram, 'The Fauna and Flora of Palestine' (1884), and many other works. See PALESTINE.

**Palestrina**, **Giovanni Pierluigi**, jō-vän'nē pē''ēr-loo-ē'jē pä-lēs-trē'nä (or **Pietro Aloisio**), **Da**, Italian composer and reformer of ecclesiastical music: b. Palestrina (ancient Præneste) 1526 (Haberl), or 1514 (others); d. 2 Feb. 1594. He studied in the school of music established in Rome by Claude Goudimel, and in 1551 was appointed by Pope Julius III. master of a choir of boys in the Julian Chapel, and was the first to receive the title of chapel-master. In 1554 he published a collection of masses dedicated to Pope Julius, who admitted him into the college of choristers of the pope's chapel. He was soon appointed chapel-master of St. John's Lateran, and six years later to the same post in Santa Maria Maggiore, in which he continued till 1571. About this time the Council of Trent, on re-assembling in 1562, had taken up, among other subjects, the abuses which had gradually sprung up in church music and which had grown to an intolerable height. Not only were masses founded on profane airs, often of the most frivolous kind, but the composers of the day, as their manuscripts show, not content with working upon popular airs which suggested the most unbecoming associations, actually imported the words of the profane melodies into their scores. A reform was entrusted to the pope, who appointed a commission to inquire into and regulate the matter. There was no such music in existence as the commission required, and Palestrina, almost the only composer from whose works some illustrative fragments could be drawn, was assigned the task of showing that the recommendations of the commission were as consistent with the requirements of art as they were with those of religious usage. In fulfilment of this important task he composed three masses for six voices, which by their artistic beauty and profound devotional feeling at once settled the question beyond dispute. One of them in particular, the 'Missa Papæ Marcelli,' so called in gratitude to his patron, at once established for him a position in the highest rank of musical genius, a place to which the subsequent advance of musical science has only confirmed his claim. In reward for this great achievement of his, Palestrina was appointed in 1571 chapel-master of the Basilica San Pietro at the Vatican, and musical director to the Congregation of the Oratory. He also became teacher of the musical school founded by Nanini. He likewise undertook the revision of the chants of the Missal and the Breviary. A complete edition of his works was published by Breitkopf and Hartel (1885-93). Consult: Cametti, 'Cenni Biografici di Giovanni Pierluigi da Palestrina' (1895), and the older work of Baini (1828).

**Palestrina**, Italy, a town in the province of and 23 miles east-southeast of Rome. It stands upon the slope of a hill and commands a



magnificent view. It was a place of Greek origin, and had become important long before Rome existed. Under the Roman Empire as Præneste it attained great magnificence, and was often the residence of the emperors. It has numerous ancient remains, particularly those of an immense Temple of Fortune, but the only modern building of note is the Barberini Palace. Pop. 6,000.

**Paley**, pā'li, **William**, English divine and philosopher: b. Peterborough, July 1743; d. Bishop-Wearmouth 25 May 1805. He was educated at Cambridge and in 1766 became a fellow and tutor of Christ's College. In 1767 he was ordained a priest. He held the tutorship of his college for about ten years, and his lectures during this period, which were highly successful, contained the elements of his future works. In 1776 he married and gave up his fellowship. Law, bishop of Carlisle, had already presented him with the living of Musgrave in Westmoreland, to which he retired; and he afterward received two other small livings. In 1780 he became prebendary of Carlisle, and in 1785 chancellor of the diocese. In 1794 he was made prebendary of St. Paul's, and in 1795 sub-dean of Lincoln.

His principal works are: 'The Principles of Moral and Political Philosophy' (1785); 'Horæ Paulinæ' (1790); 'View of the Evidences of Christianity' (1794); 'Natural Theology, or Evidences of the Existence and Attributes of the Deity collected from the Appearances of Nature' (1802).

As a writer Paley was distinguished by clearness and cogency of reasoning, force of illustration, and lucidity of arrangement. He had little claim to originality, and has acknowledged in a general way his indebtedness to others; but what he borrowed he generally set in a clearer light, and developed with the practical sagacity and strong common-sense which characterize the best English writers.

In his 'Moral and Political Philosophy' he follows the principles of Locke. He rejected the theory of a moral sense invented by Hutcheson to save the morality of the school of Locke, and founded his system purely on utilitarianism. The idea of the 'Horæ Paulinæ,' long considered his most original work, is said to have been suggested by Doddridge. The 'Evidences of Christianity' is mainly founded on Lardner's 'Credibility of the Gospel History,' while Butler and others contributed to its completeness, and his 'Natural Theology' has been shown to be taken, without direct acknowledgment, from a work of Bernard Nieuwentyt, a Dutch philosopher of the previous century (1654-1718), on the 'Right Use of Contemplating the Works of the Creator,' an English translation of which appeared in 1718-19. The celebrated illustration of the watch is taken almost literally from Nieuwentyt. Consult: Biographies of Paley by Meadley (1809), Edmund Paley (1824), and Lynam (1825); also Stephen, 'English Thought in the 18th Century.'

**Palfrey**, pāl'fri, **Francis Winthrop**, American lawyer and soldier, son of J. G. Palfrey (q.v.): b. Boston, Mass., 11 April 1831; d. there 5 Dec. 1889. He was graduated from Harvard in 1851, was commissioned a lieutenant-colonel in the Civil War and served with gallantry.

He resigned in 1863 owing to a severe wound and in 1865 was brevetted brigadier-general of volunteers. From 1872 he was register in bankruptcy. He wrote: 'A Memoir of William F. Bartlett' (1879); 'Antietam and Fredericksburg' in 'Campaigns of the Civil War' series (1882); etc.

**Palfrey**, **John Gorham**, American historian and Unitarian clergyman: b. Boston, Mass., 2 May 1796; d. Cambridge, Mass., 26 April 1881. He was graduated from Harvard University in 1815, studied theology and in 1818 accepted the pastorate of the Brattle Street Congregational-Unitarian Church, Boston, succeeding Edward Everett. He resigned in 1830 to accept the chair of sacred literature at Harvard where he remained until 1839, during which period he was dean of the faculty and one of the three preachers at the university chapel. In 1835-43 he was editor of the 'North American Review' and early allied himself with the anti-slavery movement; he delivered a course of lectures at Lowell Institute, Boston, in 1839 and in 1842, and in the latter year was elected to the Massachusetts legislature where he served until 1843. In 1844-8 he was secretary of the commonwealth of Massachusetts, and in 1847-9 served in Congress; from 1861-7 was postmaster at Boston and subsequently acted as United States delegate to the Anti-slavery Congress in Paris. He wrote much and forcibly in opposition to the slave power, was an editor of the 'Commonwealth' in 1851 and contributed to the Boston 'Whig' a series of articles, 'The Progress of the Slave Power,' which attracted much attention. He allied himself with the Free-soil party and was their candidate for governor in 1851. Among his publications are: 'Evidences of Christianity' (1843); 'The Relation Between Judaism and Christianity' (1854); 'A History of New England from the Discovery by Europeans to the Revolution of the 17th Century' (1866); etc. The last is his greatest work and a supplementary volume was added by his son F. W. Palfrey (q.v.), 'The History of New England from the Revolution of the 17th Century to the Revolution of the 18th Century' (1890).

**Palfrey**, **Sara Hammond** ("E. FOXTON"), American novelist and poet, daughter of J. G. Palfrey (q.v.): b. Boston, Mass., 11 Dec. 1823. She has published: 'Prémices,' poems (1855); 'Hermann' (1866); 'The Blossoming Bud, and Other Poems' (1887); 'King Arthur in Avalon and Other Poems' (1900); 'Katherine Morne.'

**Palghat**, pāl-gāt', India, town in Malabar district, Madras, 74 miles east of Beypur, and a station on the Madras railway. It does a flourishing business with the western coast, has a Swiss Protestant missionary station, libraries, reading-rooms, schools, and Victoria Jubilee College. Captured by the English in 1768 it served as base of operations against Tippu Sahib. Pop. (1901) 44,177.

**Palgrave**, pāl'grāv, **SIR FRANCIS**, English historian: b. London July 1788; d. Hampstead 6 July 1861. He was son of a Jewish stockbroker; was carefully educated at home; wrote a French version of the Homeric 'Batrachomyomachia' at eight; studied law; was married and became a Roman Catholic in 1823, when he changed his name from Cohen to Palgrave,



his mother's maiden name. He practised only in pedigree cases, devoting himself to antiquarian studies; contributed largely to the 'Quarterly' and 'Edinburgh' reviews; edited for the Crown 'Parliamentary Writs,' 'Rotuli Curiae Regis,' 'Kalendars of the Treasury of the Exchequer,' and 'Documents and Records Illustrating the History of Scotland'; and wrote 'History of England' (1831, only one volume), 'The Rise and Progress of the English Commonwealth' (1832); 'Truths and Fictions of the Middle Ages: the Merchant and the Friar' (1837); 'The Lord and the Vassal' (1844), and 'The History of Normandy and England' (1851-64). He was knighted in 1832. His work, though faulty in some details, did much to revive popular and critical interest in the Middle Ages.

**Palgrave, Francis Turner**, English poet and critic, son of Sir Francis Palgrave (q.v.): b. Great Yarmouth 28 Sept. 1824; d. 24 Oct. 1897. He was educated at Charterhouse and Oxford, becoming fellow of Exeter College in 1846. He was employed in the Education office after acting as Gladstone's private secretary for a time, and 1850-5 was vice-principal of Kneller Hall, a normal college at Twickenham. He became a friend of Tennyson with whom he passed many summers in Europe, and in 1884 resigned from the Education office, in which he had risen to the post of assistant secretary. In the following year he succeeded his old friend John Campbell Shairp as professor of poetry at Oxford. He was a man of remarkable sweetness of character, sensitive and cultured; his book, 'The Passionate Pilgrim' (1858), is a spiritual autobiography, which also gives some light on the facts of his life. He is best known as the critical editor of 'The Golden Treasury' of English lyrics (1861; 2d series 1896), the first volume of which ranks as a classic anthology. He edited several other volumes of selections, from Shakespeare (1865), of hymns (1867), of 'Stories for Children' (1868), of lyrics (1871), from Herrick (1877), from Tennyson (1885), etc., and wrote 'Visions of England' (1881), and 'Amenophis' (1892).

**Palgrave, William Gifford**, English diplomat and Orientalist, son of Sir Francis Palgrave (q.v.): b. Westminster 24 Jan. 1826; d. Montevideo 30 Sept. 1888. He was educated at Oxford; went to India immediately after graduation; and entered the Bombay native infantry, which he soon left to become a member of the Society of Jesus and to undertake missionary work in southern India. In 1853 he went to Syria as a Jesuit missionary. He narrowly escaped death in the Damascus massacre of June 1861, being saved only by his perfect coolness and his wonderful knowledge of native dialects and customs. In England, Ireland and France he attempted to rouse indignation at the Syrian massacres. Napoleon III. became interested in him, and in 1862 sent him across central Arabia to learn the feeling of the Arabs toward France,—an adventurous journey described in Palgrave's 'Narrative of a Year's Journey through Central and Eastern Arabia' (1865). He decided that there was no chance for Christian missions in Arabia, left the Society of Jesus, and entered the English diplomatic service. He was sent to Abyssinia in 1865, was British consul in Trebizond 1867, in St. Thomas 1873, in Manila 1876, in Bulgaria 1878, and in

Siam 1879, and in 1884 became minister to Uruguay. He wrote 'Herman Agha,' an Eastern romance (1872); 'Essays on Eastern Questions' (1872); 'Ulysses: Scenes and Studies in Many Lands' (1887), and 'A Vision of Life' (1891), a mystical poem.

**Pâli**, pā'lē, one of the most ancient of the Prâkrit dialects. Lassen traces it to western Hindustan, and declares it to be related to the S'auraseni and Mâhârâshtrî. It was the sacred language of the southern Buddhists, and died out in India with their expulsion, but they carried it to Ceylon, Indo-China, and Burma, where it was superseded as a spoken language by the vernacular. Pâli is derived from a dialect much like Sanskrit, which it closely resembles. Pâli literature embraces the sacred writings of Buddhism, and also many works on ethical, philosophical, historical, and other subjects. The greater part of the Buddhist scriptures, or Pitakas, has been translated into English. One of the most interesting portions is the Jatakas, a complete translation of which has been published under the editorship of Prof. Cowell. The Pâli text was edited by Fausböll. The Pâli works of a non-sacred character are: the Dîpavamsa, a history of Ceylon to 300 A.D., the Mahâvamsa, another history of Ceylon, written about the end of the 5th century A.D., the Dathavamsa, a history of Buddha's eye-tooth, the Milindapañha, a disputation between a Buddhist priest and the Greek king Milinda of Bactria, and the Rasavahini, a collection of fables and legends. Consult: Burnouf and Lassen, 'Essai sur le Pâli' (1826); Childers, 'Pâli Dictionary' (1875); Frankfurter, 'Pâli Handbook' (1883); Müller's 'Pâli Grammar' (1884).

**Pal'impsest** Gk. *palin*, back, again, *psestos*, rubbed, a written page prepared by erasure for being filled with new matter. Both the Greeks and Romans erased manuscripts for the purpose of again using the parchment. Cicero banters his friend the lawyer Trebatius upon his economy in using palimpsests in his correspondence, and expresses the hope that it is his own consultations and not Cicero's letters that he erases. No ancient palimpsests have come down to us. Probably the use of them by the Greeks and Romans was attended with no disadvantage to literature. When, however, the Greek and Roman commonwealths had been overthrown, and almost all the ancient manuscripts preserved in Europe were in the monasteries, the use of palimpsests began to prevail in the Middle Ages. It is still a matter of controversy whether literature has gained or suffered by the practice. On the one hand, it is held that but for the value of their material, the scraps of ancient manuscripts which have come down to us in the form of palimpsests would have been lost. On the other, it is believed that valuable manuscripts have in this way been ruthlessly destroyed.

It was in the 7th century, when Caliph Omar had cut off the supply of papyrus furnished by Egypt, that a great deficiency of parchment was felt. This deficiency continued until the invention of paper. The use of palimpsests increased until the 11th century, when it reached its height. Some declare that nearly the whole of ancient literature was thus lost in the 8th century. From the time of the Renaissance this



practice was discountenanced; it was forbidden by edicts, but it did not entirely cease until the introduction of printing. In the East the use of palimpsests began much later, and never became so general as in the West. The scarcity of parchment was increased by the demand for legal documents. The monasteries of Bobbio, Fulda, St. Gall, and Mainz were among the most extensive manufacturers of palimpsests. That which replaced the ancient manuscripts was writing of an ecclesiastical character, lives of the saints, and copies of the church services.

At the Renaissance attempts were made to decipher the ancient and underlying writing on palimpsests, but it was not till the 18th century that any progress was made. Knittel (1761) deciphered fragments of a Bible of Ulphilas, and Bruno discovered some entirely new fragments of Livy and Cicero. Niebuhr and others made subsequent discoveries, and the subject was taken up systematically and pursued with great success by Angelo Mai (q.v.), librarian successively of the Ambrosian and Vatican libraries.

The processes employed in deciphering palimpsests vary according to the nature of the manuscripts. Those which have been scraped and rubbed with pumice-stone and afterward bleached are nearly indecipherable. Those which have been merely washed with lime-water and dried are revived by chemical processes. Various recipes which have been found successful are used successively till the right one is found. The result of the researches made is on the whole disappointing, because the monks only made use of imperfect copies and fragments of ancient writings for their palimpsests, and carried on the re-manufacture of clean parchments wholesale, mixing up various manuscripts, cutting them into fresh shapes, and thus obliterating forever the connection of the original works. A very large proportion of the discoveries thus made are fragmentary, but many of the fragments are of great value. The most remarkable discovery of a palimpsest in recent times is that of the Syriac version of the four Gospels by Mrs. Agnes Smith Lewis (q.v.) in St. Catherine's Monastery, Mount Sinai (1895).

**Pal'indrome**, the name given to any verse or line which reads the same either forward or backward; for example that which is put in the mouth of Satan — *Signa te, signa, temere me tangis et angis* (cross thyself, cross thyself, you touch and torment me in vain), or as "Madam I'm Adam."

**Palingen'esis**. See RECAPITULATION.

**Palinuro**, pä-lē-noo'rō, **Cape**, Italy, promontory in southern Italy, jutting into the Tyrhenian Sea, northeast of the Gulf of Policastro, about 42° 2' N. and 15° 17' E., in classical times Palinurum Promontorium, and now sometimes called Cape Spartimento. The end of the cape forms a rocky and dangerous peninsula, on which Roman fleets were wrecked B.C. 253 and 36. The name is Greek and is the origin (not the outcome) of the story of the death and burial of Æneas' pilot, Palinurus.

**Pal'isade Cells and Parenchyma**, elongated cylindrical cells standing upright between the surface layer of the upper side of a leaf (q.v.) and the thicker layer of loose assimilation cells forming the under side. The palisade cells

characterize the "palisade parenchyma," which gives strength to the leaf and contains most of its chlorophyll.

**Palisades, The**, a rocky cliff on the right bank of the Hudson River (q.v.), extending from Fort Lee, N. J., to the hills of Rockland County, N. Y., a distance of about 15 miles. They are of basaltic trap rock, a formation which was intruded in a rift of the earth's surface between layers of sandstone and shale, and cooling in a columnar form, gave these cliffs their peculiar perpendicular formation. They are from 350 to 500 feet in height, broken and fantastic in appearance, and are considered one of the most remarkable and picturesque cliff formations in the world. A considerable amount of rock has been taken from the Palisades for building purposes, and it was feared that they would be badly injured and their beauty destroyed. The two States of New York and New Jersey therefore organized a commission in 1900, known as the Commission of the Palisades Interstate Park, the object of which is "to secure against vandalism and to preserve the natural beauty of the Palisades." To do this it was found necessary to acquire title to 73,900 feet of shore front; the report for 1903 showed 36,423 feet of this was yet to be acquired, and that the total expenditures of the commission for land, buildings, improvements and riparian rights up to the date of report had been \$305,911.77.

**Palissy**, pä-lē-sē', **Bernard**, English artist and philosopher: b. La Capelle Biron (Lot et Garonne), according to D'Aubigne 1499, according to other biographers about 1510; d. Paris 1589. Having been selected in 1543 to draw up the plan of a government survey in his neighborhood the remuneration he received enabled him to carry on experiments in enamels, to which his attention had been accidentally turned, and on which he had for some time been engaged. Being ignorant of the art of the potter he had to grope his way, making experiments with all kinds of materials, which for a long time were unsuccessful. He was compelled at last, by his own account, to burn his furniture in order to keep in his oven. The fatigue he endured in conducting himself all the operations necessary to the completion of his discovery was excessive. At length, after 16 years of unremunerated labor (1538-54), he succeeded in producing a pure white enamel, affording a perfect ground for the application of decorative art. He was now able to produce works in which he represented natural objects grouped and portrayed with consummate skill. His reputation rapidly spread, and he acquired a patron in the Duke de Montmorency. His sculptures in clay and his enamelled pottery once known became recognized as genuine works of art, and came into demand for the decoration of the houses of the great. Religious persecution, however, which had spared him in obscurity, fastened on him as soon as he had begun to attain to wealth and distinction. He was first imprisoned at Bordeaux on the charge of being a Calvinistic preacher (1562), and was threatened with death, when he was rescued by the Duke de Montmorency, who, to save him from the provincial authorities, procured him the title of *inventeur des rustiques figulines du roi*, with which he went to establish



## PALISSY WARE — PALLADIUS

himself at Paris. Here he was patronized by Catharine de' Medici, who gave him a site for his furnaces on the present situation of the palace of the Tuileries, where the remains of them were discovered in 1865. Here he continued to work for some years. He also gave for several years in Paris lectures on scientific subjects, the substance of which is probably contained in his 'Discours Admirables' (1580). He was the first in France to substitute facts and demonstrations in the teaching of science for mere hypothesis. He established a rational theory of crystallization, and his classification of salts was nearly perfect. His teaching again excited the jealousy of his theological opponents. He was arrested in 1588 and thrown into the Bastille, where he died at the age of 90, according to D'Aubigne, who knew him personally; or of 80, according to his other biographers. His 'Complete Works' (1880) contain his famous autobiography. A monograph on the artistic work of Bernard de Palissy by C. De Lange and C. Borneman appeared in 1863-5. A biography of him has been written by Henry Morley (1852).

**Palissy Ware.** See PALISSY, BERNARD.

**Palk** (pâk) **Strait**, the northern and narrower part of the channel separating Ceylon from the southeastern coast of India, the southern and wider part being the Gulf of Manar. The strait is 80 miles long, 40 to 85 miles wide, but shallow and scarcely navigable. The Pambam Passage broken with islands connects the two parts of the channel.

**Pal'ki.** See PALANQUIN.

**Pall**, pâl (Lat. *palla*), generally, the covering of a bier, but specially applied to the small linen cloth, usually stiffened with cardboard, employed to cover the chalice. The upper part of the pall may be of silk, and colored according to the season. It is often richly embroidered. While part of the corporal is sometimes laid over the chalice as a covering, the pall or palla, according to Pope Innocent III., is not to be considered identical with the corporal.

**Pall-mall** (pěl-měl') **Game**, an ancient pastime in which a round box-wood ball was struck with a mallet or club and sent through a ring elevated upon a pole, standing at either end of an alley. The game was formerly practised in Saint James' Park, London, and gave its name to the street called Pall Mall.

**Pallace'æ**, the stink-horn toadstools. See FUNGI.

**Palla'dian Architecture**, a variety of 16th century Italian architecture so named from Andrea Palladio (q.v.). It was founded upon the Roman antique as interpreted by the writings of Vitruvius, but rather upon the secular buildings of the Romans than upon their temples. It is consequently more applicable to palaces and civic buildings than to churches. A characteristic feature of the style is the use of engaged columns in façades, a single range of these often running through the two principal stories. It was introduced into England by Inigo Jones, a follower of the Venetian school of Palladio.

**Palladio**, päl-lä'dē'ō, **Andrea**, Italian architect: b. Vicenza, Venetian territory, 30 Nov. 1518; d. Venice 19 Aug. 1580. He was originally a stone-cutter, and at the suggestion of

the poet and savant Trissino (see TRISSINO, GIOVANNI GIORGIO), went to Rome for the purpose of studying ancient and modern art. Returning to his native country he designed many palaces, and county houses of great beauty and dignity. His designs were also sought in England and other parts of Europe. Palladio belongs to the masters who, in the 16th century, by the study of the works of Roman builders, created a new era in architecture. Among his works the theatre degli Olimpici, in his native place, is the most important. Venice also owes to him many of her finest buildings. The villa built by Lord Burlington at Chiswick (since enlarged by James Wyatt) was from a design of Palladio, as was also a bridge at Wilton, the seat of the Earl of Pembroke. The majestic simplicity of antiquity was always present to his mind, and Algarotti called him the Raphael of architects. His published works include 'Antichità de Roma' (1554); and 'Quattro Libri dell' Architettura.' He also provided designs for Barbaro's edition of 'Vitruvius' and illustrated Cæsar's 'Commentaries.' His life was written by Temanza (1763). Consult the biography by Fletcher (1902).

**Palla'dium**, among the Greeks, a statue or image of Pallas (Minerva), which is said to have fallen from heaven, and to have been found by Ilius, who placed it in a temple in his new city (Ilium). It was believed by the Trojans that their city would be invincible so long as it contained the Palladium. Ulysses and Diomedes, to remove this impediment to the capture of the city, are said to have carried it off. The Romans, however, pretended that it was brought to Italy by Æneas, and preserved in the temple of Vesta at Rome. It was considered holy and the protecting divinity of the city. The term palladium has figuratively acquired the sense of bulwark, protection, sanctuary.

**Palladium**, atomic weight 106.5, a metal resembling platinum, discovered by Wollaston (1803) while purifying a quantity of crude platinum. Occurs native in platinum ores, but principally alloyed with gold and silver in a gold ore from Brazil. Obtained from these ores by complicated processes which ultimately give the palladium as palladium cyanide. This decomposes on ignition, giving pure spongy metallic palladium. A ductile, malleable, white metal, specific gravity 11.8 and having the lowest melting point of all the platinum metals. It is not acted on by atmospheric oxygen or moisture, slowly attacked by strong nitric, hydrochloric, or sulphuric acids, but very easily by aqua regia. In the spongy form it has the power of absorbing gases. Freshly ignited palladium will absorb about 350 times its own volume of hydrogen at room temperature and nearly twice as much when heated to the temperature of boiling water. It forms two compounds with oxygen PdO, palladous oxide, and PdO<sub>2</sub>, palladic oxide. Two classes of salts are known related to these two oxides, the palladous salts being the most important. Palladium is used in the manufacture of many fine scientific instruments because of its properties of hardness, color, and resistance to the action of the atmosphere.

**Palladius**, pa-lā'dī-ūs, Greek patristic writer of the 4th century. His 'Historia Lausiaca' dedicated to Lausus, chamberlain of



the imperial court, gives us the results of his journeys among the principal districts of the Roman empire, where monks and hermits had settled. He is indeed the Herodotus of the early Church, whose self-chosen task was to travel from one religious house or colony to another, curiously inquiring about the life of each, and picking up from the gossip of the highway or actual observation a rich fund of information which has enabled him to give a living picture of the ascetic phase of church life in Palestine, Egypt and Syria. His works are published in Migne's 'Patrologia Græca,' Vol. XXXIV. Consult Preusschen, 'Palladius and Rufinus' (1897).

**Palladius**, pā-lā'dī-ūs, **Rutilius Taurus Æmilianus**, a Roman writer of the 4th century of our era. He wrote 'De Re Rustica,' a didactic work in 14 books on agriculture, the topics being arranged according to the seasons, and forming a sort of farmers' calendar. The first book is introductory, and the last, written in elegiac distichs, is a poem on the art of grafting, the other 12 containing accounts of the agricultural and gardening operations for each of the 12 months. Much of the work is simply borrowed from earlier writers. The poem was popular in the Middle Ages, and there is an English translation of it belonging to the 15th century. An English translation by Thomas Owen appeared in 1803, and others have followed.

**Pal'lah**, or **Impalla**, a large reddish, bush-ranging South African antelope (*Æpyceros melampus*), called "roibok" by the Boers. The horns were lyrate, abruptly bent, and were possessed by the males alone. These animals were formerly numerous, but were not only especially a prey to the large carnivores, but were shot wrathfully by Boers and sportsmen, because they were extraordinarily suspicious and alarmed all the game in the neighborhood by loud whistling cries the moment they discovered a hunter's presence. Now, therefore, they are rare. Consult the works of sportsmen-naturalists in Africa; and Lydekker, 'Book of Antelopes' (1896); Sclater, 'Fauna of South Africa, Mammals' (1900).

**Pallas**, pāl'as, freedman and favorite of the Roman emperor Claudius: d. 63 B.C. He was a slave of Antonia, mother of Claudius; was set free by his master when he became emperor; together with Callistus and Narcissus was the real power during Claudius' reign; induced the emperor to marry Agrippina, his own niece, and to adopt Nero; and with the connivance and assistance of Agrippina, now his mistress, poisoned Claudius and brought Nero to the throne. He was subsequently poisoned by Nero's order.

**Pallas**, pāl'lās, **Peter Simon**, German naturalist and traveler: b. Berlin 22 Sept. 1741; d. there 8 Sept. 1811. He studied there, in Leyden, and in England, devoting himself especially to the classification of collections of zoological specimens, and in 1768 was invited by Catharine II. of Russia to become adjunct of the St. Petersburg Academy and to lead a scientific expedition through Russia in Asia. This trip of exploration, undertaken with Sokoloff, Suyeff, and Rytchkoff, and lasting more than six years, was his greatest work, the specimens collected

forming the nucleus of the Academy's museum in St. Petersburg. In 1777 he became a member of the Imperial Topographical Survey, and in 1787 was appointed historiographer of the College of Admiralty. He retired in 1796 and returned to Berlin not long before his death. His published works include a description of his travels in Asia (1771-6), 'Flora Rossica' (1784-1815); 'Icones Insectorum' (1781-98), a study of the Mongolian races (1776-1802); and a great and incomplete 'Vocabularium Linguarum totius Orbis' (1787-9).

**Pallas**, pāl'as, in astronomy, one of the minor planets revolving round the sun between Mars and Jupiter. It was discovered in 1802 by Olbers at Bremen. It revolves round the sun in 4.61 years. The eccentricity of its orbit is 0.23969, and its semi-axis major is 2.77 times that of the earth's orbit. Its diameter is 172 miles. When nearest the earth in opposition Pallas shines as a full seventh-magnitude star, with a decided yellowish light.

In Greek mythology, the goddess of wisdom. See **ATHENE**; **MINERVA**.

**Pallavicino**, pāl-lā-vē-chē'nō, **Ferrante**, Italian satirist: b. Plaisance 23 March 1615; d. Avignon 5 March 1644. He took orders; became a canon of Augustine; had to escape to Venice because of his broken vows; wrote there against Odoardo, duke of Plaisance, but had to leave Venice in turn because of his immoral life and writings; spent some time in Germany; again went to Venice, where he was imprisoned, but soon set free; then broke entirely with the Church and bitterly and foully attacked the Pope in 'Il Divorzio Celeste.' Venturing into France he was arrested by the papal officers, found guilty of heresy, and beheaded.

**Pallavicino**, **Sforza**, Italian cardinal and ecclesiastical historian: b. Rome 1607; d. there 1667. He was educated in the Collegio Romano; was made governor successively of Iesi, Orvieto, and Camerino by Urban VIII.; at 30 entered the Jesuit order; soon afterward became professor of philosophy and theology in the Roman College; and made such a name by his philosophical treatises that he was chosen by the Catholics to write a party history of the Council of Trent which refuted the work of Paolo Sarpi.

**Pal'len**, **Condé Benoist**, American journalist and author: b. St. Louis, Mo., 5 Dec. 1858. He was graduated from Georgetown University in 1880 and was editor of 'Church Progress,' a religious weekly in St. Louis, 1887-97. He has published 'The Philosophy of Literature' (1897); 'Epochs of Literature' (1898); 'What is Liberalism?' (1899); 'The New Rubaiyat,' a poem (1899); 'The Feast of Thalarchus' (1901); 'The Death of Sir Launcelot and Other Poems' (1902).

**Palliser**, pāl'ī-sēr, **SIR William**, British inventor and engineer: b. Dublin 18 June 1830; d. 4 Feb. 1882. He passed through the Staff College at Sandhurst, and in 1855 obtained a commission in the Rifle Brigade, was subsequently transferred to the Hussars, and retired from the army in 1871. Besides inventing the projectiles and guns which bear his name he devised many improvements in fortifications, etc. He was knighted in 1873, and for a few years sat in the House of Commons as member for Taunton. See **PROJECTILES**.



## PALLIUM — PALMA

**Pallium**, an article of ecclesiastical dress consisting of a band of white wool, some three inches wide, with two narrower bands of the same material, one of which hangs down the back and the other over the breast. It is embroidered with four purple crosses. It is a part of the vestments of the pope, patriarchs, and archbishops. It is sent by the pope to the patriarchs and archbishops as a token that they are invested with the fulness of the episcopal office. It is sometimes, though rarely, also sent to bishops. When a bishop is elected or appointed to a metropolitan see, he at once solicits the pallium from the pope within three months after his consecration or confirmation. The pallium is made from the wool of two lambs annually presented in the Church of St. Agnes, Rome, by the apostolic sub-deacons, and woven by the nuns of Torre de' Specchi, to whom alone belongs the privilege. The historical origin of the pallium is not known, or, at least, wrapt in such obscurity that no definite conclusion has ever been arrived at. Some writers believe that it was first conferred upon bishops by the emperors as a mark of dignity, and then passed over to a purely ecclesiastical usage. It is only worn on solemn and special occasions. Consult: Thurston, 'The Pallium' (London 1802); Vespasiani, 'De Sacri Palli Origine' (Rome 1856).

**Palm**, pām, **Johann Philipp**, Bavarian bookseller and publisher: b. Schorndorf, Bavaria, 1768; d. Braunau, Bohemia, 26 Aug. 1806. The firm of which he was a member published a pamphlet, 'Germany in Her Deepest Humiliation' (1806), which was hostile to Napoleon and his measures. It was brought to the attention of Napoleon who ordered the arrest of Palm, had him tried by court-martial, and though the pamphlet was to the publisher merely trade matter, he was sentenced to death and executed at Braunau on the following day. This act aroused the deepest indignation in Europe as well as in Germany where the hatred of the Germans for Napoleon was already intense. Consult Schultheiss, 'Johann Philipp Palm' (1860).

**Palm Butter, Oil, Sugar, Wax.** See PALMS.

**Palm-cat**, or **Palm-civet**, any of several animals of the civet family (*Viverridæ*), and of the genus *Paradoxurus*, known also as tree-cats, toddy-cats, from their habit of climbing palm-trees to eat their fruit. They inhabit India and southeastern Asia, the Malay Archipelago, etc., and somewhat resemble large cats with comparatively short legs. The best known is the Indian species (*P. niger*), which is often kept about houses and subsist mainly on animal food, such as rats, small birds, lizards, etc. Consult: Blanford, Jerdon, Blyth, Wallace, and other authorities on East Indian zoology; and Allen's Natural History, article 'Cats, Civets, and Mongoose' (1894).

**Palm-crab**, a large burrowing land-crab which feeds upon cocoanuts. See ROBBER-CRAB.

**Palm-kale**, a variety of cabbage extensively cultivated in the Channel Islands and also in Italy. It grows to the height of 10 or 12 feet, and with a crown of leaves at top it has much the aspect of a palm.

**Palm Oil.** See PALMS.

**Palm Sunday**, the Sunday next before Easter Day, so called because on that day is celebrated Christ's last entry into Jerusalem before his Passion, where palm branches were strewn in his way by the multitude. In some churches palms are employed as decorations at the services on this Sunday, and fragments of them distributed to the people.

**Palm-swift.** See SWIFT.

**Palm-weevil**, or **Grugru**, a large curculionid beetle (*Rhyncophorus palmarum*), 1½ inches long, common throughout the American tropics, which places its eggs in holes bored by the beak of the female in the wood of palms, especially the cabbage palms of the genus *Euterpe*. The grub, as soon as hatched, begins to eat its way forward to the spongy pith of the tree, where it feeds and grows into an exceedingly fat and oily creature, sometimes three inches long by one in diameter, which is eaten roasted by all kinds of people, and eaten with pepper is regarded as one of the delicacies of the tropics. Similar species occur elsewhere in warm countries. The species above mentioned (*R. palmarum*) also occurs in southern California; and a similar species (*R. cruentatus*) infests the palmetto of the Southern States. Java has a well-known species (*R. ferrugineus*), whose grub has long been a table-delicacy in the East. Consult Kirby and Spence, 'An Introduction to Entomology' (1828), and general works.

**Palma**, **Giacomo**, jä-kō'mō päl'mä, called IL VECCHIO, Italian painter: b. probably, Serintola, near Bergamo, about 1480; d. Venice 1528. He is supposed to have been a pupil of Giovanni Bellini, but little is known regarding his life. It may be divined from the pictures that go by his name that he imitated one after another several great artists of the Venetian school and many of his works have been attributed to Giorgione, whose coloring he took for his standard of excellence. The Italian churches have multitudinous examples of paintings called "Santa Conversazione" representing the Virgin and the Child, and the donor of the picture presented to them by his patron saint. Of these large compositions Palma Il Vecchio painted very many. He was also successful in mythological subjects, and his landscape backgrounds are exquisite. His works place him among the foremost painters of his time. Some of his best known paintings are 'Adoration of the Shepherds'; 'The Holy Family'; 'Mars and Venus'; 'The Mystical Marriage of Saint Catherine'; 'Divine and Heathen Love'; 'Portrait of Andrea Palladio in his Youth.'

**Palma**, **Giacomo**, called IL GIOVANE, Italian painter, grand-nephew of the Elder Palma: b. Venice about 1544; d. there 1628. His early work was excellent, comparing in fresh coloring with Titian, who greatly influenced him. Later his vicious mannerism grew so as to be a predominating feature of his work. Hence Lanzi called him the last good and first bad painter of Venice.

**Palma**, **Ricardo**, Peruvian author: b. Lima, Peru, 7 Feb. 1833. He was exiled to Chile in 1860 as a result of implication in a political revolt, but upon his return became secretary to President Balta. Later he served as senator and then was assistant in the National Library.



After the sack of the library by the Chileans in 1881 he reorganized it, gathered the remaining fragments, and assisted by gifts from foreign governments succeeded in re-opening the library in 1884. He is the author of several works of fiction, some poetry, and the historical work 'Anales de la Inquisición de Lima' (1863). Since 1870 he has been occupied in recording the traditions and legends of Peru.

**Palma, Thomas Estrada**, Cuban patriot: b. Bayamo, Santiago province, Cuba, 15 July 1835. He studied law, but did not enter practice; during the revolution of 1868-78, known as the Ten Years' war, rose to be a general in the Cuban forces; and after nearly nine years of service was captured and imprisoned in Spain until the close of the insurrection. At the time of his imprisonment he had succeeded Cespedes in the rather empty honor of president of the Cuban provisional government. After his release he went to Honduras, where he became postmaster-general of the republic. Later he removed to the United States, where he opened a school for Latin-Americans at Central Valley, N. Y. This institution he successfully conducted until the beginning of a fresh revolt in Cuba in 1895, when he was elected delegate-at-large and minister plenipotentiary of the Cuban republic, and took charge of the well-known Junta in the United States, which purchased arms, organized filibustering expeditions, and otherwise aided the army in the field. In 1901 Palma was almost unanimously elected president of the republic, and on 20 May 1902 was inaugurated, the United States on that day turning over to the new government the administration of the internal affairs of the nation. On 23 Sept. 1905 he was again elected to the office of president but resigned 28 Sept. 1906. See CUBA — *History*.

**Palma**, (1) the capital of Majorca (q.v.), the largest of the Balearic Isles, and of the Spanish province of Baleares, on the Bay of Palma indenting the south coast. The city, encircled by a fortified wall, stands in the midst of orange plantations, and with its Moorish architecture has a very picturesque effect. It is one of the most aristocratic of European cities. A railway connects it with Manacóar on the east coast. Its chief edifice is the Gothic cathedral (1322-1601); it contains the tomb of King Jayme II. of Aragon, and a valuable collection of church ornaments. In the church of Saint Francis is the tomb of Raymond Lully (q.v.). Other notable structures are a fine exchange (1426-46), an old Moorish palace, a 16th-century town hall, and several fine modern buildings and institutions. Its numerous manufactures include woven silks and woollens, jewelry, etc., and it has a considerable trade in wine, oil, cattle, and agricultural produce, the total annual value of its commerce averaging \$8,000,000. Its fine harbor is protected by a mole. Pop. (1900) 63,783.

(2) A town of Sicily, 14 miles southeast of Girgenti. Pop. 11,702. (3) The name of one of the larger of the Canary Islands (q.v.).

**Palma Christi**. See CASTOR-OIL PLANT.

**Palmas**, päl'mäs, **Cape**. See CAPE PALMAS.

**Palmer**, pä'm'ér, **Alice Freeman**, American educator: b. Colesville, N. Y., 21 Feb. 1855; d. Paris, France, 6 Dec. 1902. She was graduated

from the University of Michigan in 1876 and was the next year a teacher of the classics and mathematics at Geneva Lake, Wis. From 1877 to 1879 she was principal of the high school at East Saginaw, Mich., becoming in the last-named year professor of history in Wellesley College. In 1882 she became acting president, and in 1882 president of that institution, which position she retained till her marriage in 1887 to Professor G. H. Palmer (q.v.) of Harvard University. During her administration the college standard of scholarship was raised, the number of students very greatly increased, and several important buildings added. In 1892-5 she served as non-resident dean of the woman's department of the University of Chicago. She took an active interest in educational and reform associations, was a member of the Massachusetts State board of education from 1889, and lectured frequently on educational and municipal topics. In 1882 she received the degree of Ph.D. from the University of Michigan, and that of L.H.D. from Columbia in 1887, while in 1895 she and her husband each received the degree of LL.D. from Union University.

**Palmer, Anthony**, American colonial governor: b. England about 1675; d. Philadelphia, Pa., May 1749. He was a merchant in Barbados for some time, but in 1707 purchased a large tract of land in Philadelphia where he then settled. In 1708 he was a member of the provincial council and served until his death. When Lieutenant-Governor George Thomas resigned in 1747 the government devolved upon Palmer, who was president of the executive council, and during the succeeding 18 months he administered the affairs of the colony with much ability. He conciliated the Indians and took precautions for the military defense of the colony against Spain and France, though opposed by the Quaker members of the council. The "Kensington District" of Philadelphia was originally a portion of his farm.

**Palmer, Sir Charles Mark**, English iron-master and shipbuilder: b. South Shields 3 Nov. 1822; d. London 4 June 1907. He was educated for a commercial career in France; was partner in several coal companies; reformed the coal-carrying trade from the north of England by building screw colliers (1852), which drove the sailing brigs out of business; and at Jarrow established a great shipyard. Both iron and coal for this yard are supplied by Palmer's own mines. He introduced the use of rolled plates for men-of-war, held several important government contracts; and was a member of the House of Commons 1874-1907. He was made a baronet in 1886.

**Palmer, Edward Henry**, English Oriental scholar: b. Cambridge 7 Aug. 1840; d. Arabia 11 Aug. 1882. He was educated at St. John's College, Cambridge, and later made extensive journeys of exploration in the East. In 1871 he was appointed professor of Arabic at Cambridge, and from that time onward accomplished a vast amount of literary work. In 1874 he was called to the bar. In 1882 he was engaged by the British government to assist in keeping the Arabs of the Sinai region quiet, and preventing them from interfering with the Suez Canal, when he was captured and murdered with two other Englishmen. He had a remarkable knowledge of Oriental life and language, and was a





THOMAS ESTRADA PALMA,  
PRESIDENT OF THE CUBAN REPUBLIC.







## PALMER

man of very varied gifts. His works include: 'Oriental Mysticism' (1867); a 'Grammar of the Arabic Language' (1874); 'A Concise Dictionary of the Persian Language' (1876); 'The Song of the Reed' (1877), comprising Persian verse translations and original poems; 'The Poetical Works of Behá-ed-Din Zoheir of Egypt, with a Metrical English Translation, Notes, and Introduction' (1876-7); a translation of the Koran ('Sacred Books of the East,' 1880); a 'Life of Haroun Alraschid' (1881); an Arabic Manual (1881); and a 'Simplified Grammar of Hindustani, Persian, and Arabic' (1882). Consult 'Life' by Besant (1883).

**Palmer, Erastus Dow**, American sculptor: b. Pompey, N. Y., 3 April 1817; d. Albany, N. Y., 9 Mar. 1904. His best known works were 'Morning and Evening'; 'The Angel of the Sculpture'; 'The White Captive'; 'Landing of the Pilgrims' (a group of 15 life-size figures intended for the Capitol at Washington). He also executed many portrait busts, and statues, including the statue of Robert R. Livingston in the National Capitol.

**Palmer, Frederick**, American journalist: b. Pleasantville, Pa., 29 Jan. 1873. He was educated at Allegheny College, Meadville, Pa., and was a London newspaper correspondent 1895-7, during the Greek war, 1897, and from the Klondike and Philippines 1897-8. He has published 'Going to War in Greece' (1897); 'In the Klondike' (1899); 'The Ways of the Service' (1901); 'The Vagabond,' a novel (1903).

**Palmer, George Herbert**, American educator and classical scholar: b. Boston 19 March 1842. He was graduated from Harvard in 1864, studied at the University of Tübingen 1867-9, and at Andover Theological Seminary in 1870; and after serving as an assistant professor at Harvard 1873-83, and professor of Philosophy 1883-9, became Alford professor of natural religion there in 1889, which position he still holds. He has published a rhythmic prose translation of the Odyssey (1891); 'The New Education' (1887); 'The Glory of the Imperfect' (1898); 'Self Cultivation in English' (1897); 'The Antigone of Sophocles,' a translation (1899); 'The Field of Ethics' (1901).

**Palmer, James Shedden**, American naval officer: b. New Jersey 1810; d. St. Thomas, W. I., 7 Dec. 1867. Entering the navy in 1825 as midshipman, he was made lieutenant in 1836. In the war with Mexico he commanded the Flirt, a blockade-schooner, in 1855 became commander, and when the Civil War broke out was with the Mediterranean squadron and in command of the Iroquois. Recalled from that station, he joined the blockading fleet under Admiral Dupont. In 1862 he was promoted to a captaincy, and in the passage of the batteries at Vicksburg held the advance of the Union vessels. At New Orleans and Mobile Bay he performed important services as flag-captain to Farragut, with whom his relations were most intimate. Made commander in 1863, he rose to the rank of rear-admiral in 1866, and until his death was in command of the North Atlantic squadron.

**Palmer, John McAuley**, American soldier and politician: b. Eagle Creek, Scott County, Ky., 13 Sept. 1817; d. Springfield, Ill., 25 Sept. 1900. He attended Shurtleff College, Upper

Alton, Ill., for a year, and later studied law and was admitted to the Illinois bar in 1839. He first entered politics in the campaign of 1840, when he actively supported Van Buren; in 1843 he was elected probate judge of Macoupin County; in 1847 was a delegate to the State constitutional convention; and in 1849 was elected county judge. In 1852 he was elected to the State senate and re-elected in 1854. His opposition to the Kansas-Nebraska bill, however, led him to sever his connection with the Democrats, and ally himself with the Republican party. He was active in the organization of this party, was president of the Republican State Convention in 1856, and delegate to the National Convention of the same year and that of 1860. He was one of the representatives of his State at the Peace Conference in Washington 1861. At the outbreak of the Civil War he joined the army as colonel of an Illinois regiment, took part in the Springfield campaign, and in December 1861 was promoted brigadier-general; in 1862 he was made major-general, in 1863 given command of the Fourteenth corps, and later of the Department of Kentucky. He took part in the operations against Island No. 10 (1862), led a division at Murfreesboro (1862) and at Chickamauga (1863); as commander of the Fourteenth corps he was engaged in the battles of Chattanooga (1863), Kenesaw Mountain and Peach Tree Creek (1864), and in the Atlanta campaign. After the war he continued his law practice in Illinois, and in 1868 was elected governor of the State; during his administration he steadily resisted special legislation and the granting of special privileges. In 1872 he left the Republican party and supported Greeley for the presidency, and in 1876 was one of the most active supporters of Tilden. In 1890 he was nominated for United States senator by the Democrats, and elected, serving for six years. In 1896 he was nominated for the presidency by the Gold Democrats who refused to accept the regular nominations on account of the free silver plank of the platform. He wrote his autobiography, published under the title 'Personal Recollections of John M. Palmer.'

**Palmer, John Williamson**, American author: b. Baltimore, Md., 4 April 1825; d. there 26 Feb. 1906. He was graduated from the University of Maryland as a physician in 1847; was city physician in Baltimore 1849-50, and subsequently was connected with the staff of the Century and Standard dictionaries. Among his publications are: 'The Golden Dragon; or, Up and Down the Irrawaddi' (1853); 'The New and the Old; or, California and India in Romantic Aspects' (1859); 'After His Kind,' a novel (1886); 'The Poetry of Compliment and Courtship' (1867); 'For Charlie's Sake and Other Lyrics and Ballads' (1901); and 'Stonewall Jackson's Way,' one of the most popular ballads of the Civil War.

**Palmer, Nathaniel Brown**, American sea-captain: b. Stonington, Conn., 1799; d. 1877. He went to sea at 14 and in 1821 he commanded the sloop Hero which set sail from Yankee Harbor in South Shetlands on an exploring expedition. He discovered the land known as the Palmer Archipelago, which at the time was supposed to be a portion of the Antarctic continent. He followed a seafaring life until 1849 and was



afterward a director of the Fall River line of steamers.

**Palmer, Ray**, American Congregational clergyman and hymnologist: b. Little Compton, R. I., 12 Nov. 1808; d. Newark, N. J., 29 March 1887. He was graduated at Yale in 1830; studied theology and entered the Congregational ministry. He was pastor of churches at Bath, Maine, 1835-50, and Albany, N. Y., 1850-66; and secretary of the Congregational Union in New York city 1866-78. He was the author of many sacred poems, of which the best known is the hymn 'My Faith Looks Up to Thee,' included in very many collections of church hymns and translated into more than 20 languages. His published volumes are: 'Hymns and Sacred Pieces' (1865); 'Hymns of My Holy Hours' (1868); 'Voices of Hope and Gladness' (1880).

**Palmer, Samuel**, English painter: b. Newington, Lancashire, 27 Jan. 1805; d. Reidgate, Kent, 24 May 1881. He was a pupil in the antique school of the British Museum, and received some inspiration from his acquaintance with William Blake. His studies were for two years continued at Rome (1837-9) after which he devoted himself to water colors and became a member of the Water Color Society in 1854. While belonging to the ideal school of Turner and Wilson he confined himself entirely to water color and etching, in both of which departments he reached the highest excellence. Among his best-known pictures which are suffused with profound poetic feeling are: 'Dream on the Apennines' (1864); 'Curfew' (1870); and 'The Waters Murmuring' (1877). His finest etchings include: 'The Sleeping Shepherd'; 'The Skylark'; 'The Lonely Tower.' He translated the eclogues of Virgil and intended to illustrate them, but only lived long enough to complete one plate, 'The Opening of the Fold.'

**Palmer, Walter Launt**, American painter: b. Albany, N. Y., 1854. After studying under F. S. Church at Hudson, N. Y., he became the pupil of Carolus Duran at Paris and developed great skill in landscape painting. He was awarded a gold medal at the World's Columbian Exposition in 1893 and honorable mention at the Paris Exposition of 1900. His Venetian scenes and snowy landscapes are remarkably effective and among his best productions are 'Venice' (1882); 'January' (1887); 'Domes of La Salute'; 'End of a Winter Day'; and 'Under the Pines' (1896). He is a member of the National Academy and of the Society of American Artists.

**Palmer**, a term in mediæval times applied to a pilgrim who had visited the Holy Land and carried on his return a branch of the palm for a staff as a memorial of his journey. The name was also given to pilgrims who wandered from shrine to shrine without a fixed home, probably because many of the pilgrims who had been to Jerusalem were in the habit of doing so.

**Palmer**, Mass., town, Hampden County; on the Chicopee, Swift and Ware rivers, and on the Boston & A., and Central V. R.R.'s; 14 miles east of Springfield. It includes the villages of Palmer, Three Rivers, Bondsville, Thorndike, and Duckville, of which the first two are the most important. It was first settled in 1716 by

John Kingston, and was incorporated as a town in 1775; for several years previous to its incorporation (1741-52) it was called Kingston. It is an enterprising industrial town and manufactures cotton and woolen goods, carpets, wire, wire nails, hats, etc. It has a public and an association library. Pop. (1890) 6,520; (1900) 7,801. Consult: Temple, 'History of the Town of Palmer, Massachusetts.'

**Palmerin** (päl'mér'in) of England (PALMERIN DE INGLATERRA), a romance of chivalry in the style of 'Amadis of Gaul,' and in this class of literature regarded as second only to it in point of merit. It is this book, which, with 'Amadis,' Cervantes saves from the holocaust in 'Don Quixote.' It was long supposed to be the work of Francisco Moraes, a Portuguese, who published it in 1567 as a translation from the French, and in 1807 Southey published an English translation, attributing the original to Moraes, and credited him with modesty in not claiming the authorship. It has since been found to have been the work of Leon Hurtado, and to have been published originally in Spanish, in Toledo, in 1547. This story is in some respects a continuation of 'Palmerin de Oliva' (q.v.).

**Palmerin de Oliva**, päl-mä-rën' dā ō-lē'vā, a romance of chivalry, a feeble imitation of 'Amadis of Gaul,' first published in Salamanca in 1511. It has generally been considered to be of Portuguese origin; but Ticknor, in his 'History of Spanish Literature,' asserts that the author of it was a carpenter's daughter in Burgos. This is one of the books against which Cervantes inveighs as responsible for the mental condition of Don Quixote; and in the famous scene of the burning of the books of chivalry, he says: "This Oliva, let it be hewn in pieces and burnt, and let not the very ashes be left." A continuation by the same author, 'The Second Book of Palmerin,' which treats of the adventures of his sons, Primaleon and Polendos, appeared later.

**Palmerston**, päm'ér-stôn, **Henry John Temple**, VISCOUNT, English statesman: b. Romsey, Hampshire, 20 Oct. 1784; d. Brockett Hall, Hatfield, Hertfordshire, 18 Oct. 1865. He was educated at Edinburgh University and at St. John's College, Cambridge University, being graduated from the latter in 1806. In 1806 and 1807 he was the Tory candidate for member of Parliament from Cambridge University, and was both times defeated, but in 1807 was elected to Parliament from Newtown, Isle of Wight. In 1809 he succeeded Lord Castlereagh as secretary at war, and in 1811 was elected member of Parliament for Cambridge University. As secretary of war he carried out a vigorous reform of the details of administration; regulated the finances, paid off arrears, and reduced the previous confusion of the war office to order. He mainly confined himself in his parliamentary speeches to the business of his department, but also spoke on Catholic Emancipation, of which he was always a supporter. He retired from office in the Wellington ministry in 1828 with others of the Canning party. In 1830 he became foreign secretary in the Whig ministry of Earl Grey, and from this time continued a member and leader of the Whig party. In 1831 he lost his seat for Cambridge, but was elected to Parliament from Bletchingley, then from South



## PALMETTO — PALMISTRY

Hants, and in 1835 from Tiverton, which borough he continued to represent till his death. It was during his service as foreign secretary that he earned a reputation for vigilance and energy in the conduct of foreign affairs, and especially for guarding the interests of individual Britons abroad, which, while it increased his popularity at home, gained him enemies abroad. He succeeded in establishing and maintaining friendly relations with France so that the two nations acted in concert; took a leading part in gaining the independence of Belgium, and in establishing constitutional government in Spain and Portugal. He supported Austria and Turkey against Russia, in the East, and took part in the war against Mehemet Ali. In Parliament he supported the liberal policy of free trade and labor laws regulating hours, factory conditions, etc. He was foreign secretary till 1841, when the Whig ministry went out of office on the question of free trade in corn, but on the Whigs' return to power in 1846 he again took that office, under Lord Russell. During the period of 1848-9 he manifested his liberal tendencies and sympathy with the revolutionary party without active interference with the affairs of foreign states. Several of his acts in this administration aroused party criticism, especially his favoring the cause of a Portuguese Jew at Athens, Don Pacifico, a naturalized British subject, which caused a quarrel with Greece, and nearly produced a war with France. This was the occasion of a keen discussion of his policy in Parliament, which resulted in a formal vote in the House of Commons approving the foreign policy of the government. In 1851 he unofficially expressed to the French ambassador in London his approbation of the *coup d'état* of Louis Napoleon, without consulting either his colleagues or the Queen, and he was forced to resign. In the next year he defeated the Russell ministry on the question of the Militia Bill, but refused to accept a position in the cabinet under Lord Derby. In December 1852 he took office as home secretary in the coalition ministry of the Earl of Aberdeen, and on the resignation of this ministry, in consequence of alleged mismanagement of the Crimean war, he was on the almost universal demand of the country called to the premiership, and vigorously carried on the war with Russia. In 1857 Parliament, on the motion of Richard Cobden, passed a vote of censure on the conduct of the Chinese war; dissolution of the house gave Palmerston a majority, but in February 1858 he resigned, after being defeated on the Conspiracy Bill; he returned to power in June 1859, and continued to hold the premiership during the remainder of his life.

Among the important events of his administration were the American Civil War (with the recognition of the Confederate States as belligerents and the Alabama incident), the Prussian war against Denmark, which he opposed, and the union of Italy, which he strongly favored.

Consult: Dalling, 'Life of Lord Palmerston' (continued by Sir Evelyn Ashley); Francis, 'Opinions and Policy of Viscount Palmerston' (1852); Lorne, 'Biography of Lord Palmerston' (1891); Sanders, 'Life of Viscount Palmerston' (1888); and Trollope, 'Life of Lord Palmerston' (1882).

**Palmet'to.** See PALMS.

**Palmetto Ranch, Engagement at,** the last engagement of the Civil War. On the evening of 11 May 1865 Col. T. H. Barrett, 62d United States colored infantry, in command at Brazos Santiago, Texas, sent Lieut.-Col. Bronson, with 300 men, to attack some Confederates on the Rio Grande, who were procuring horses to remount their cavalry. Marching by night, Bronson, early next morning, attacked about 200 Confederates at Palmetto Ranch, on the Rio Grande, seizing their camp and taking some prisoners, horses, and cattle. Bronson then fell back to White's Ranch, where he was joined on the morning of the 13th by Col. Barrett, with about 200 men of the 34th Indiana, under Lieut.-Col. Morrison. Barrett advanced in the direction of Palmetto Ranch, which the Confederates had reoccupied. He was met by cavalry, which was easily driven back; Palmetto Ranch was reached, the buildings and public stores burned, and after following the Confederates some distance Barrett retired to a hill about a mile from Palmetto Ranch where, about 4 P.M. he was attacked by Gen. J. E. Slaughter, with 675 men and six guns. The infantry and four guns attacked in front, while about 250 cavalry and two guns, under cover of a chaparral, flanked him and endeavored to gain his rear. Barrett had no artillery, and fell back fighting. About 50 men of the 34th Indiana were cut off and captured. The retreat was covered by a part of the 62d colored infantry, deployed as skirmishers, who resisted every effort of the Confederate cavalry to break the line, repelling several determined attacks. The running fight continued about three hours and then, at sunset, Confederate pursuit ended. Col. Barrett reports: "The last volley of the war, it is believed, was fired by the 62d United States colored infantry, about sunset of the 13th May 1865, between White's Ranch and the Boca Chica, Texas. The Union loss in the expedition was 115 killed, wounded, and missing. The Confederate loss is not known. Consult: 'Official Records,' Vol. XLVIII.; Lossing, 'History of the Civil War,' Vol. III.

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**Palmetto State,** a name applied to South Carolina. The palmetto tree appears on the coat of arms of the State. See SOUTH CAROLINA.

**Palmistry, or Chiromancy,** is the art of "reading the palm"—the art which professes to discover the temperament and character of any one, as well as the past and future events of his life, from an examination of the palm of his hand, and of the lines traced upon it. As a considerable body of very complicated rules and directions have been laid down by authorities, ancient and modern, to enable the student to read the palm, palmistry claims to be regarded as a "science," or at least as a branch of an interpretative science of the hand in general, to which the name *Chirosophy* has been given. The other branch of this general science has been called *Chirognomy*, and is concerned with the interpretation of the form and character of the hand and fingers, while Chiromancy treats of the palm only. The science was known to the ancient Greeks and was somewhat popular on the continent during the Middle Ages. The chief authorities on palmistry in recent times are two Frenchmen, M. le Capitain D'Ar-



## PALMITIN — PALMS

pentigny, and M. Adrien Desbarrolles; and it is on their works that modern English books on the subject are chiefly founded. The observation of the fingers and joints on the hand is quite as important to the chiromant as that of the palm itself. The thumb is generally regarded as chiromnically the most important part of the hand. The first, or upper phalange of the thumb, when well developed, shows the presence of will and decision of character; the second, according to its development, indicates more or less logical power. What has to be considered by the chiromant proper is the "mounts" of the hand, with the marks on them, and the lines in the palm. The "mounts" are the elevations at the base of the fingers and thumb and in the "percussion" of the hand—that is, the side of the palm which extends from the root of the little finger to the wrist; it is so called because it is used in striking. They are seven in number, and are named from the planets. When well developed the mounts indicate the possession of the quality associated with the respective planets—for example, Jupiter developed denotes pride and ambition; Saturn, fatality; Apollo, art or riches; Mercury, science or wit; Mars, courage or cruelty; Venus, love and melody; the Moon, folly or imagination. But the effect of a greatly developed mount may be modified by the lines in the palm or by other signs. There are four principal lines, namely, the line of life, which surrounds the thumb, and which, if long, indicates a long life; the line of head, the line of heart, and the rascette or the bracelets. These last (the bracelets), if well marked, strengthen the effect of the line of life, each bracelet indicating thirty years of life. The line of heart, if long, clear cut, and well colored, denotes an affectionate and devoted character; and the nearer the line stretches to Jupiter the better the character. If the line end in a fork, so much the better. In actors and mimics this line ascends the mount of Mercury. A good line of head—that is, a clear-cut, long, unbroken line—indicates the presence of superior intellectual qualities. If the line stretch to the mount of the Moon, it indicates imagination. A winding headline shows folly and indecision of character; a linked line (like a chain) denotes want of concentration. The other lines (which are not present in all hands) are the line of Saturn or fate, the line of Apollo, the line of liver or health, and the line of Venus. A long, clear-cut line of Saturn foretells a happy and prosperous life, breaks or windings in the line foretell misfortunes or obstacles; a good line of Apollo shows that its owner will be successful in art; a good liver-line promises a long and healthy life; while the Venus line, when present, indicates a character very liable to be influenced by the passion of love. Marks on the mounts or lines, such as stars, crosses, etc., have their respective significations. A good open space between the lines of head and heart (the quadrangle) indicates a generous and noble disposition, while a very narrow space in the quadrangle is a sign of avarice and egotism.

**Palmitin, or Tri-palmitin**, a fatty substance occurring quite commonly in the natural fats and organic oils, and closely analogous to stearin in its chemical structure and deportment. It is especially abundant in palm oil, from which circumstance it derives its name. Tri-palmitin

may be conveniently prepared from palm oil by expelling the liquid portion by pressure, washing the solid residue with boiling alcohol to remove such other fats as it may still retain, and finally crystallizing from a solution in ether. By this process it is obtained in the form of white crystals which are scarcely soluble in alcohol but readily soluble in ether, and which melt at 144° F. Varieties of tri-palmitin are said to exist, however, which melt at 115° F. Chemically, tri-palmitin is a compound of palmitic acid,  $C_{15}H_{31}.COOH$ , with glycerin,  $C_3H_5(OH)_3$ ; three molecules of the acid being combined with one of the glycerin, as indicated by the equation  $3C_{15}H_{31}.COOH + C_3H_5(OH)_3 = 3H_2O + C_3H_5(C_{15}H_{31}.COO)_3$ , the last formula on the right hand side of the equality sign being that of tri-palmitin. Two other compounds of palmitic acid with glycerin are also known, but they are of less importance. Mono-palmitin has the formula  $C_3H_5(OH)_2(C_{15}H_{31}.COO)$ , and melts at about 140° F. It may be distilled in a vacuum, but when heated in the air it breaks up with the formation of acrolein and other products. Di-palmitin has the formula  $C_3H_5(OH)(C_{15}H_{31}.COO)_2$ , and its melting point is given, by various authorities, at from 125° F. to 140° F. When a mixture of glycerin and palmitic acid is heated for 24 hours at 400° F., all three of the palmitins are formed; and when the product is shaken with lime water and then extracted with ether, and the ethereal solution is evaporated, tri-palmitin, di-palmitin and mono-palmitin separate out in the order named. The palmitins are readily saponified by heating with caustic alkalies, and free palmitic acid may be conveniently prepared by adding hydrochloric acid to an aqueous solution of potassium palmitate.

**Palms**, trees, or shrubs of the monocotyledonous family *Palmæ*, ranking in economic importance next to the grasses. The species, of which about 1,000 are recognized, belong to about 130 genera. The great majority of these genera consist of only a few species, in many cases of only one. *Calamus* (the rattan palms) is the largest genus, consisting of about 200 mostly Asiatic species with no representatives in the Western hemisphere. *Geonoma* and *Bactris*, American genera, each contain about 100 species. The fourth, an American genus, is *Chamadorea* with about 60 species. The Asiatic and Australasian genus, *Licuala*, contains about 30 species. *Cocos*, an American genus with the exception of the cocoanut, which is cosmopolitan within the tropics, also contains about 30 species. *Desmonicus* (American), *Pinanga* and *Areca* (Oriental) each contain about 25 species. Geologists and botanists are fairly well agreed that the palms represent a once more extensively distributed and more numerous group of plants and that they are now upon the decline. Fossil remains are preserved in the rocks of the Middle Cretaceous, and, in North America, in those of the Upper Cretaceous from Greenland southward; in both Europe and North America they are also found in the Tertiary rocks.

With few exceptions the individual genera and even the tribes which they comprise are restricted in their distribution; certain tribes are African, other Asiatic or American, etc., and certain genera are found in very small areas; for instance, *Pseudophœnix sargenti* is found only in certain of the Florida Keys and even



## PALMS

there in limited numbers, and the species of *Howea* only in Lord Howe's Island, a tiny speck of land in the Southern Pacific Ocean. Only one species (*Chamærops humilis*) is an acknowledged native of Europe. The most noted exception to this rule is the cocoanut palm (*Cocos nucifera*) which appears throughout the tropics upon maritime land. It is among the first plants to obtain a root-hold upon newly formed islands. As a group, the palms are almost restricted to tropical and subtropical countries; the European species mentioned, however, extends as far north as latitude 44; an American species, the palmetto (*Sabal palmetto*), to 35; some Asiatic species to 34. In the Southern hemisphere some American species reach latitude 36 S., some African 30 S. In Australia, latitude 35 S. is the limit; but in New Zealand one species reaches 38 S. There are, however, a few South American species which approach the perpetual snow line upon the mountains. With respect to habitat, the various species exhibit a wide range of adaptability, some, like the cocoanut, growing only upon the sea coast, others wholly inland; some in sand, others in rich alluvial soils; some in swamps, others on dry hillsides; some in exposed places, others in the depths of the forest; some solitary, some in groups, some in forests or jungles to the exclusion of other species of trees.

In general, palms are erect, unbranched trees with buttressed bases. They often attain heights of 100 feet and at the summits of the usually smooth or slightly ringed columns, they bear a rosette of large leaves, each of which resembles in some kinds a fan and in others a feather. In some species of the former type the leaves may exceed 40 feet in length and six feet in breadth; in the latter, 20 feet by four or more, without division. There are, however, exceptions to the ordinary columnar habit of growth; a few species are branching; some are low growing, even creeping; others are slender stemmed plants which climb by means of hooked spines; some have flexible stems which extend from tree to tree in festoons and attain several hundred feet, 500 feet being common, and some writers placing the length at 1,500 and even more. In the ordinary species the flowers are borne in huge clusters which appear from within spathes that open in some cases with a report. The fruits are of various kinds, berries and drupes being perhaps most common. They are often enclosed in a fibrous husk, and frequently contain a hard nut. The flowers, which are generally small and individually inconspicuous, bear no relation in size to the fruit, which may be as small as a pea or, as in the double cocoanut, larger than a man's head.

While the grasses are of widest economic importance among plants, the palms are employed for the largest number of purposes. All parts of the various species are used, but in few do more than two or three parts find extensive employment. Many palms furnish good fuel, some useful timber, others masts and spars. The pith of certain species, especially of *Metroxylon* and *Caryota*, supply sago. The thin, pliant stems of many species of *Calamus*, known commercially as rattan, are widely used throughout the world for wickerwork and furniture. The terminal bud of several kinds is cooked and eaten like cabbage, such species being known as

"cabbage palms"—for instance, *Euterpe oleracea*. The leaves serve for thatching houses, and as material for walls, mats, screens, shields, clothing, hats, bedding, cordage, twine, nets, etc. The spines of certain species are used for tipping arrows and spears, for tattooing, for fish-hooks, etc. The fibre of the leaves of many species seems to offer useful paper-stock; that of others, for example, the piassaba fibre (q.v.), derived from various species of *Attalea* (especially *A. funifera*) is extensively used for brushes of various kinds, ranging from hair-brushes to stable brooms and street-cleaning machines. The sap of several species is used for the manufacture of palm-wine and of arrack, the latter a spirituous liquor; it is also employed in making jaggery, a kind of sugar of some commercial importance. For this latter purpose *Phœnix sylvestris* is perhaps the principal species. In some cases the sap is obtained by tapping; in others by cutting the terminal bud or even the trunk near the base.

The fruits of many species are useful. As food the cocoanut and the date are probably the most widely known and important. The former is employed not only as a fruit, but its contained liquid or "milk" furnishes a palatable drink either fresh or prepared as a wine. The kernel supplies the "shredded cocoanut" employed in confectionery, cakes and puddings. It also yields cocoanut butter or oil. The fibre of the husk is widely used for matting and is very popular where great durability is essential, as upon the aisles of public halls. The shells make serviceable dippers, bowls, and other utensils, or when carved and polished, attractive ornaments. The date palm supplies the Arab and other peoples of northern Africa and southern Asia with one of their chief foods, for which purpose it is commonly seen near dwellings, besides being planted extensively for commercial purposes. The chief commercial supplies come from Arabia, Persia and Mediterranean Africa.

Oils are obtained from the fruits of a large number of species, especially *Elæis guineensis*. Some of these oils are used for food, others for lubricating; some for illuminating; and others for soap and candle making. Usually these oils are orange-colored, violet-scented, and sweetish. They are generally obtained by boiling the ripe fruits in water, though also frequently by expression. Like butter, they soon become rancid unless kept cold. Palm butter is a popular name for several of the kinds. A palm wax is secured from species of *Copernicia*, and is used like beeswax.

The seeds of many species are very hard and are used for manufacturing small ornamental and useful articles such as knife handles, collar buttons, etc. Probably the best known of these is the so-called "vegetable ivory" (q.v.) which is derived from the *Phytelephas macrocarpa*, a South American species with a short or even creeping stem, from which arise pinnate leaves often more than 15 feet long. The seeds of *Areca catechu* are mixed with lime and pepper leaves to make the notorious "betelnut" (see BETEL) of eastern Asia. The product is used as a stimulant.

The most remarkable palm of all is perhaps the palmyra, deleb or borassus palm (*Borassus flabellifer*). This species is a native of southern Asia, the Australasian Archipelago and western



## PALMYRA

Africa, where it sometimes exceeds 100 feet in height. The leaves, which often exceed three feet in length, have spiny-margined petioles; the triangular fruits are about five inches in diameter, have a brownish or black, glossy, succulent, fibrous rind, and contain three seeds about as large as goose-eggs. Throughout India this is the commonest palm, and in Ceylon it occurs in extensive forests. It is employed for more purposes than perhaps any other plant, upward of 800 uses being recorded for its various parts. Its wood, palmyra wood, is heavy, dark, hard, durable, easily polished, difficult to cut across the grain but easy to cut with the grain. It is used for house-building, furniture, etc. The wood of some other palms is also known by this name and as porcupine-wood. The leaf stalks make excellent fences. The leaves are employed for thatch, mats, umbrellas, fans, hats, baskets, as writing tablets, for ropes, twine, etc.; the down at the leaf-bases for lint, and for filtering liquids; the sap yields sugar, palm wine and arrack; the fruit is cooked as an esculent; the young seeds are similarly employed, and the young plants serve as pot-herbs. A large part of the population of southern India depends upon this plant to supply its needs—fuel, shelter, clothing, food, etc.

Among the most important palms the following with their chief uses may be mentioned: Assai or Para palm (*Euterpe edulis*), a South American species whose fruits are macerated in water to make a popular drink called assai; Bourbon palm, one of the most widely grown of greenhouse and house palms, usually called *Latania borbonica* by florists, but properly *Latania commersonii*; double Seychelles, or sea-cocoanut palm (*Lodoicea callipyge*), chiefly noted for its great size, slow growth, enormous seeds weighing more than 10 pounds (even, it is said, more than 30 pounds), which from their seeming malformation but more particularly from their formerly unknown origin, gave rise to numerous fabulous tales; curly palm (*Howea belmoriana*) one of the best known greenhouse palms, and popularly called *Kentia belmoriana*; fan-palm, any species with fan-like leaves; fern-palm (*Cycas revoluta*, etc.), commonly raised in greenhouses; fish-tail, wine, or toddy palm (*Caryota urens*), a source of jaggery, arrack and palm wine; flat palm (*Howea fosteriana*), a favorite greenhouse palm popularly known as *Kentia fosteriana*; raphia palm (*Raphia*), which furnishes the raphia used by florists and nurserymen for tying up plants; Royal palm (*Oreodoxa regia*), so named in expression of its majestic appearance, and one of the most popular avenue-palms of warm countries; umbrella palm (*Hedyscopia canterburiana*); walking-stick palm (*Bacularia monostachya*); wine palm (*Caryota urens*; *Phoenix sylvestris*; *Borassus flabelliformis*, and *Cocos butyracea*); gomuto or areng palm (*Arenga saccharifera*), which furnishes fibre used for cordage, canvas, etc., and sugar, wine, vinegar, etc.; inaja palm (*Maximiliana regia*), the spathes of which are used as baskets and as cooking utensils; doum palm (*Hyphæna thebaica*), one of the few branching palms; talipot palm (*Corypha umbraculifera*), noted for its prodigious fertility in flowers, the number of blossoms upon a single tree having been estimated at 60,000,000, the inflorescence attaining a height of 30 feet above the crown of leaves. The

“palm” of the Bible is believed to be the date-palm, which is one of the commonest species in Syria at the present time. The so-called Panama-hat palm (*Carludovica palmata*) is not a palm botanically, but a member of the order *Cyclanthaceæ*.

With the exception of the date and the cocoanut, palms are little cultivated, the wild species being relied upon for commercial purposes. Even these species and those used for sugar, arrack, etc., are usually planted in favorable situations and allowed to shift for themselves after once becoming established or even before. For ornamental purposes, however, more or less care is given the young trees used in warm climates for bordering avenues, and as lawn or garden specimens.

During the closing decade of the 19th century palms sprang into popularity as greenhouse and house plants, for which purposes, and for decorating halls, churches, hotels, lobbies, etc., about a dozen species have become deservedly popular, not only because of their graceful appearance, but because of their ease of cultivation. Many other species are also found in private conservatories. In the United States the chief centre of palm production for these purposes is the Middle Western States, but the South is also increasing its area devoted to ornamental palms. The plants are nearly all grown from imported seeds sown in warm greenhouses. In some cases the seeds require months or even more than a year to germinate; but usually a month or two is sufficient. In many cases the young seedlings resemble one another, whether they will develop into pinnate-leaved or fan-leaved specimens. At all times ample water and good drainage are essential; shading is also generally beneficial. The plants generally succeed best in well rotted sod obtained from rather light soil rich in humus. Scale-insects and the red spider are the chief enemies; the former may be controlled with kerosene emulsion (see FUNGICIDE); the latter by forcible spraying, moist atmosphere, and by evaporated (not burned) sulphur. The fumes of burning sulphur are fatal to the plants.

Consult: Bailey, ‘Cyclopedia of American Horticulture’ (New York, 1900–2); Martius, ‘Historia Naturalis Palmarum’ (Munich, 1823–50); Kerchove de Denterghem, ‘Les Palmiers’ (Paris, 1878).

M. G. KAINS,  
*Crop Expert.*

**Palmyra**, pāl-mī'ra, Asiatic Turkey, the Hebrew *Tadmor*, City of Palms, an ancient city of Syria, now in ruins, 140 miles east-northeast of Damascus, lat. 34° 24' N., lon. 38° 20' E. It was founded or enlarged by Solomon in the 10th century B.C. It is situated in an oasis of the Syrian Desert, with a ridge of hills to the west, and an extensive plain on the east. It is said to have been a bulwark of the kingdom of Israel against the wandering tribes of the desert, and was an entrepôt for the trade between Damascus and the Mediterranean, from which it drew considerable wealth. Palmyra was little heard of in history until the time of the Roman Empire. It is mentioned as having been attacked by Mark Antony, who hoped to find in it the means to pay his troops; but the Palmyrians transported their goods beyond the Euphrates, and he was compelled to leave without accom-



## PALMYRA—PALOS

plishing his object. During the earlier period of the empire it was independent, and carried on a considerable trade with Persia, India, and the Mediterranean. Subsequently, about 130, or according to other authorities later, it submitted to Rome, and became a Roman colony. The protection of Rome against its neighbors, the Parthians and the Persians, was of value, while the yoke of so distant a mistress was not heavy. It became the faithful ally of Rome in her wars against the Eastern powers. During the reign of Gallienus (260-8), Odenathus, the ruler of Palmyra, rendered such effectual assistance against the Persians that that emperor gave him the title of Augustus, and recognized him as his colleague. Odenathus was succeeded by his widow Zenobia, to whom Palmyra chiefly owes its fame, and who took the title of Queen of the East. She was besieged in Palmyra by Aurelian, and compelled to surrender. On his departure the Palmyrians revolted, on which Aurelian returned and destroyed the city (273 A.D.). He permitted the inhabitants to rebuild it, but it never recovered its importance. The remains of Palmyra are chiefly of the Corinthian order, with the exception of the Temple of the Sun, which is Ionic. They are supposed to belong to the period of Odenathus and Zenobia. See ZENOBIA. Consult Wright, 'An Account of Palmyra and Zenobia' (1895).

**Palmyra, Mo.**, city, county-seat of Marion County; on branches of the Chicago, B. & Q. railroad; about 14 miles northwest of Hannibal. It was settled in 1818, laid out in 1819, and incorporated in 1855. It is in a farming country and the chief manufactures are connected with farm products. It has a pickle factory, creamery, flour and grist mill, and a carriage factory. The educational institutions are Centenary High School (M. E. South), founded in 1884, and the Saint Paul's College (P. E.), founded in 1848 as the Ingleside Female College, and public and parish schools. Pop. (1890) 2,515; (1900) 2,323.

**Palmyra Fibre.** See FIBRE.

**Palmyra Wood.** See PALM.

**Palni** (pāl'nē) **Hills**, mountain range of Southern India, joining the Eastern and Western Ghats, in the district of Madura, Madras presidency. The soil is fairly fertile and affords excellent pasturage. The climate is equable, comparatively dry and healthy, and there is a sanatorium at Kodikanal, 47 miles northeast of Madura.

**Palo**, pä'lō, Philippines, a pueblo of the island of Leyte, situated on the northeast coast at the mouth of the Malo Malo River, six miles south of Tacloban. It is an important road centre, being connected by road with Tacloban and other important towns to the south and west. Pop. 17,740.

**Palo Alto**, pä'lō ä'l'tō, Cal., town in Santa Clara County; on the coast division of the Southern Pacific railroad; 33 miles southeast of San Francisco and 18 miles northwest of San Jose. It was settled in 1891 by the opening of the Leland Stanford Jr. University (q.v.) which is located here. In 1892 a number of people established homes in Palo Alto on account of the university. It was incorporated in 1894. Palo Alto is a "university town," with but few

industrial establishments. The planing mills have about 30 employees; and there are stores sufficient to supply a limited amount of the local needs. There are eight churches, a high school, elementary graded schools, Manzanita Hall, a preparatory school for boys, and two preparatory schools for girls. The one bank has a capital of \$100,000. The town is governed by a board of five trustees. The town owns the water and electric-light plants and has a good sewerage system. Pop. (1900) 1,658, not including students.

**Palo Alto**, Texas, the name of a plain, or field, eight miles northeast of Brownsville (q.v.), Cameron County, where was fought, 8 May 1846, the first important battle of the war between the United States and Mexico. General Taylor with 2,000 U. S. troops was on the Rio Grande opposite Matamoros; and General Arista with a force of 6,000 Mexicans tried to cut him off from Point Isabel which was the base of U. S. supplies. Taylor attacked and defeated Arista; the Mexicans retreated to Resaca de la Palma (q.v.). The United States loss was four killed and 126 wounded; the Mexicans, 102 killed and 128 wounded. Consult: Howard, 'General Taylor' (1892); Bancroft, 'History of Mexico,' Vol. V.

**Palo'lo**, an annelid (of the genus *Eunice viridis*) found in great abundance in the sea near the coral reefs of tropical islands. They are taken in large numbers in autumn in nets by the islanders, who esteem them, when roasted, as a great delicacy. The body, about a foot long on the average, tapers toward both ends, and along each side are tufts of gills. An American species (*E. fucata*) abounds in various parts of the West Indies and Gulf of Mexico, but is not eaten.

These worms are interesting mainly on account of their extraordinary breeding habits. During the most of the year the worms lie coiled up in burrows in rotten coral-rock, or other friable material. When the eggs have ripened within the body, and the time for their discharge has come (which happens in early November in the South Pacific, and in July in the West Indies), the hinder part of the worm, which contains the ovaries and sexual organs, creeps backward out of the burrow, and struggles to get away, while the forward vital part holds on to its burrow. This takes place simultaneously with all the millions of worms in a district. After a little struggle the posterior part breaks away and swims with great rapidity to the surface, vast swarms rushing together to the top, where they are devoured by fishes and birds, and in the South Seas are netted by men, women, and children, by the thousand. Almost at once each worm bursts, discharging the eggs in a shower, and when all are gone the worm ceases its backward flight, collapses and dies. On no other occasion is the worm seen to leave its submarine burrow.

**Palos**, pä-lōs', Spain, a former important seaport town of Andalusia, in the province and 10 miles southeast of Huelva, on the left bank of the Rio Tinto, near the Gulf of Cadiz, where Columbus fitted out his ships, and whence he sailed on his first voyage for the discovery of the New World in 1492. The convent at the gate of which Columbus appeared as a poor stranger, and asked bread and water for his



child, is still standing here. Palos is now an unimportant village. Pop. (1900) 1,619.

**Pal'pi**, the organs or appendages, consisting of stalked or jointed processes, found in connection with the mouth of many invertebrate animals, and which appear to be chiefly devoted to the exercise of the sense of touch, the means by which the animal explores the surface upon which it walks, and probably in some cases of taste also. Thus, in many insects palpi are borne by the "maxillæ" or lesser pair of jaws (*maxillary palpi*), and by the "labium" or lower lip (*labial palpi*). The labial palpi in butterflies form the cushion-like organs by which the elongated proboscis or tongue is protected when at rest; and the small maxillary palpi of these insects are sometimes known as *palpuli*. In bees, etc., the labial palpi are of great relative length. In *Arachnida* (spiders, scorpions, mites, etc.) the maxillary palpi are largely developed. In the spiders these organs in the males are concerned in reproduction, and in the females they are terminated by hooked claws. In the scorpion the same structure forms powerful nipping-claws or *chela*. In the higher crustaceans (lobsters, crabs, etc.) certain of the jaws bear palpi. Consult Packard, 'Zoology' (1897).

**Palpita'tion**, abnormal movement or beating of the heart, sometimes violent and spasmodic; sensible to the patient, and causing discomfort or even distress. Its immediate cause is an over-stimulation of the excitability of the muscular structures of the heart, due to disturbed action of the ganglia and nerves which control its movements. The predisposing and exciting causes of palpitation are numerous; for example, an excitable temperament; bodily and mental exhaustion; inanition; deterioration of the blood as in scurvy, chlorosis, and spasmia; violent exercise or emotion; mental shock; dissipation; dyspepsia. In short, whatever tends to disturb the orderly action of the nervous system may induce palpitation, which is sometimes accompanied by symptoms of choking (*globus hystericus*), vertigo, ringing in the ears, impaired vision, partial unconsciousness, a clammy coldness of the extremities, and the fear of death, due to general nervous agitation. When palpitation arises from actual or organic disease of the heart it is sometimes spoken of as symptomatic; when due merely to disturbed action of the heart or to disorders elsewhere it is frequently called functional, though it is always but a symptom. When occurring with organic disease it often causes more anxiety to the patient than the disease itself. In treatment, remove as far as possible the exciting cause, enjoin absolute rest, keep the feet warm, sometimes give hot drinks—milk, cocoa, and hot water containing a little baking-soda are useful. Valerian and aromatic spirits of ammonia are often valuable. Severe cases should be under the care of a physician.

**Palsy**. See PARALYSIS; PARALYSIS AGITANS.

**Paludamen'tum**, a white cloak, which the commander of the Roman army put on in time of war. Sometimes, however, the color may have been crimson, and in the case of the emperor himself it was purple.

**Paludan-Müller**, päl'oo-dän-mül'lër, **Fred-erik**, Danish poet: b. Kjerteminde, on the island of Funen, 7 Feb. 1809; d. Copenhagen

29 Dec. 1876. In 1828 he entered the University of Copenhagen, and while a student there attracted attention by his poem 'Raab til Polen' (1831) and a drama 'Kjarlinghed ved Hoffet' (1832). His first poem of note was 'Dandserinden' (1833), followed in 1834 by the lyric drama 'Amor og Psyche' and by two volumes of 'Poesier' (1836-8). His later works include 'Venus' (1841, a dramatic poem); 'Dryadens Bryllup' (1844); 'Tithon' (1844); 'Tre Digte' (1854), among them the lyric drama 'Kalanus'; 'Nye Digte' (1861); and the two prose works, 'Ungdomskilden' (The Fountain of Youth) (1865); and 'Ivar Lykkes Historie' (1866-73), a novel. His chief work is 'Adam Homo,' a poem in *ottava rima*. An edition of his poems in eight volumes appeared in 1878-9.

**Pal'udism** (Lat. *palus*, *palud-*, a marsh), malarial poisoning; disease or disposition arising from malaria (q.v.).

**Pam'ban-manche**, or **Serpent Boat**, the native name for a long canoe used on the Malabar coast. They are from 30 to 60 feet in length, not more than three feet in beam, and are hollowed out of a single tree. The largest are rowed by about 20 men, double-banked, and can attain a speed of 12 miles an hour.

**Pamela**, pa-mē'la, or **Virtue Rewarded**, a novel by Samuel Richardson, published 1741-2. It was the first work of its author who began what is called the modern analytic novel. It won instant applause and a wide circle of readers, all classes of society following with close attention the shifting fortunes of Pamela Andrews, a serving-maid whom the son and heir of the family dishonorably pursues. Richardson created a new era in fiction when he chose a girl of the humble class for heroine, and made use of every-day contemporaneous persons, and scenes for the purposes of the novelist. Thus the story of incident and the analysis of character came into English fiction, and thus the modern novel traces its development from Richardson. It was satirized and parodied in 'Joseph Andrews' by Fielding.

**Pamir** (pä-mër') **Plateau**, **The**, or **The Pamirs**, Central Asia, an elevated region described as a "huge boss or knot," north of the Hindu-Kush Mountains, connecting the Himalayan and Thian-Shan mountain systems. (See HIMALAYA.) The plateau is about 150 miles long by 150 miles broad, nine tenths of the area being mountainous and the rest pasture-land. The name applied to the valleys is derived from the Persian *pai* and *mir*, signifying "the foot of mountain peaks"; the region is called also by the Persians *Bām-i-dunyā* ("the roof of the world"). The territories belonging to Russia, China, Afghanistan, and Britain meet in the Pamir region, and until the completion of the Anglo-Russian surveys in 1895 demonstrated its strategic valuelessness, owing to climatic and physical conditions, it was a fertile source of political dispute. The plateau has a general elevation of more than 13,000 feet, dominated by still loftier ridges and summits attaining a maximum altitude of 25,800 feet in Mustagh-ata, in the Sarikol range, and covered with perpetual snow. On the plateau are several small lakes, and the sources of the Oxus. From November to April the Pamirs are snow-bound and prac-



## PAMLICO — PAMPANGOS

tically inaccessible, while in the spring and summer the high winds make traveling very unpleasant. The great part of the surface is bare and barren; the native Kirghiz, however, find a certain amount of pasture for their cattle in summer, and in favored localities there is some cultivation. The "roof of the world" is celebrated throughout Central Asia, and notwithstanding its physical drawbacks, two recognized trade routes have traversed it east to west for ages.

**Pamlico**, pām-lē'kō, a river in North Carolina, really an estuary of Tar River, opening into Pamlico Sound. It is 40 miles long, from one to eight miles wide, and navigable for steamers which can enter the sound. Several small streams flow into the Pamlico River.

**Pamlico**, a sound or lagoon on the coast of North Carolina, the largest lagoon on the east coast of the United States. It is about 80 miles long and from 10 to 30 miles wide. It is separated from the Atlantic Ocean by long, narrow, sandy islands,—bars or beaches,—the point farthest out is called Cape Hatteras. Pamlico and Neuse rivers enter the sound, and the outlets on the east are Hatteras and Ocracoke inlets. The northern part is shallow, the southern part is about 20 feet deep. Fish and wild fowl are abundant. Several small islands skirt the shore. Roanoke, in the northern part of the sound, is the largest.

**Pamlico Indians**, a former American tribe living on the Pamlico River in Beaufort County, N. C. They were greatly reduced in number by the smallpox in 1697, and were practically exterminated by the Tuscarora war in 1711.

**Pampa**, pām'pä, or **Bamba**, a Quichua word meaning "plain," applied to various great plains in South America, and also occurring in proper names, for example, Riobamba, Moyobamba, Ayapampa ("Plain of Death"), and Cochabamba ("Lake Plain"). Rarely, as in Peru along the Ucayali River, forested plains are spoken of as pampas; the typical pampas are stretches of treeless plain, varied with rolling prairie, their vegetation being annual or perennial herbaceous plants, with a few shrubs. Water courses are absent, but there are many lakes or pools of rather brackish water. The predominance of grasses, especially varieties of the cereals, make the pampas in general an ideal feeding ground for steers, horses, and sheep. A marked botanical feature of the pampas is a huge thistle apparently indigenous to the Northern hemisphere.

In common usage Pampa or the Pampas is confined to a great plain in Argentina, the administrative district of Pampa Central, with General Acha (1,500 inhabitants) as capital, and a total population of 26,000. Here to a certain degree the original nature of the vegetation has been altered by tree planting, so that much of the plain, which 30 years ago was opened up for cattle grazing by Roca's successful expedition against the Indians of this region, now no longer grows the pasto amargo, but only grasses better suited for sheep. These are tended by Gauchos, Spanish and Indian half-breeds. A few years ago it was estimated that 5,300,000 sheep, 520,000 beef cattle, and 221,000 horses, mules, etc., grazed in this great plain. The Pampas have been scientifically studied by

d'Orbigny, Darwin, and Roth. Beneath a layer of thin vegetable mold, there is 40 or 50 yards of reddish clay, with an admixture of fine sand of chalky infiltrations, apparently proving repeated inundations in geological time. There is a rich prehistoric fauna, notably remains of machærodus, hippidimus, mylodon, megatherium, and mastodons; in the whitish lacustrine deposits near the surface fragments of terra-cotta and primitive tools, as well as bones (some of prehistoric animals), engraved and polished by man. Consult Ameghino, 'La antigüedad del hombre en la Plata' (1880).

**Pampa Aullagas**, owl-yä'gäs, or **Poopo**. See AULLAGAS.

**Pampanga**, pām-pän'gä, Philippines, a province of the island of Luzon, situated in the southwestern part of the island, bounded on the north by Tárlac, on the east by Bulacán, on the south by the Bay of Manila, and on the west by Zambales; length 37½ miles from north to south; greatest width 34 miles; area 2,209 square miles. The province is high in the north and mountainous in the northwest and west, but low and marshy in the south; along the shore of Manila Bay and for several miles inland the country is covered by canals and the estuaries of the Grande de la Pampanga River. The principal products are rice (raised in the lowlands of the south), sugar, sweet potatoes, gabe, tobacco, and cotton. Agriculture is the chief occupation of the inhabitants, but mechanical industries are also quite extensively developed; the most important are weaving and the manufacture of sugar, the fisheries of Pampanga are increasing in importance, and there is a large local trade in nipa, sugar, honey, sacks, etc. There are roads connecting all the towns, and connecting the province with Manila, Cavité, Tárlac, and Nueva Ecija; the Manila & Dagupan Railroad crosses the province from southeast to northwest, passing through the larger towns, and has been an important factor in the industrial development of the province. The great majority of the people are Pampangos (q.v.). Civil government was established in the province in February 1901. Pop. 224,000.

**Pampanga, Rio Grande de la**, rē'ō grän'dā dā lä pām-pän'gä, one of the four great rivers of Luzon, Philippines, is formed in the northern part of Nueva Ecija by the junction of a number of streams that drain the western slopes of the Caraballos Sur, flows southwest and south through the provinces of Nueva Ecija and Pampanga, and empties into Manila Bay through a delta of eight mouths. It drains a large territory, and has numerous tributaries, chief among them the Rio Chico de la Pampanga; in the rainy season it overflows its banks in the lower part of its course, and these inundations make fertile soil for the cultivation of rice. It is about 100 miles long, and the means of a large local trade.

**Pampangos**, a group of tribes of the Philippine Islands inhabiting the province of Pampanga, Luzon, and single localities in Nueva Ecija, Bataan and Zambales. They are of the Malay race, and at the time of the Spanish conquest of the islands had a civilization and writing of their own. In Pampanga they use their own language, which is spoken exclusively in that province.



## PAMPAS — PAMPLONA

**Pampas**, pām'paz (Sp. pām'päs). See PAMPA.

**Pampas Cat.** See GRASS-CAT.

**Pampas Deer**, a small deer (*Cervus campestris*) of the plains of southern South America, having antlers of three points each.

**Pampas Grass**, the most beautiful and the most important commercial ornamental grass (*Gynerium* or *Cortaderia argenteum*). It is a native not of the pampas of South America, but of the well-watered higher lands of Brazil and the Argentine Republic. It grows in large clumps, has leaves often more than six feet long, and flowering stems frequently exceeding 10 feet in height, surmounted by great graceful plumes (panicles) of silvery-white flowers which may occupy even more than two feet of the stem. This beautiful plant is grown in large quantities in California and sold for use in decoration, the plumes often being dyed with aniline in various tints. Outside of California, which is the only country where this grass is grown for market, the plants are cultivated for ornament in parks and gardens, but in the north they need protection with leaves or litter during the winter. They will grow in any good garden soil with no special attention. There are several horticultural varieties whose flowers are pink, carmine, purple, and intermediate tints. Two related species are of some importance: uva grass (*G. saccharoides*), a native of Brazil, furnishes considerable sugar, and *G. jubata*, a plant even more graceful than the pampas grass. Neither is grown in the United States, the former being very tender and the latter little known.

**Pampas del Sacramento**, pām'päs děl säk-rä-mën'tō, Peru, great plain in the north-eastern part of the republic, between the Ucuyali and Aullaga (or Huallaga) rivers. It is crossed by excellent waterways, has a rich vegetation, and was settled in the 18th century by Jesuit missionaries, but is now almost deserted.

**Pampeluna**, pām-pā-loo'nä, or **Pampelune**, pänp-lün, variant spellings of Pamplona (q.v.).

**Pamphilus**, pām'fī-lūs, Greek painter: b. between 390 and 350 B.C. He and Eupompus were the founders of the Sicyonian school of painting. He was the teacher of Apelles and Melanthus and was famous for scientific accuracy in drawing and perspective. He made his pupils pay him a talent (about \$2,000) for a course in painting. Among his works famous in antiquity were 'The Battle of Phlius'; 'The Voyage of Ulysses'; and 'Family Group.'

**Pamphilus, Saint**, a priest of Cæsarea, by birth a Phœnician, who for refusing to sacrifice to idols was cast into prison. He was a theological teacher at the famous catechetical school at Alexandria and collaborated with Eusebius in writing 'The Apology for Origen.' Persisting in adherence to the Christian faith he was condemned to death (309) and suffered martyrdom by decapitation 16 February, the day on which his festival is celebrated.

**Pamphlet**, a name applied to an ephemeral publication, occasional and not periodical, commonly discussing some question of public or special interest at the time. There are thus two distinct classes of pamphlets, the one addressed

to the general public, and discussing some question of immediate though probably of temporary interest. Political pamphlets form the type of this class. The other is addressed to a special class of readers, and discusses something connected with their particular interests or pursuits. Pamphlets of both classes are now to a great extent superseded by the opportunities of discussion afforded by regular periodical literature. They still, however, serve many important uses. Pamphlets have at various times since the introduction of printing exercised a very important influence, especially in this country, and in general in all times of political and religious excitement pamphleteers have been both numerous and vehement. They have comprised all sorts of men, from scholars and men of genius to the most vulgar and venal of partisans. Consult Waugh, 'The Pamphlet Library' (1898).

**Pamphylia**, pām-fīl'ī-ā, ancient division of Asia Minor, bounded on the north by Pisidia, on the east by Cilicia, on the south by the Mediterranean (Gulf of Adalia), and on the west by Lycia. Its coast line measured 75 miles, and its extent north and south was about 30 miles. The geological formation is peculiar, the entire surface of the country having been greatly changed since classical times by continuous fluvial deposits of carbonate of lime. The region was never an independent kingdom, so far as we know, but was successively subject to Lydia, Persia, Macedonia, Pergamum, and Rome. The population in early times seems to have consisted of an admixture of Semitic and Indo-Germanic elements. There were Greek settlements at Perge, Aspendus, Side, Cibyra, and Attalia, and remains of Pamphylian inscriptions show that the dialect of Greek used there resembled both Cyprian and Arcadian and hence was a very early form. Consult: Ramsay, 'Historical Geography of Asia Minor' (1890); Radet, 'Les Villes de la Pamphylie' (1890, in 'Revue Archéologique'); and Lanckoronski, 'Städte Pamphyliens und Pisidiens' (1890).

**Pamplona**, pām-plō'nä, **Pampeluna**, or **Pampelune**, Spain, capital city of the province of Navarre, situated near the French border, 200 miles northeast of Madrid, in a plateau 1,400 feet above sea-level, on the right bank of the Arga River and on the railway from San Sebastian to Saragossa. There is an old and a new quarter. The former with its narrow streets has changed little since the city was the capital of the French kingdom of Navarre; but the new part is regularly laid out. The main objects of interest are a cathedral, begun by Charles III. in 1397, the historic hall where the Cortes of Navarre used to meet, the churches of San Nicolas and San Saturnino, and several fine promenades and boulevards, La Taconera being the best; nearby are the gorges of Mayo and Roncevalles. A citadel built by Philip II. has been reinforced by more modern fortifications; the city is an important point strategically. The main industries are the manufacture of leather, linens, paper, flour, soap, strings for musical instruments, and wines. There is a great market at Pamplona from 29 June to 18 July. The city may have been a Roman colony Pompeiopolis; but the derivation is not certain. It was taken from the Arabs by Charlemagne in 778, passed to Ferdinand of Aragon in 1512, was held by the



## PAMUNKEY — PAN

French during the Peninsular war, and figured in the Carlist insurrections. Pop. (1900) 30,609.

**Pamunkey**, pa-mŭnk'ī, a river in Virginia, formed by the junction of the North and South Anna. It joins the Mattaponi at West Point and forms the York River. From the source of the South Anna to the York is 100 miles. The Pamunkey Indians have a reservation on the Pamunkey River.

**Pamunkey**, pa-mŭnk'ī, and **Totopotomoy**, two streams in Virginia, the banks of which were the scenes of military operations during the Civil War. When Gen. Grant withdrew from the North Anna (q.v.) on the night of 26 May 1864, he moved rapidly by the left to cross the Pamunkey, about 33 miles east. Gen. Sheridan, with Torbert's and Gregg's cavalry divisions, preceded the infantry in the afternoon, and at 9 o'clock next morning had crossed the Pamunkey and occupied Hanover Town, near which place, on the Hanover Court House road, one of Gen. W. H. F. Lee's cavalry brigades was met and forced back toward Hanover Court House. On the morning of the 28th Gregg's cavalry division, advancing on the Mechanicsville road, had a severe engagement with the Confederate cavalry near Hawes' Shop (q.v.) and, aided by Custer's brigade, drove it back upon the infantry at the Totopotomoy. Gen. Lee had early information of Grant's movements, and on the 27th put his army in motion to interpose between him and Richmond. Early's corps crossed the South Anna, and by midday of the 28th was in position with its right near Beaver Dam Creek, its left on the Totopotomoy, near Pole Green Church, four miles from Hawes' Shop. Anderson's corps formed on Early's right, and covered the road from White House, on the Pamunkey, by Old Church, Bethesda Church, and Mechanicsville, to Richmond. Hill's corps and Breckinridge's command extended on Early's left to near Atlee's Station, crossing the Virginia Central Railroad a mile north. On the afternoon of the 28th the Sixth and Second Union corps crossed the Pamunkey at Huntley's, four miles above Hanover Town, and took position across the Hanover Court House road at Crump's Creek, and the Fifth corps crossed at Hanover Town, the left near the Totopotomoy, an affluent of the Pamunkey, which it entered two miles below Hanover Town. The Ninth corps crossed at midnight. The Second, Fifth and Sixth corps formed a line in front of Hanover Town, 17 miles from Richmond, the Sixth on the right, the Second in the centre, and Fifth on the left. At noon of the 29th Barlow's division of the Second corps advanced on the road from Hawes' Shop to Atlee's Station, small bodies of Confederate cavalry falling back before it to the other side of the Totopotomoy, where the infantry was found strongly intrenched. Warren's Fifth corps took position on the Shady Grove Church road, skirmishing with the enemy. Wright's Sixth corps moved on the right of the Second, occupying for a time Hanover Court House, and then closing in to the left, and the Ninth corps moved between the Second and Fifth, pushing out on the road to Pole Green Church. There was incessant skirmishing during the 30th in an effort to develop the Confederate position, and late in the day Early's corps attacked Warren's Fifth corps

near Bethesda Church and attempted to turn its left, but was repulsed. To relieve the pressure on Warren, Hancock at 7 P.M. was ordered to attack, and Brooke's brigade carried the first line of rifle-pits occupied by the Confederates. On the 31st Birney's division crossed the Totopotomoy and carried the enemy's advanced line on the right of the Richmond road. Gen. Wilson's cavalry division moved to Hanover Junction and destroyed the railroad bridge over the North Anna, at the same time defeating the Confederate cavalry and driving it from Mechump's Creek; and Sheridan, with two divisions of cavalry, was sent to occupy Cold Harbor, driving the enemy out, and was directed to maintain his position at all hazards. On 1 June Warren moved out to develop the Confederate position, and found it intrenched strongly in his front, beyond clear ground, swept by artillery fire. He lost 200 killed and wounded, extended his line some distance to the left, and was attacked in several places during the day, and quite severely on the right just before dark. Everywhere Gen. Grant had found Gen. Lee confronting him in strong works, and determined again to retire from his direct advance toward Richmond and to throw his troops rapidly to the left to Cold Harbor (q.v.). This movement began on the night of 31 May, the corps moving successively from the right. Consult: 'Official Records,' Vol. XXXVI.; Humphrey, 'The Virginia Campaign of 1864-5'; Wather, 'History of the Second Army Corps'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV. E. A. CARMAN.

**Pan**, in Greek mythology, a rural divinity. Comparative philology, showing that the name is related to *pastor* (Latin, "shepherd"), agrees with the results of modern mythological study which traces his various attributes back to an original god of the flocks, so that we can credit neither the decadent explanation of his name, from the Greek word meaning "all," by his being the son of Penelope and *all* the suitors, nor agree with the Stoics who made of him a god of the universe, the ever-present spirit of nature in *all* things. It seems evident that Pan was originally a shepherd god of Arcady; indeed the figure that Arcady cuts in modern pastoral poetry seems to be due entirely to its mention in classic authors in connection with the pastoral god. Considered as a typical shepherd Pan naturally develops into hunter, fisherman, and, in time, warrior; and "Panic fear" or "panic" is explicable as an extension of the unreasoning terror that seizes a flock of sheep. Another school of mythologists stress the fact that Pan was an Arcadian god, make his various rural activities merely those of the normal Arcadian, and explain his warlike functions by noting that the Arcadians were often mercenaries; but this scheme fails to explain the myth of Pan's love of Selene, the moon-goddess, which is perfectly explicable if we reckon the god a shepherd who must "watch by night." The Arcadian myths of Pan's birth are many, the commonest make him son of Zeus and Callisto, or of Hermes and a daughter of Dryops, and associate him closely with Dionysus. The myth and the cultus of Pan spread slowly through Greece. He was not worshipped at Athens until after the battle of Marathon, where the panic of the Persian army



## PAN-AMERICAN CONFERENCE — PANAMA

was accredited to him; compare Browning's poem 'Pheidippides.' In Rome Pan was identified with Faunus or Inuus and later confused with the Satyrs, so that *Panes* and *Panisci* were spoken of; moreover his nature was sensualized somewhat, so that in early Christian times he became par excellence the god of Greek heathenism. Hence the myth of the death of Pan at Christ's birth; and hence, too, because of the representation in art of Pan as a horned being half-man, half-goat, the popular picture of the devil. Earlier Greek art, it must be remembered, made of him merely a beautiful young shepherd, only occasionally giving him horns, such as were worn by other divinities of nature, notably the river-gods. Consult: Wieseler, 'De Pane' (1875); Roscher, 'Ueber Selene und Verwandtes' (1890).

**Pan-American Conference**, in American history, a convention held in Washington, D. C., in 1889-90 at the instance of James G. Blaine, then secretary of State, at which delegates were present from all the governments of South and Central America. A second conference was held in the City of Mexico 22 Oct. 1901, delegates being present from 19 states. These conferences had for an object the furtherance of international comity and commerce among the races of the American continent. The meetings of the first conference were protracted for nearly six months, the delegates meantime visiting every city of importance in the United States. The conference possessed no legislative or executive functions, its duties being purely advisory. The definite recommendations made by the conference included a coinage of uniform weight and fineness, a common method of legalization of documents, the metrical decimal system, and a uniform system of weights and measures, regulation of the fees of consular agents, and certain conveniences of method in customs administration. These were only suggestions to the countries represented, and they could be made effective only by treaties. Other important propositions were unanimously adopted, such as a great trunk railway; government subsidies for steamship lines connecting the American countries represented; uniform protection for literary and art property, trade-marks, and patents; uniform quarantine regulations; a uniform extradition treaty, and a great international bank.

**Pan-American Exposition**, a great fair held in Buffalo, N. Y., from 1 May to 1 November 1901. It was so called from the large number of exhibits brought from Central and South America. The numerous buildings were made of staff, as were those of the Columbian Exposition, but were tinted a soft greenish-blue, thus avoiding the glare of the pure white. Power for the electrical exhibit was derived from Niagara Falls. Over 5,000 horse-power and 200,000 incandescent lamps were used. The electrical tower alone had 44,000 electric lights on its sides. The "Midway," a section of the grounds devoted to various kinds of shows and entertainments, was very popular. It included a Japanese village, an Indian Congress, panoramas, etc. Financially the exposition was a failure, due largely to President McKinley's assassination, which caused a temporary closing. The total cost of the exposition was \$8,860,757.20; the total receipts \$5,478,589.37. See EXHIBITION.

**Pan-Presbyterian Council.** See PRESBYTERIAN SYSTEM, ALLIANCE OF THE REFORMED CHURCHES THROUGHOUT THE WORLD HOLDING.

**Pana**, pā'na, Ill., city in Christian County; on the Baltimore & O. S. W., the Cleveland, C., C. & St. L., and the Illinois Central R.R.'s; about 40 miles southeast of Springfield. It was settled about 1845, and in 1867 was incorporated. It is in an agricultural region in which hay and corn are important products. In the vicinity are coal deposits. About 1,000 employees work in the coal mines; the hay compress companies have about 40 employees, and other industrial works employ about 50 more. There are seven churches, public and parish schools, and a free public library. The two banks have a combined capital of \$250,000. The general law of 1870, for the government of cities, is in force in Pana. The waterworks are owned and operated by the city. Pop. (1890) 5,077; (1900) 5,530.

**Panætius Rhodius**, Stoic philosopher: b. Rhodes about 180 B.C.; d. Rome about 110 B.C. He spent most of his life in Rome disseminating the tenets of Greek and more especially of Stoic philosophy. Here he enjoyed the friendship of Lælius and the younger Scipio. He subsequently traveled extensively in the East and visited Egypt and on his return opened a Stoic school at Athens. He really belonged to the middle Stoic or Eclectic school and borrowed from Plato and Aristotle. Only fragments of his writings are extant to-day. His chief treatise was one on 'Duty' from which Cicero in his 'De Officiis' has drawn much material. Consult: Van Lynden, 'De Panætio' (1802); Schmekel, 'Die Philosophie der mittlern Stoa' (1892).

**Panama**, pä-nä-mä', republic of Central America, bounded on the north by the Caribbean Sea, on the east by the Gulf of Darien and the Atrato River, which separate it from Colombia, on the south by the Pacific Ocean, notably on the southwest by the indenting Gulf of Mexico, and on the west by Costa Rica, the boundary being unsettled and long in dispute. The interior in general, and especially in the northwest along Mosquito Bay and in the southeast along the Atrato River is marked "unexplored" on the most recent and complete maps of the country. The interior is thick with hills and mountains, a few being extinct volcanoes. These have no connection either with the North American Cordilleras or with the Andes. The only systematic ranges are a bit of the Costa Rica central divide, which runs over into western Panama, and on the Atlantic coast further east the Cordillera de San Blas. The detached and irregular hills are often separated by streams greatly subdivided. The banks of these streams, and, indeed, the greater part of the country is covered with dense tropical vegetation. The exceptions to this rule are a few treeless uplands along the Pacific side between the Costa Rica border and the Gulf of Panama. The streams are unimportant with the exception of the ill-named Rio Grande, emptying into the Pacific near the city of Panama, and the Rio Chagres which flows into Limon Bay near Colon. The importance of these two rivers lies largely in their proximity to the projected canal. This lack of interior waterways and the general impassability of the country make the only outlet for most towns the sea and make other











## PANAMA

means of communication (save between Colon and the city of Panama by rail), as well as other location than near the sea, practically impossible. The altitude of the country varies between 200 and 1,500 metres. The climate is warm and damp, and extremely unhealthy. The terrible mortality consequent upon the canal excavations made by the French are so commonly taken to prove that the earth if merely upturned breeds a deathly miasma, the "creeping Johnny," that the natives neither hoe nor plow in their small agriculture. But the high death rate is quite as probably explicable by the lack of sanitation and by the unrestrained use of mountain streams for laundries, drains, cess-pools, and drinking water reservoirs.

*History.*—Columbus landed on the isthmus in 1502. Then came further exploration, notably by Balboa, and in train of that colonization, still in the first quarter of the 16th century. In the more flourishing days of Spanish rule in that century and the next the country in general and the city of Panama (q.v.) in particular enjoyed the advantages coming from the shipment of South American silver and gold. But this prosperity had so drooped at the close of the 18th century that Panama was largely isolated from Colombia and took comparatively little part in the various revolts that culminated in Colombian independence in 1819. Two years after that date, however, the people of Panama proclaimed their independence and became part of the republic of Colombia. This was a strongly centralized government held together by little but Bolivar's personal influence and power. It was shattered in 1831, the year after his death, and three new republics were formed, namely, Venezuela, Ecuador, and New Granada. The last named included the Isthmus. Strangely enough the form of government of the new republic was practically identical with that which had brought it to revolt against Colombia; and in the new republic of New Granada the centralized government was equally ill-adapted to its heterogeneous elements. Moreover there was no simple and speedy means of intercommunication such as might have welded the country into some national unity. In the existence of this type of government is the philosophic key to the history of both the old republic of Colombia down to 1831, and after that date of New Granada and the New United States of Colombia. It was in the very nature of things that as New Granada had broken from Colombia, so Panama, New Granada's remotest part, must break, or attempt to break from New Granada. A state's rights or Federalist party did rapidly rise throughout New Granada. In 1840 revolutions broke out in most of the provinces. An independent "State of the Isthmus," containing the provinces of Panama and Veragua, was proclaimed in 1841, but the Centralists were successful, the revolution was suppressed, and the old régime was restored. The sentiment against this method of government steadily increased until in 1855 by an act of the Congress of New Granada at Bogota the autonomous state of Panama was erected out of the Isthmian provinces. But the sincerity of this act may well be questioned and its aim was probably political and the purpose to crush the Federalist party for good and all. But the attempt of the national government to revoke its act, and, it seems, to provoke a revolution, and then in crushing that

revolution to put a stop to all Federal agitation, overreached itself. The revolution in behalf of the new constitution was completely successful. For a score of years and more Panama, like the other states in the Colombian Union, enjoyed (more or less interruptedly) its individual rights. A Centralist uprising in 1885, however, effected a return to old conditions. The former state of Panama was again ruled from Bogota, and became a department called Panama. This department was divided into four provinces, Chiriqui, Veraguas, Azuero, and Panama; the last named province occupied the eastern half, approximately of the department of the same name, with which it is very easily confused.

It is worth noticing in passing that during this revolution in 1885 the United States of North America landed marines to protect the transit of the Isthmus between the cities of Colon and Panama, a circumstance of material assistance to the Centralist insurgents, but an act undertaken simply for the sake of inter-oceanic and trans-Isthmian commerce. That it could have been for any reason other than this is impossible, since the right and duty of the United States to preserve neutrality in the Isthmian strip was due to a treaty made in 1846 with the government of New Granada, a government not in existence in 1885. In short the obligation was one to a territory and not to any power; and if to any power simply to that in control of the Isthmus, no matter what its relation to the original treaty-making power.

Since 1885 the relations of Panama with Colombia have been no closer nor more familiar than before. Several revolts have taken place, and in July 1900 under the lead of Porras, later a leading candidate for the vice-presidency of the republic, a desperate but unsuccessful attempt was made by a Liberal army to get control of the city of Panama. In 1903 a more successful plot was planned, growing out of the discontent of the people of Panama with the attitude of Colombia toward the Panama Canal Treaty with the United States. Whether through fear that the United States would in time gain sovereignty over the canal—there was an old saying that the canal when built would become the southern boundary of the United States—or a hope that the bid for the canal might be largely increased, the Colombian Congress refused to ratify this treaty and adjourned 31 Oct. 1903. By the terms of the Spooner Bill this made the Panama Canal apparently an impossibility and the Nicaragua Canal a certainty, for the President had been bidden to treat for the Panama Canal, and if such negotiations failed to carry through the project of the Nicaragua Canal. In short, the people of Panama would have been deprived of the fulfilment of their hopes of renewed commercial importance by this inexplicable action of the Colombian Congress, had not the revolution planned as early as the summer of 1903 offered a solution. How the desire for autonomy, the desire for a canal, and the desire for the money to be paid for the canal, respectively, bulked in the minds of the revolutionary plotters it is impossible to say. The foregoing sketch of Panama's political history would show at least that a revolution for purely political reasons was a possibility. The mixture of motives amounts to little more than a coincidence of several impulses, each of which alone would



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have been sufficient. On 3 Nov. 1903—that is three days after the adjournment of the Colombian Congress—the municipal council of the city of Panama proclaimed the independent republic of Panama. There was no bloodshed. An army of 400 Colombians (mostly boys between 12 and 14) arrived 4 November in Colon, whence its general with his staff went to Panama, was dined there, and upon his refusal to acknowledge the new republic, of which he knew nothing until the evening of the 4th, was imprisoned for a few days, but on the 7th with his army was shipped back to Cartagena from Colon. In the meantime upon the 6th of November the United States government recognized the new republic, being satisfied that there was not the slightest internal opposition to its establishment. France's recognition followed 10 November, and soon afterward like action was taken by Germany, England, and Russia. The remarkable haste with which the provisional government was recognized by our own is not without precedent; in a Senate debate 5 Jan. 1904, Senator Lodge pointed out that in 1848 the French republic was recognized after three days and that the Republic of Brazil had received formal recognition within two days after its formation. It is to be noticed also that Panama's government may perfectly justly be reckoned a "resumption" of previous independence. As to the action of our government in landing marines to protect the trans-isthmian railroad, its defense lies in an appeal to the Treaty of 1846, to the precedent of 1885, when the Centralist cause was as much (and as unintentionally) aided as it was checked in 1903, and to the principle that it is the Isthmian commerce that we aim to protect by keeping the strip neutral rather than any government, and hence that an appeal from any established power in the Isthmus for protection of the railroad must be met by speedy and unhesitating action. The objections to this view of the case and the disagreement with the actions of the existing administration came from various sources; first, as in the case of the New Haven petition sent to the Senate 11 Jan. 1904, from unpartisan constitutional experts; and second from the opposition in Congress and the supporters of the Nicaragua route, who saw their last chance to win. The New Haven petitioners simply asked the Senate to make a careful and deliberate investigation. The opposition in Congress (and in the press) urged that the revolution in Panama was fostered if not actually started by the Republican administration and the landing of troops was for the purpose of preventing Colombia from subjugating the rebellious department; in fine, that both revolution and recognition grew out of pure self-interest in the proposed canal. Whatever the merits of these arguments, the inability of the Democratic caucus to bind its members to oppose the Canal Treaty, the instructions from the Mississippi Legislature to the Senators from that State, and 11 Jan. 1904 the practical confirmation of the nomination of W. I. Buchanan to be minister to Panama by the tabling Senator Morgan's motion to reconsider,—all these things seemed to show that the actual opposition to the course of the administration was political and temporary.

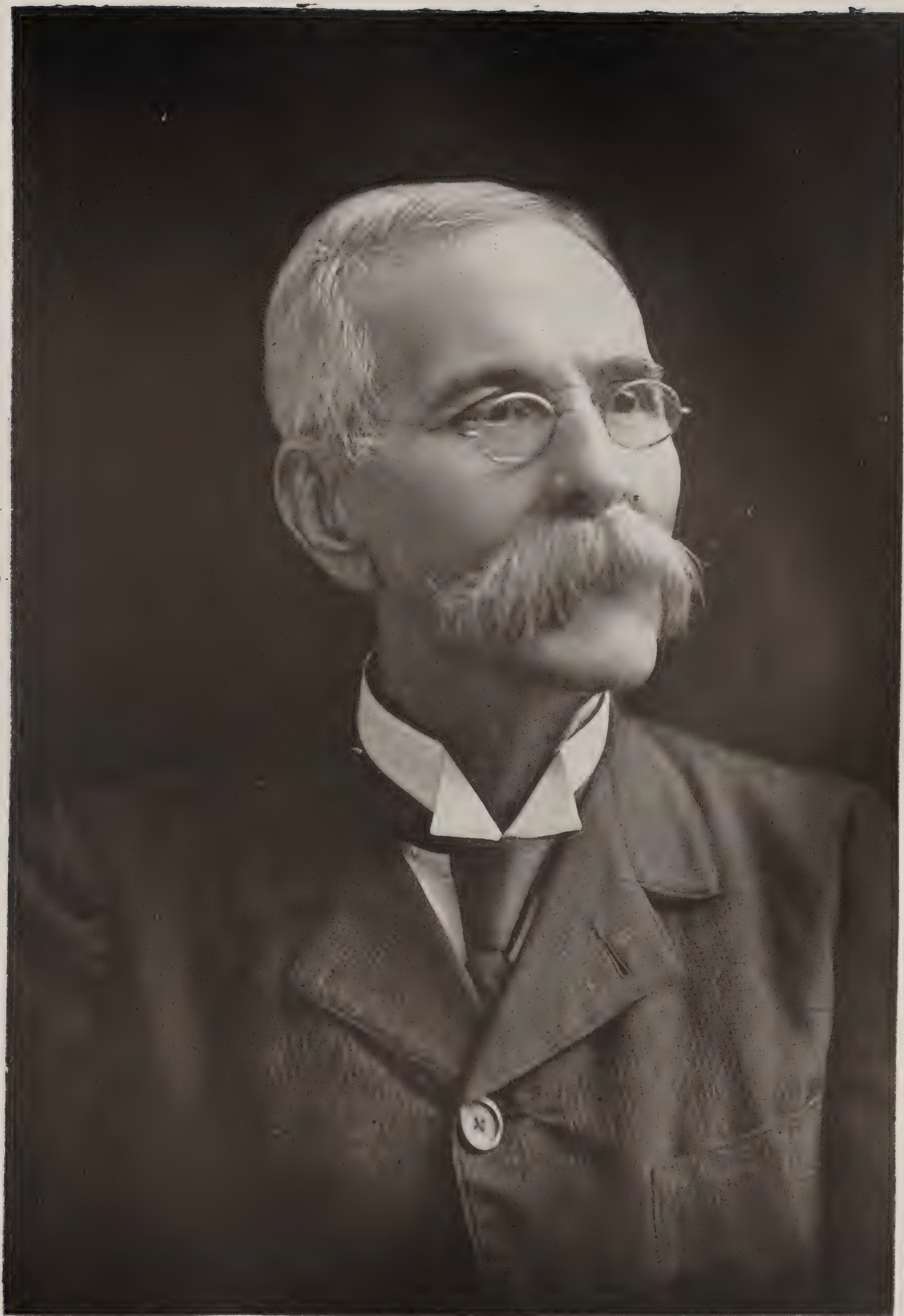
The provisional government founded 3 November was in the hands of a junta consisting of J. A. Arango, Tomas Arias, and Federico

Boyd. The last-named member of the junta arrived in the United States on 18 December and late the same day a Canal Treaty was signed by Secretary of State John Hay and the minister from Panama to the United States, Philippe Bunau-Varilla (see VARILLA, PHILIPPE BUNAU), who had been formally received at Washington eight days before. This treaty is practically the same as the convention made with the Colombia; the compensation is the same; but the canal strip is made wider and the powers granted to the United States are larger. The junta named above took control of the government, being assisted by the following provisional cabinet: Minister of Government, Eusebio Morales; Minister of Finance, Dr. Manuel Amador Guerrero (later elected president); Minister of Foreign Affairs, F. V. de la Esprilla; Minister of Justice, Carlos Mendoza; Minister of Public Instruction, N. Victoria; and Minister of War and Marine, M. de Obarrio, Jr. On 27 December a general election of delegates to a national convention took place. In most instances municipal authorities acted as electors; the scheme of manhood suffrage originally promulgated having proved impracticable. Four delegates were chosen from each province except Panama, which elected eight, making a total of 32. These delegates, meeting 15 Jan. 1904, were called to frame a constitution and to elect a president. The provisional government ratified the Canal Treaty 2 Dec. 1903, and five days afterward the treaty was submitted to the United States Senate, where the question of its ratification furnished an opportunity to criticise the stand of the administration throughout in its relations to Panama, as has been outlined above. On 16 Feb. 1904, Guerrero was elected president, with Arasemena, Obaldia, and Mendoza as *designados*, or vice-presidents.

*Statistics.*—With an area of 31,500 square miles and an extent east and west of 460 miles the republic of Panama has a population of scarcely 300,000 of the most heterogeneous sort. There are a few natives of Europe and of the United States, mostly engaged in the operation of the railway; many people of Spanish and Indian descent; and especially on the Atlantic coast, a number of English-speaking negroes and mulattoes. The chief commercial cities are Colon (or Aspinwall), with a population of 3,000, and Panama (q.v.), the termini of the present railroad and of the proposed canal. The commerce of the country is mainly with the United States. Complete figures are lacking, but a total of those given for Panama and Colon would not fall far short of being complete. For the commerce of the City of Panama see that title. The imports at Colon in 1903 were valued at \$952,684, distributed as follows: United States, \$614,179; France, \$119,086; England, \$118,322; Germany, \$76,386. The principal imports from the United States were: Dry goods, \$200,744; provisions, \$189,333; coal, \$59,890; lumber, \$38,642; kerosene, \$32,900; hardware, \$31,940; liquors, \$30,400. The exports from Colon to the United States for the fiscal year ending 1 June 1903 amounted to \$173,370, and included: bananas, \$75,432; cocoanuts, \$54,060; turtles shells, \$12,742; ivory-nuts, \$9,400; hides, \$6,460; coffee, \$5,424.

**Panama**, city of Central America, capital of the republic of Panama, situated on a coral





DR. MANUEL AMADOR,  
FIRST PRESIDENT OF THE REPUBLIC OF PANAMA.







## PANAMA — PANAMA CANAL

peninsula running into the Gulf of Panama. It has no actual port, but vessels anchor safely between the mainland and a chain of islands. Founded near the Pacific coast in 1518 by Pedro Arias Davila, Panama became wealthy in the days of the Peruvian mines, and was the oldest and richest colony in America in 1671 when it was taken, looted, and burned by the buccaneer, Sir Henry Morgan (q.v.). The present city, six miles from the site of the old, was built two years after, and with its granite fortifications, now in ruins, was long the strongest Spanish fortress on the Pacific. The rush of gold-hunters to California in 1849 renewed its prosperity somewhat and in 1855 procured for it railroad connections with Colon, a new port on the Atlantic; nearly 100,000 passengers and 1,000,000 tons of freight landed by about 1,000 steamships are annually carried by this road. Besides this mere reshipping business it has the large part of the export trade of what is now the republic (and was the department) of Panama. In 1903 the city shipped to the United States india rubber valued at \$49,974, hides at \$56,767, cocobolo nuts at \$27,805, ivory nuts, \$16,598; deerskins, \$13,372, and coffee, \$6,908, a total of \$193,402. The city is the seat of a bishop and of several consulates, and has a cathedral, ruined convents, a Jesuit college and a university founded in 1751. Panama is the centre of the country; in it the revolution against Colombia was carried out 3 Nov. 1903. Pop. about 30,000.

**Panama, Isthmus of**, the tongue of land connecting the northern and southern American continents and varying in width from 30 to 70 miles. The isthmus runs east and west with a double curve in either coast line, so that the western hollow made by Mosquito Bay on the north side and the eastern indentation of the Gulf of Panama on the south side, each with a corresponding bulge opposite, give the entire isthmus the shape of a recumbent S or of the sign of variation. In this more extended use of the term the words Isthmus of Panama are applied to the entire republic of Panama (q.v.), that is, what was formerly the department of Panama. The term is also used of the eastern and narrower part, corresponding roughly with the former province of Panama; to this part the name of Darien was originally applied. The isthmus was reached by Columbus in 1502, and was an immediate field for Spanish civilization. It was crossed in 1513 by Balboa, who "from a peak in Darien" discovered the Pacific. The cities of Panama and Nata were colonized before 1520. The isthmus was also the scene of the Darien scheme of colonization fathered by William Paterson (q.v.). In spite of its having been known so long to European explorers, large parts of the Isthmus to the west of Colon are unexplored. The contour of the isthmus is broken by irregular hills much worn by erosion.

**Panama Canal**, an all-water route between the Atlantic and Pacific to run from Colon to the city of Panama. Balboa's explorations of the Isthmus were made with the particular purpose of discovering a strait which would make possible the longed-for western passage. In 1550 a Portuguese navigator, Antonio Galvão, brought to the attention of the King of Spain

a plan to cut a canal through the isthmus, but for political reasons the project was suppressed, and the death penalty was attached to any attempt to reopen the matter. A canal at Nicaragua was suggested by Nelson in 1780, and in 1804 Humboldt mapped five routes, one of them between Chagres (near Colon) and Panama. Spain had determined to begin work when the country was snatched from her control in 1821 by the independence of New Granada. Guatemala, San Salvador, and Honduras tried to interest Louis Philippe in a canal in 1844, but were unsuccessful. The discovery of gold in California in 1849 renewed interest in trans-Isthmian commerce and six years later the railway between Chagres and Panama, practically the route of the canal now planned, was built. An American commission between 1870 and 1875 examined the routes proposed and declared in favor of a canal through Nicaragua. The investigation was renewed with greater care upon the suggestion of the International Congress of Geographical Sciences which met in Paris in 1875. From the end of 1876 to the spring of 1879 a French commission, led by Bonaparte Wyse, made careful surveys in the Isthmus. Acting upon these in 1879 an International Congress, meeting in Paris and convened by Ferdinand de Lesseps, decided that the best route for a canal was from the Bay of Limon to the Gulf of Panama and that the canal should be a tide-water canal. Almost a year before the meeting of this Congress Wyse had received from Colombia permission to build the canal. This concession he had immediately transferred to de Lesseps, who at the second attempt managed to float the first Panama Company. The expense was tremendous, and it was necessary to issue loan after loan until in 1888 the French public refused to buy anywhere near the total amount of stock offered. On 4 Feb. 1889 the Company was declared insolvent and a receiver was appointed. A commission sent to the Isthmus in 1890 reported that a canal with locks could be finished in eight years at an expense of 900 million francs (\$180,000,000). There had been rumors of mismanagement even before the dissolution of the Company in March 1889, and 11 June 1891 an investigation into the affairs of the Company was ordered. It lasted 17 months, and was followed by another from November 1892 to June 1893 and a third from June 1897 to July 1898. Bribery, corruption and maladministration were brought to light. But the case (like the Dreyfus affair) was so enmeshed in politics and involved so many in high position that justice was never done; apparently great injustice was done to de Lesseps and his son, who were convicted in 1893 of misappropriation of funds, sentenced to fine and imprisonment, and never punished. Though occasional spasmodic attempts were made to carry on the work, for the most part to come up to the requirements of repeated renewals and extensions of time from the Colombian government, this was the end of French activity in Panama save on a small scale. American interest in an interoceanic waterway was sharply aroused by the exigencies of the war with Spain. Going on the results of the Commission which had reported in 1876 every one turned to the Nicaragua project; the Panama Canal seemed out of the question. And



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a new commission appointed by President McKinley in 1899 also reported in favor of the Nicaragua route, being influenced to do so by the prohibitive price first set by the French company on its franchise and property in Panama. But a supplementary report in favor of the Panama Canal followed the offer of the French company to sell for \$40,000,000, the valuation set by the American Commissioners. Both houses of Congress had previously shown their readiness to vote for the Nicaragua scheme; and in the Senate particularly its adherents under the leadership of Senator Morgan of Alabama, chairman of the Senate's Committee on Canals, seemed pledged to that route. The Senate, however, was quickly won over by the efforts of Senator Hanna, who had become interested in the Panama scheme, it is said, by the efforts of Philippe Bunau Varilla (q.v.), one of de Lesseps' engineers, and now minister of the republic of Panama to the United States. The House of Representatives was brought over by the compromise measure called the Spooner act, which was passed in January 1903. It authorized the President to carry through such negotiations with Colombia as would assure the digging of the Panama Canal, and, if this proved impossible, to treat with Nicaragua and build the canal along the route originally recommended by the Walker Commission. The title of the French company was first investigated and 16 Feb. 1903 the United States accepted the offer of the Panama company to sell out for \$40,000,000, on the condition that terms could be made with Colombia. The Hay-Herran treaty was signed by representatives of the two governments after long delay; was sent to the Senate for ratification in January 1903; was successfully opposed by Senator Morgan and his few followers through the session of the 57th Congress; and was passed upon favorably 18 March in special session after a debate of almost exactly a fortnight. This treaty arranged for the payment of \$10,000,000 for the concessions, a payment of \$250,000 per annum beginning in the tenth year after the ratification of the treaty, and in return a lease of the canal for 100 years, with the privilege of continued renewals at the pleasure of the United States. The Clayton-Bulwer Treaty had previously been revoked and superseded by the Hay-Pauncefote treaty of 1901, so that Great Britain allowed the right of the United States to build and police the canal alone. But all obstacles were not removed even yet, for the Colombian Congress now refused to ratify the treaty which had been signed by its representative in Washington. This obstacle was removed 3 Nov. 1903 by the declaration of the independence of the Republic of Panama (q.v.), which immediately sent one member of its provisional junta to Washington, where 18 November the Hay-Varilla treaty was signed. (For a summing up of its details see PANAMA, REPUBLIC OF.) This treaty was ratified in Panama 2 Dec. 1903, and 7 December was submitted to the U. S. Senate for ratification.

Consult: Map with "Profile of the Panama Canal;" ISTHMIAN CANALS; and under CANALS, illustration "Comparison of the Panama and Nicaragua Canal Routes."

**Panama Congress**, a congress of representatives of various American nations held at

Panama June 1826, for the discussion of matters of interest to the American peoples. The meeting was originally intended only for South and Central American delegates, but the ministers of Mexico, Colombia, and Guatemala at Washington formally invited the United States to be represented. After some friction in Congress two delegates were appointed, but at the congress 22 June 1826 the American delegates were not present, one having died en route and the other having been delayed in transit. Chile and Brazil approved of the congress but did not send delegates. The congress held 10 sessions, and among other results agreed to a perpetual union for defense against Spain.

**Panama Hats.** See HATS AND HAT MAKING.

**Panathenæ'a**, Greek festivals, celebrated at Athens in honor of Athena. The Panathenæa were distinguished into the greater and the less, in both of which three kinds of games were exhibited, conducted by 10 presidents. On the first day were races with torches in the Ceramicus; on the second, gymnastic exercises, and imitations of naval fights; on the third, contests of music and declamation, and dramatic representations. An olive crown from the groves of Academus and a vessel full of sacred oil were the rewards of the victor. Then followed the sacrifices and the sacrificial feasts.

**Panay**, pā-nī', Philippines, the most northwestern island of the Visayan group, lying a little to the southeast of the centre of the archipelago, bounded on the east by Iloilo Strait, and on the west by Mindoro Sea; area 4,752 square miles, with dependent islands 5,103 square miles. The largest of the dependent islands is Guimará (243 square miles), lying to the southeast of Panay.

*Topography.*—The shape of the island is roughly triangular. A mountain range extends from the peninsula of Buruanga in the northwest to the extreme south, and from Maymagui Mountain, in the centre of this range, another mountain system extends to the east and north. The island is thus naturally divided into three provinces. There are three large rivers, the Panay, Jalaur, and Aclán, and numerous smaller streams. The coast on the east and north is well indented with bays and harbors, 15 of which afford safe anchorage for vessels of all sizes; the best harbor is at Iloilo.

*Industrial Resources.*—The chief industry of Panay is agriculture; cotton, corn, chocolate, pepper, coffee, tobacco, sugar, rice, and copra are raised; the last three are the staple crops, and of excellent quality. The maximum shipment of sugar was in 1892, amounting to 177,467 tons; in 1899, during the insurrection, the amount of sugar shipped was 77,641 tons, and of copra 636 tons. There are also large numbers of live stock raised, cattle, carabaos, and horses, excellent grazing lands being found in all parts of the island. The horses raised in the province of Iloilo are very highly prized throughout the archipelago. The forests are valuable; among the more important woods are molane, ebony, and sibucan, large quantities of which are exported; honey, wax, and pitch are also gathered in considerable quantities. The mineral resources have not been scientifically developed; gold is found and is mined in small quantities; and fine marbles and tonalite are quarried to



## PANAY — PANCREAS

some extent; there are deposits of gypsum, marl, and iron; quicksilver and copper are also reported. The mechanical industries are well advanced and produce for export; fine fabrics of pineapple fibre, jusi, sinamay, and cotton are manufactured; also sugar sacks, hats, and palm-leaf baskets; the woven fabrics of the province of Antique are especially well known, the looms giving employment to over 12,000 women; lime of good quality is manufactured in Iloílo. The fisheries are also valuable, particularly those of the island of Guimarás. Within the three provinces there are excellent road systems; but as the mountains are almost impassable the trade between provinces is entirely by sea; there is also a large foreign trade, the town of Iloílo being next to Manila in commercial importance.

*People and History.*—The people of Panay are almost entirely of Visayan race; a few thousand wild Mundos and a few Negritos live in the mountains. This island was a stronghold of the Filipino insurrection; it was first occupied by United States troops in the early part of 1899, when a base of operations was established at Iloílo; the enemy's force in that province was dispersed and order established. Cápiz was occupied in the same year, and San José de Buenavista, the capital of Antique, was taken in 1900; but the American advance was vigorously resisted, and the island was not completely pacified until January 1901. Civil government was established under military control, and public schools put in operation as soon as possible, until the permanent government was organized under the provincial government act of the Philippine Commission in April 1901. The island was divided into three provinces (in accordance with the natural divisions), Antique, Cápiz, and Iloílo; the former Spanish commandancia of Concepcion was consolidated with Iloílo. Pop. 801,900.

**Panay**, Philippines, a pueblo of the province of Cápiz, island of Panay, situated a few miles inland from the northern coast, three miles southeast of Cápiz, the provincial capital. Pop. 15,500.

**Panay River**, a river of the province of Cápiz, island of Panay; rises on the eastern slopes of the Tapas Mountains, flows north, and empties into the sea near the town of Cápiz; length, 38 miles. It is one of the most important rivers of the island of Panay, has five chief tributaries, and drains the greater portion of the province of Cápiz. It has a high-tide depth of 13 feet at its mouth, and is navigable for large native craft for a considerable distance.

**Panchatantra**, pān-cha-tān'tra, an old collection of apologues and stories in Sanskrit. Vishnuserman is represented as the narrator of the stories and author of the book. The Panchatantra has been frequently revised. Wilson had three widely varying manuscripts before him while he drew up his analysis of the work. Kosegarten, who first edited the Sanskrit text, used 11 varying manuscripts. In these he recognized two versions, one simple, the other more extended and elaborated. Neither of these can be the first form of the work, which must have been a still more ancient text.

Some of the apologues contained in the Panchatantra occur in the Mahabharata, others originate in Buddhist books, and several abridgments or imitations occur elsewhere in the Sanskrit.

The 'Panchatantra' is one of the works styled in India as 'Nitishastras' (*shastra*, "book of knowledge," and *niti*, "conduct"), written for the instruction of kings and all those called to take a share in the government. The five books of which it is made up form as many distinct sections related to each other by a preface in which a king, after taking the advice of his councillors, entrusts to a Brahman the training of his three sons. The Brahman composes the Panchatantra for the edification of the young princes, and by the reading of that work he succeeds in overcoming their idleness and in developing their minds.

The first book has for its title 'Mitrabheda' ('The Disunion of Friends'). It aims at acquainting kings with the danger incurred by lending ear to the insinuations of those who seek to sow divisions between a prince and his faithful subjects. The second book 'Mitraprapti' ('The Acquisition of Friends') shows how advantageous it is for men to unite and help each other. The third book, 'Kakolukiya' ('The War of the Crows and the Owls') demonstrates the danger of trusting to untried men or to enemies. The fourth, 'Labdhapranasana' ('The Loss of Acquired Good') proves that we frequently lose by imprudence what we had acquired with difficulty. The fifth and last book, 'Aparikshitakarakā' ('Inconsiderate Conduct'), shows the danger of being precipitate. The narrative is interspersed with sentences, maxims, thoughts, extracts from legal codes, poems, and dramas.

Consult: Kosegarten, 'Panchatantrum' (1848-59); Lancereau, 'Pantchatantra,' French version (1871); Schmidt, 'Pancatantra, Textus Ornatio,' German version (1901).

**Pan'coast**, Henry Spackman, American educator: b. Germantown, Pa., 24 Aug. 1858. He was educated at the Germantown Academy, studied law, and was admitted to the bar in 1882, but retired from practice in 1887 to devote himself to teaching. He has published 'Representative English Literature' (1892); 'Introduction to English Literature' (1895); 'Introduction to American Literature' (1898).

**Pan'cras**, Saint, or **Pancratius** ("Victor in every game") a Christian martyr, who at the age of 14 defied the decree against Christianity issued by Diocletian and was accordingly put to death (304). There are many churches dedicated to him in England, Italy, France, and Spain, and his festival is celebrated on the anniversary of his death (12 May).

**Pan'creas**, a lobulated racemose gland situated behind the stomach, lying in a nearly straight manner across the spinal column, at the level of the first lumbar vertebra or that of the loins. The head and broader portion or right extremity lies with a loop or curve formed by the duodenum or first portion of the intestinal tract (see **INTESTINE**); while the tail or narrower part or left extremity, is in apposition with the spleen. In man the pancreas is about eight inches long, in thickness it may vary from a half inch to an inch or more; its average breadth being about 1½ inch. Its weight is usually three ounces or over. The splenic vein and splenic artery pass along its upper border, while the lower border rests upon the transverse portion of the duodenum. Behind, the pancreas is in contact with the vena cava inferior, with the



## PANCREATIN — PANDECTS

kidney of the left side and its supra-renal capsule, and with the portal vein at its commencement. The duct or excretory tube of the pancreas passes from the right to the left of the structure in the front, and at the lower or inferior edge of the gland.

The diseases of the pancreas are few, and do not betray their presence by any very marked symptoms. The most common form of disease is cancerous deposit in the head of the gland, which frequently induces jaundice by obstructing the common biliary duct near its opening. An accurate diagnosis of disease of this organ is extremely difficult, and cannot lead to efficient treatment; all that can be done in these cases being to palliate the most distressing symptoms. The pancreas of ruminating animals is a favorite article of food under the name of sweetbread. See ANATOMY, COMPARATIVE; DIGESTION.

In bears, dogs, and many other *Mammalia* the pancreas exhibits a structure more complicated than that found in man. In rodents, in the hedgehog and flying fox, etc., it exhibits a branched or arborescent structure. In the horse and pig it is trilobular. In the ox it is invariably and in man sometimes double. In birds the sweetbread is narrow and elongated, lies within the duodenal loop, and possess usually two ducts. The pancreas of reptiles and amphibia presents no features worthy of special remark. In certain fishes a pancreas exists, but its place in the generality of fishes appears to be filled by a greater or less number of cæcal appendages (the pyloric cæca), which are attached to the pyloric or hinder aspects of the stomach. In the sword-fish these cæca become aggregated together so as to form a pancreatic-like structure. In the lancelet no pancreas or homologous organ exists. In *Invertebrata* certain organs connected with the digestive system have had a pancreatic function assigned them. In gasteropodous mollusks it makes its first definite structural appearance as a long glandular sac.

**Pancreatin**, a substance secreted by the pancreas, and often administered, in medicine, for the correction of certain digestive disorders. The commercial supply that is used in medicine is mostly obtained from the pancreas of the hog, and is best known in the form of a grayish, amorphous powder, usually with a tinge of yellow, and with a faint, characteristic smell. Pancreatin is not a definite chemical substance, but contains several distinct ferments. Its composition varies, moreover, with the source from which the substance is prepared, and with the state of activity of the particular pancreas from which it is extracted. One of its normal components, steapsin, is an exceedingly powerful agent for effecting the emulsification of fats, and it is even able to partially separate them into free glycerin and free fatty acids. Another constituent, trypsin, converts coagulated albuminous substances into soluble peptones, resembling pepsin in this respect, although its action is somewhat different. Pancreatin, for example, is effective only in an alkaline medium, while in the case of pepsin the medium must be acid. Another constituent, amylopsin, converts starches and other amylaceous substances into sugars; and a fourth ferment that is present possesses the power of coagulating the casein of milk.

**Pan'da**, or **Wah**, an animal (*Ælurus fulgens*) of the raccoon family, which inhabits the

eastern Himalayas to a height of about 12,000 feet. It is equal in size to a large cat, and has remarkably glossy reddish-chestnut fur, darker below, with a white face and a long ringed tail. It seems to be the remnant of a once very widespread group which in the early Tertiary Period was numerous in Europe, explaining the present curious distribution of the family, for all other existing raccoons are American. The animal is described as inhabiting forests and feeding almost entirely on vegetable food; but it eats eggs and insects when it can get them. Most of its time is spent upon the ground, but it has semi-retractile claws and is able to climb trees. It is said to be rather a dull-witted, defenseless creature, reminding one of the kinkajou. Consult: Flower and Lydekker, 'Mammalia' (1891); Blanford, 'Fauna of British India: Mammals' (1888).

**Pandan**, pän-dän', Philippines, a pueblo of the province of Antique, island of Panay; on the west coast near the Bugang River; 66 miles north of San José de Buena Vista. It is on the coast road, and has a good anchorage ground. Pop. 13,800.

There is a small pueblo of the same name (pop. 2,143) on the north coast of Catanduanes Island, near Albay, Luzon.

**Panda'nus**. See SCREW-PINE.

**Pandarus**, pän'da-rüs, Trojan hero, son of Lycaon. He was given by Apollo a bow with which he became famous as an archer. In the war between the Greeks and Trojans he broke the truce, and after wounding Menelaus and Diomedes was slain by the latter. He also appears in Shakespeare's 'Troilus and Cressida' as a procurer, whence the English word "pander."

**Pandavas**, pän'da-vaz. See MAHÁBHÁRATA.

**Pan'dects**, **The**, the most important compilation of the Roman law, prepared by several scholars at the order of the Emperor Justinian (q.v.). It is also called 'The Digest.' It was an attempt to form a complete system of law from the commentaries of the great jurists. The work was done by a committee of the jurist Tribonianus and 16 others learned in law; it was begun in 530 A.D. and completed in 533. The magnitude of the task becomes apparent from the fact that about 2,000 various treatises were consulted, and from these about 9,000 extracts appear. One third of them comes from Ulpian, one sixth from Paulus, one twelfth from Papinianus, and the rest from 36 other writers. The Pandects, with the Codex Justinianus, became the law for the Roman empire. When the Lombards invaded Italy in 568, they overturned almost all the few remaining Roman institutions, the law courts among them. In Ravenna, however, the Roman law was still taught; and the Lombards allowed their Roman subjects to be judged according to the Roman law. The Codex, which begins with an invocation to the Trinity, and contains a great deal of legislation on ecclesiastical matters, was held in esteem by the clergy; but the Pandects were at first ignored, as being the work of pagan jurists. In the last part of the 11th century, however, there was a great revival of the study of Roman law. Irnerius of Bologna, the greatest teacher of his time, renewed the study of the Pandects, which, together with the Codex, became the basis of all



## PANDORA — PANGO-PANGO

mediæval legislation. The Pandects may justly be considered the most famous collection of law ever made. In both its central idea of codification and its content and phraseology it has profoundly influenced subsequent legislation, including that of New England and the United States.

**Pando'ra**, in Greek mythology, the first woman; so called because she received gifts from all the Olympians. She was the creature of Prometheus, and the gods came down to see her, and conferred their gifts on her. Athena instructed her in all works of female skill. Aphrodite endowed her with beauty and fascination. Hermes inspired her with a desire of pleasing, and taught insinuating words. Athena carried her thus equipped into the assembly of the gods, and all admired the work. She became the wife of Epimetheus, a mortal, brother of Prometheus, and brought sorrow into the world by opening, in her curiosity, a box containing the blessings of life; all these escaped, save Hope. This is clearly a late and philosophic addition to the myth.

**Pandours**, păn'doorz, or **Pandoors**, the name formerly given to the Servian or Raitzian foot-soldiers coming from the village of Pandur, in the county of Sol, in Lower Hungary. They were at first irregular troops. In 1750 they were made regular troops.

**Pan'el**, (1) in law, a schedule, or roll of such jurors as the sheriff returns to pass upon any trial; and impaneling a jury is returning their names in such schedule of parchment. In Scottish law the prisoner at the bar is the panel. (2) In carpentry, a tympanum or square piece of thin wood, sometimes carved, framed, or grooved in a larger piece, or between two upright pieces and two cross pieces. (3) In masonry, a face of hewn stone. (4) In bookbinding, a depressed part of the sides within a relatively elevated bordering portion; or a space on the back between bands. (5) In mining, a system of coal mining in which the projected winning is divided into large, square allotments, divided by massive walls of coal, instead of placing the whole working in one undivided arrangement. The pillars are left very large, the rooms small; the pillars are worked out, props being substituted; these are knocked out, and the goaf filled up by the caving down of the ceiling. (6) In painting, a piece of wood—oak, chestnut, or white poplar—on which, instead of canvas, a picture is painted. The earliest paintings in oil were generally executed on panels, which were composed of various pieces of wood, cemented together with cheese glue; and this glue, or cement, caused each portion to adhere so firmly that such panels were considered stronger than those which consisted of one piece of wood only.

**Pangasinán**, păn-gă-sē-năn', Philippines, a province of the Island of Luzon, in the western central part of Northern Luzon at the head of the Gulf of Lingayen; length, east and west, 56 miles; width, 33 miles; area, 1,316 square miles. The province is mountainous in the northeast, and also near the western boundary; the rest of the surface is flat, sloping toward the sea, and near the coast is very low and frequently inundated by the rivers. There are numerous rivers, of which the Agno is largest and most important. The staple crop is rice, though this is often injured by floods; sugar, corn, tobacco, and co-

conut are also abundantly cultivated; the nipa palm grows luxuriantly. There are abundant deposits of salt, and also gold, copper, iron, magnetite, and sulphur. The important industries besides agriculture include the making of nipa wine, the weaving of burí, and manufacture of mats, hats, and sacks, and boat building. The Gulf of Lingayen affords excellent commercial facilities; the commerce is carried on almost wholly by the Chinese. Many of the rivers are navigable for some distance; well constructed roads extend all over the province, and the Manila & Dagupan Railroad also crosses the province. Pop. 302,178, mostly Pangasináns.

**Pangasináns**, a group of tribes of the Philippine Islands inhabiting the province of Pangasinán, Luzon and some localities in the province of Zambales, Nueva Ecija, and Benguet. They are of the Malay race, and at the time of the arrival of the Spaniards had a civilization and written language of their own. Their language is now generally spoken in the province of Pangasinán. They are Christians.

**Pangen'esis**, a theory advanced by Darwin to account for the phenomenon of heredity, and especially to explain the (alleged) inheritance of acquired characters (effects of use and disuse of parts) which formed the basis of the theory of evolution of Lamarck. (See LAMARCKISM.) The problem was to form a hypothesis by which changes in any part of the body could so affect the germ-cells that the parental peculiarities should re-appear in succeeding generations. Darwin supposed that every cell of the body gives off at every stage of its existence minute particles, or gemmules, which when furnished with proper nutriment will give rise to parts similar to those from which they were derived. These gemmules are collected from every part of the body to form the sexual elements, and their development in the next generation forms a new being. To explain the fact that characters may skip a generation he assumed that the gemmules may lie dormant for a time. This theory was weak in that it assumed the existence of particles of which we have no other evidence, and it was shortly disproved by Galton. If these gemmules are constantly given off they must be carried by the blood and hence if introduced into another animal they must effect the progeny. Galton introduced into the blood of silver-gray rabbits the blood of rabbits of other colors, in some cases to the extent of half the blood, but the offspring invariably showed no trace of change of color. Brooks in his 'Heredity' (1883) modified the theory so as to avoid Galton's experiment, but the theory has been dropped in later years, and has only a historic interest. Consult: Darwin, 'Variation of Animals and Plants under Domestication' (1868), and the authorities mentioned under HEREDITY.

**Pango-Pango**, păng'gō-păng'gō, or **Pago-Pago**, a harbor on the south coast of the island Tutuila, Samoa. It is L-shaped, with the greatest length (17 miles) from east to west. It is land-locked and in every way one of the finest harbors in the Pacific. It was ceded to the United States as a naval and coaling station in 1872, and the cession was confirmed by a treaty signed in 1878, by which the United States was given the right to establish at the



## PANGOLIN — PANJANDRUM

harbor a station for coaling, naval supplies, freedom of trade, commercial treatment as a favored nation, and extra-territorial consular jurisdiction. It was occupied by the United States in 1898, with the purpose of utilizing its advantages as a coaling and supply station; and by the agreement of 1899, the island of Tutuila came into the possession of the United States. See SAMOAN ISLANDS.

**Pan'golin**, or **Scaly Ant-eater**. See MANIS.

**Pangutarang**, päng-oo-tä'räng, a group of islands of the Sulu Archipelago, lying in the Sulu Sea, northwest of the island of Sulu and west of Mindanao. The group includes 13 islands of which the two largest are Pangutarang, 44 square miles, and Panducan, 14 square miles; the area of the whole group is 72½ square miles. The islands are moderately high, and are very heavily wooded. The chief industries are fishing, and agriculture which is carried on in the rudest and most primitive manner. The island of Pangutarang is low and level; it is thickly populated and carries on a considerable trade with Sulu.

**Pan'han'dle, The**, a long, narrow strip of land, resembling the handle of a pan, generally projecting from a State or Territory, as the Panhandle of West Virginia, or the Panhandle of Idaho. There is also a well-known projection in Texas called the Panhandle.

**Panic**, in finance and commerce, a word denoting insecurity and danger to money values and credits. When a panic occurs the banks are besieged by depositors, money is hoarded and general financial distrust ensues. The word is also applied to sudden displays of terror and alarm at public gatherings, theatres, etc., as in case of fire. The most noted financial panics since 1750 were as follows:

- 1763 Amsterdam. Heavy failures in Holland, England, and Hamburg.
- 1773 Holland. Failures exceed \$50,000,000.
- 1793 England, owing to French war. Government issued \$25,000,000 Exchequer bills.
- 1799 England. Panic at Liverpool. Government lent \$2,500,000 in Exchequer bills on goods. Eighty-two failures at Hamburg.
- 1814 England. 240 banks stopped payment.
- 1825-1826 England. 770 banks stopped payment owing to failure of South Sea bubble companies. Owing to the distress occasioned by the consequences of this panic, families in Yorkshire were reduced in 1829 to live on bran. From the same cause about 200,000 families emigrated to the Continent, America, etc., in four years.
- 1831 Calcutta. Failures, \$75,000,000.
- 1837 United States. "Wild Cat" crisis.
- 1847 England. Owing to excessive railway speculation. Failures, \$100,000,000. Discount rate, 13 per cent.
- 1857 United States. Failures \$555,000,000. Minor crisis in England.
- 1866 London. Owing to over-speculation. Total failures, above \$500,000,000. The last of the serious panics.
- 1873 United States. Heavy failures in New York and elsewhere.
- 1884 Grant & Ward and Marine Bank failures.
- 1885 London. Much temporary disturbance owing to expected Russian war.
- 1890 London. Baring crisis. Liabilities guaranteed by English banks.
- 1892 Financial crash in Australia.
- 1893 United States. The silver crisis, also by some attributed to fear of changes in tariff by the Democratic party.

See also BANKS AND BANKING; FINANCE.

**Panicum**, an important genus of grasses, the millets. See GRASSES OF THE UNITED STATES.

**Panini**, pä'nī-nī, Indian philologist: b. Salatura (near modern Attock), Punjab, 4th century B.C.; probably the oldest writer on grammar whose works are extant, although he quotes the names of 64 predecessors. He is reckoned among the sages of the Puranas. Nothing is known of his life. His grammar is in eight books, divided into chapters, and containing 3,996 rules or sutras. Its method is wholly different from that of European grammarians. The separate chapters treat the various phenomena of language as they appear in all the various forms of speech; hence the work is strictly a philosophical treatise, requiring to be studied as a whole, and not conveying sectional information in a form classified for reference according to the European model. His style is condensed, obscure, and difficult to the Western student. He is the first who has classified the philological principles of grammar, as distinguished from the mere forms or parts of speech. He did not treat of syntax, and inflections are not formally given, but must be obtained by a collation of separate rules. The grammar of Panini has been often annotated. Its chief critic is Patanjali (q.v.). The chief edition of Panini is by Bothlingk (1887), and that of Patanjali's 'Great Commentary' by Kielhorn (1878-85).

**Panipat**, pän-i-püt', or **Paniput**, India, town in the district of Karnal, Panjab, about 52 miles north of Delhi, on the Grand Trunk and the East I. R.R.'s. It is a strategic centre; and was the scene of the negotiations of Duryodhana and Yudishthira at the beginning of the 12th century B.C., of the Mogul victory of Baber over Ibrahim Lodi, which established the Mogul power in north India in 1526, of Akbar's victory over the Afghans in 1556, which reassured the existence of the Mogul empire, and of the Afghan victory of 1761 over the Mahrattas, which prepared the way for English rule. It exports a coarse sugar. Pop. (1901) 26,914.

**Panitan**, pä-nē'tän, Philippines, a pueblo of the province of Cápiz, island of Panay; on the Malinannang River, seven miles south of Cápiz, the provincial capital. Pop. 10,020.

**Panizzi**, pä-nēt'sē, Sir **Anthony**, English librarian: b. Brescello, Modena, 16 Sept. 1797; d. London 8 April 1879. He was educated at Reggio and the University of Parma. Having taken part in revolutionary movements, he went to England in 1822, and became professor in Italian in University College in 1828. In 1837 he was appointed keeper of printed books in the British Museum, succeeding to the principal librarianship in 1856. He contributed very largely both to the increase of the number of books and to the cataloguing and general arrangement of the library and designed the vast reading-room and its annexes. He edited Boiardo's 'Orlando Innamorato'; Ariosto's 'Orlando Furioso'; and Lord Vernon's reprint of Dante's 'Divine Comedy' (1858). Consult Fagan, 'Life of Panizzi.'

**Panjab**, pün-jäb', **Punjab**, or **Punjaub**. See PUNJAB.

**Panjan'drum**, the name applied to an imaginary personage of power and influence; a burlesque monarch or Great Mogul. The word was originally coined by Samuel Foote in a long string of rigmarole as a test for Macklin who boasted of his memory. It is also called the Grand Panjandrum.



## PANJNAD — PANSLAVISM

**Panjnad.** See PUNJNUD.

**Panmix'ia**, in the theory of organic evolution, the cessation of the operation of natural selection. The process of the survival of the fittest, says Parker, has a reverse side, which has been termed the elimination of the unfit. Of the varieties that appear, some are less completely adapted to their surroundings than the majority, and these (the conditions remaining the same) tend to become destroyed owing to their unfitness to cope with their environment. The result of this process of elimination (apart altogether from the selection of progressive variations by which evolution, according to the theory, proceeds) is to keep up a certain standard of efficiency in the organs of the members of the species. Under certain conditions this *sustaining* influence, as we may term it, of natural selection may be suspended; the organism may be placed under conditions in which natural selection acts with reduced effect or does not act at all. There is, under such circumstances, no "elimination of the unfit"; and, as a result, fit and unfit survive indiscriminately, inter-breed, and produce offspring, the ultimate outcome in the course of generations being a gradual deterioration in the whole race.

This suspension of the influence of natural selection or *panmixia*, acts more commonly on single organs than on the entire organism. Thus, if, owing to some change in surrounding conditions, an organ is no longer kept up to the previous degree of efficiency by the elimination of the individuals in which the organ in question is imperfectly developed, and, as these cross with one another, offspring is produced in which the organ is below the efficient standard; and by a continuance of this process through a series of generations, it is supposed that the organ gradually dwindles in size, and may altogether disappear. The cetaceans furnish good examples of the process. Consult Parker and Haswell, 'Text-book of Zoölogy' (1897).

**Pannonia**, pa-nō'nī-a, in ancient geography, a Roman province on the Danube, including what is now western Hungary, Slavonia and Bosnia, eastern Austria and Styria. Neither of the origin of the name nor of the inhabitants, the Pannonians, is anything certain known, but the people may have been of Illyrian stock with an admixture of Celtic due to a Celtic invasion in the 4th century B.C. They were conquered by the Dacians about 50 B.C. Octavian defeated them in 35-34 B.C., but they rose a generation later and Pannonia was finally conquered in 9 A.D., but not occupied save on the frontier until 102-107 A.D., by Trajan. The principal cities planted by the Romans were Vindobona (Vienna), Carnuntum (near Deutsch-Altenburg), Savaria (Szvombathely), Arrabona (Raab), Siscia (Sissek), Poetovio (Pettau), Aquincum (Altofen), and Sirmium (Mitrovitza). Trajan divided the province into a lower and an upper Pannonia. In the beginning of the 5th century Valentinian III. of the Western empire ceded Pannonia to Theodosius II. of Byzantium, who surrendered it to the Huns. It was occupied by the Ostrogoths about 450 A.D., by Theodoric of Italy in 488, by the Lombards in 527, and by the Avars in 568. Then came the influx of the Slavs. Consult Jung, 'Römer und Romanen in den Donauländern' (1887).

**Pano** (pä'nō) **Indians**, a South American tribe living along the banks of the Ucayali and Huallaga rivers in Peru. They were formerly very numerous but now number less than 2,000. During the 17th century the missionaries persuaded many of them to gather in the mission villages. They were of a rather low grade, but understood hieroglyphic writing on bark. When the missions were broken up, in 1767, most of the Panos returned to their savage life, forming numerous small tribes. They have always been friendly to the whites. They are expert boatmen and build canoes some of which are 40 feet in length.

**Pano'an Indians**, a South American family comprising upward of 20 tribes and occupying the forest regions of Peru, Bolivia and Brazil. Among the better known tribes are Cashibo, Conibo, Mayoruna, Pano, Remo and Setebo. They are a savage race in all that the name implies and several of the tribes practise cannibalism. They have steadily decreased in number during recent years.

**Panora'ma**, a picture representing a wide or general view, as of a large tract of country, so exhibited a part at a time by being unrolled and made to pass continuously before the spectator. It was invented in England in 1787 by Robert Barker. See also CYCLOPAMA.

**Panpipe**, an ancient wind instrument, undoubtedly the precursor of the organ (q.v.). It was formed of seven, eight, or nine short hollow reeds, fixed together by wax, and cut in graduated lengths so as to produce a musical scale. The lower ends of the reeds were closed, and the upper open and on a level so that the mouth could easily pass from one pipe to another.

**Panslav'ism**, a general name for the efforts of the Slavonic races in Europe for a unity of civilization and literature. An anonymous work, the European Pentarchy (1839), and the writings of A. Gurovski, made a considerable impression in favor of a union under Russia; while later events favored the Austrian headship; but none of these projects ever possessed a reasonable chance of realization. The mere fact that the Slavonic race comprises nations so bitterly hostile as Russia and Poland, not to speak of geographical and political difficulties, and of such diversities of religious creed as are contained within the range of Christianity and Mohammedanism, made any attempt to unite the scattered elements of such a race in a voluntary political union impracticable. For similar reasons little more real progress has been made with the attempt to promote a literary union.

The most important effort put forth toward the realization of a political union of the Slavs was in 1848, when, stimulated by the rival efforts at union of the German nations, and especially by the summons to Bohemia to send her full contingent to the German parliament, the Slavonic clubs summoned a congress of all the Slavs in the Austrian Empire, with a view to confer on the constitution of the empire. The congress met at Prague on 2 June. The various nations represented were classified in three departments: the first, consisting of the Bohemians, Moravians, Silesians, and Slovaks or Western Slavs; the Poles and Ruthenians forming the Eastern Slavonians; the Slovenians, Croats, Servians, and Dalmatians the southern



## PANSY — PANTHEISM

division. Each of these divisions chose 16 members, who formed a committee, with Palacky at their head, who drew up a plan of confederation and alliance among the various nationalities of the empire. The proceedings of the congress, however, which had to be conducted in German, as the only common means of communication, could not be brought to a formal conclusion, and the congress was interrupted by a Slavonic insurrection, which proved futile. Since 1866 renewed but unavailing efforts have been made by the scattered Slavonians of Austria to form a union among themselves, in order to counterbalance the preponderance of the German and Magyar races.

**Pansy**, an annual or imperfectly perennial herb (*Viola tricolor*) of the order *Violaceæ*. It is a native of Europe where it has been in cultivation for at least 400 years, and whence it has been taken to all cool temperate climates of the civilized world. The plant, which is rarely more than six inches tall, bears long-petioled, heart-shaped leaves, and large irregular flowers which slightly resemble the human face. Its name is a corruption of the French, *pensée*, thought, and its old folk-name, "heart's-ease," signifies remembrance, a double reason for its popularity. Few flowers show the effects of care in selection more than the pansy. Naturally the blossoms are borne upon rather short stalks and are less than a third the size of improved varieties, which often attain a diameter of three inches. In dry climates fresh seed must be imported annually, since home-grown seed even of improved strains is apt to produce flowers inferior to the imported, each year emphasizing the deterioration. The cultivated pansies are grouped in strains rather than as individual varieties, and as a rule exhibit mixtures of blue, white, and yellow, although some kinds are all of one color. Pansies thrive best upon rather heavy loams well drained and well supplied with plant food and humus. In the United States and other countries where the air becomes very dry during the summer, the plants generally fail during the hot months, even when planted in shady places, the most favorable situations. Hence, in such climates the seed is usually sown in cold frames during August or September, kept cool and moist by a rather thick mulch of loose straw until the plants appear, and then these are protected from drying winds. Being tolerably hardy the plants can be left in the frames during winter, previously having been transplanted from the seed-bed so as to stand about two inches apart. In the spring they may be allowed to blossom where they stand or may be transplanted to garden beds as soon as the ground can be worked. After flowering in these beds for a month or six weeks they should be replaced by geraniums or other heat-loving plants.

**Pan'theism** (Greek, *pan*, all, and *theos*, god), in philosophy, the doctrine of the identity of God and the material world. The doctrine stands midway between atheism and dogmatic theism. There are only three ways in which the philosopher can deal with the idea of the existence of God, that is, of a being who is the cause or original sum of all being. He may deny his existence altogether, or may infer psychologically that there is a God, and proceed to the inference that he is the first cause of all things, but leave unexplained the nature of the

relation between God as cause and other existences as effects. Finally, he may proceed to reason back from the effect to the cause, and show a necessary connection between them. The last process is the source and explanation of pantheism. The origin of the idea of a God with the theist and the pantheist is the same. It is by reasoning upon ourselves and the surrounding objects of which we are cognizant that we come to infer the existence of some Superior Being upon whom they all depend, from whom they proceed, or in whom they subsist. Pantheism assumed the identity of cause and effect, and the consequent adequacy of each effect, rightly interpreted, to indicate its cause. Matter, not less than mind, is with it the necessary emanation of the deity. The unity of the universe is a unity which embraces all existing variety, as proceeding from it in a way necessarily explicable by the result. Hence each existing thing contains all the explanation of its own existence which it is capable of receiving.

The earliest school of Greek philosophy, the Ionian, in as far as it admitted any theism, was essentially pantheistic; and to the same school of pantheism belong Epicurus and Lucretius in ancient, and Giordano Bruno in modern times. The atomic theory, or the origination of all things in conscious atoms, is the culminating theory of this school. The Sankhya of Kapila, one of the most celebrated Indian systems of philosophy, in which probably originated the Buddhist religion, was the chief representative of pantheistic tendencies in the East. Kapila enumerates 25 first principles of things: of which the first (*mulaprakriti*) is matter; the second (*buddhi*), intelligence; the third (*ahankara*), self-consciousness. Speusippus, the sister's son and successor in the Academy of Plato, might be called an ultra-pantheist. He taught, what may possibly be considered the true logical culmination of the doctrine, that the Divine or Best is first indeed in rank, but is chronologically the last product of development. He defined happiness as the habit of conformity to nature. The soul, according to him, was a higher union of the arithmetical and the geometrical, or extension harmoniously shaped by number. The Stoics, differing widely from the school of Epicurus, may also be numbered among the adherents of pantheism. Their doctrine was that whatever is real is material. The universe as a whole possesses consciousness, and this consciousness is deity. The world undergoes a constant evolution, the elements of water, earth, and air being evolved out of fire, which again absorbs them, and the process recommences in an eternal cycle. The human soul and the deity, which are one in nature, act and react on each other. Intelligence, whether in man or the deity, they considered as consisting chiefly in force. Perhaps there is nothing which seems more opposed to pantheism than the mysticism of the Alexandrian school, and particularly of Plotinus, which makes of God so pure an abstraction that even thought, without being separated from individuality, cannot attain to it. Yet from the bosom of this school a prolific source of pantheism has arisen. Dionysius, the pseudo-Areopagite, a Christian philosopher of the Neoplatonic school, introduced it among his speculations, in which the particular is derived by a series of gradations, as genus and species, from the universal. John Scotus Erigena, the founder



## PANTHEON—PANYASIS

of the scholastic philosophy of the Middle Ages, gave this speculation a realistic turn, making God the essence of the world, and the universal, the genus, the species, and the individual so many particular developments which actually succeed each other. Eckhart, a German philosopher of the beginning of the 14th century, also a disciple of Dionysius, and often regarded as the father of German philosophy, taught some views which were developed in a pantheistic direction by some of his followers. Eckhart held that the works of creation were eternally in God in idea or conception; this was developed into a pantheistic doctrine of the eternal existence of ideas or types of all things. Giordano Bruno, like Epicurus and Lucretius, taught that monads are the elements of all existing things. God is the imminent cause of the universe. Power, wisdom, and love are his attributes; but he is the monad of monads, the minimum because all things are external to him; the maximum because all things are in him. He produces the worlds freely, but by an inner necessity of his nature. The worlds are nature realized; God is nature working. Stars are moved by the souls that reside in them. God is in all things, as being in things that exist, or beauty in objects that are beautiful.

No modern pantheist has acquired a greater renown than Spinoza, probably because none has developed his doctrines into a system so comprehensive, or with a logic so rigorous. A disciple of Descartes, he founds upon that master's definition of cause a system in which he develops the relation of God to the universe in a series of propositions, graduated like a succession of consequential demonstrations in mathematics. According to Spinoza the essence of God is existence, and he has two fundamental attributes, extension and thought. All things which exist are modes of God's attributes. Their existence is necessary, and all changes which take place in them, whether affecting intelligent or non-intelligent beings, are necessary. God alone is free, and he is free because he acts by an inner necessity, and is not controlled by any other being. It may be added that Spinoza combats the apparent inference from his doctrine, that the sum of things which exist is God. Things are diverse, complex, and limited, while God is one, simple, and infinite. They are not God, but only the necessary modes of his attributes. Among modern pantheists a place is also due to Leibnitz. According to him all souls are monads, or atoms containing active powers consisting in ideas. God is the primitive monad; all other monads are its fulgurations. Bodies, as plants and minerals, are aggregations of sleeping monads with unconscious ideas. The relations of the monads are purely mechanical, and their co-operation is determined by the theory of pre-established harmony. (See MIND, HUMAN.) Diderot recognized God in natural law, truth, beauty, and goodness; for Leibnitz's monads he put atoms, and gave them sense in place of ideas, which became thought in organized beings. Finally, the modern doctrine of evolution, when it assumes a transcendental form, and carries speculation as to the origin of things beyond the range of inferences founded on the observation of nature, is necessarily pantheistic.

**Pan'theon**, anciently a name applied to a temple or shrine dedicated to the gods. The

most historical pantheon is that erected in Rome by Agrippa about 25 B.C. and dedicated by him as a temple to all the gods. For 13 centuries it served as a Christian church, having been dedicated by Boniface IV. about the year 607. It is 188 feet in circumference and is covered by a dome 142 feet in span. The entire height is 141 feet. Raphael and Victor Emmanuel II. are buried in the Pantheon. Another noted structure bearing this name is the Pantheon of Paris (Church of Saint Genevieve), for a description of which see PARIS.

**Panther**, some large cat, in North America usually a cougar; in South America a jaguar; in India or Africa, a leopard.

**Panther-cat**, a name locally given to several spotted wildcats; most often, probably, to the ocelot (q.v.).

**Pan'tograph**, an instrument by the aid of which maps, plans, and designs may be copied mechanically, either on the scale on which they are drawn or on an enlarged or reduced scale. It is made in a variety of forms.

**Pan'tomime**, the name given by the Romans to an actor in a dramatic performance consisting of dance and gesture. This sort of representation appears to have been indigenous to Italy. The modern Christmas pantomime in Great Britain is a spectacular play of a burlesque character, founded on some popular fable, and interspersed with singing and dancing, followed by a harlequinade, the chief characters in which are the harlequin, pantaloon, columbine, and clown.

**Pantop'oda**, or **Pycnogonida**, a group of marine spider-like, but hard-shelled arthropods, which is classified near the horseshoe crabs (*Limulus*). The body (*cephalothorax*) is so small and the limbs are so large that the animal, which may span two or three inches in large species, seems all legs, and a popular name along the New England coast is "no-body crab." There are four pairs of equally large many-jointed walking legs, in advance of which are two pairs modified into chelate mouth-organs, and a third pair upon which, in the breeding season, the male carries the eggs cemented to these appendages. The abdomen is represented by only a small tail-like part posterior to the legs. A metamorphosis occurs in most species, and the larva looks something like a nauplius, but is not equivalent to it. These curious creatures live from the shore-line to deep water.

**Panuco**, pā'noo-kō, (1) river of Mexico, rising in the plateau north of the City of Mexico and flowing generally northeast. It forms part of the boundary of Tamaulipas and Vera Cruz and receives the waters of several smaller streams before emptying into the Gulf of Mexico near the city of Tampico (q.v.). Its bar has been removed by elaborate engineering works and the river mouth is now a fair port. (2) A district about this river, so called by Cortez and his followers. It was partially conquered by Cortez in 1522, but in 1526 was granted to de Guzman, who was independent of Cortez.

**Panyasis**, Greek epic poet of the 5th century B.C., ranked one of the five great epic poets of Greece for his poems on Heracles and on the Ionic migration. He was born in Halicarnassus, and is thought to be the uncle of



Herodotus. His few fragments are edited by Kinkel (1877); the most important are on wine, its use and abuse.

**Paoay**, pã-ō-ī', Philippines, pueblo, province of Ilocos Norte, Luzon, three miles inland from the western coast, on a small lake; 12 miles south of Laoag. It is on the main highway. Pop. 11,850.

**Paola**, pã'ō-lä, Kan., city, county-seat of Miami County; on the Missouri P., the Missouri, K. & T., and the St. Louis & S. F. R.R.'s; about 40 miles south by west of Kansas City. It was settled in 1855 and in 1869 was chartered as a city. It is in a fertile agricultural country and in a natural gas belt. Coal deposits are in the vicinity; cultivating grain and stock-raising are prominent industries in this section. The trade is chiefly in wheat, corn, live-stock, and coal. It is the seat of the Ursuline Academy, and has public and parish schools and a free public library which contains about 6,000 volumes. Pop. (1890) 2,943; (1900) 3,144.

**Paoli**, pã'ō-lē, **Pasquale de**, Corsican patriot: b. Morosaglia, Corsica, 26 April 1725; d. near London, England, 5 Feb. 1807. He was educated at the Jesuits' College at Naples, and in 1755 was appointed captain-general by his countrymen, then struggling for their independence against Genoa. By his energetic efforts the government and military resources of the island were reformed, and he maintained a protracted and generally successful struggle with the Genoese. The latter, however, first made an agreement with France to garrison the places held by them in Corsica, and finally, in 1768, sold the island to France. After a brief struggle Paoli was obliged to yield, and fled to England. Here he remained 20 years, till the revolution of 1789, when he was recalled by the national assembly and made lieutenant-general of Corsica. Dissatisfaction with the extreme measures of the revolutionists in France soon led him to throw himself into the arms of England; in 1793 a British army was landed in Corsica, and through his influence the crown was offered to George III., in 1794. Paoli, however, did not obtain the government of the island and withdrew to England and was pensioned by the British government. His remains were removed to Corsica in 1889. Consult Arrighi, 'Histoire de Pascal Paoli' (new ed. 1891).

**Papacy**, the doctrine of the Roman Catholic Church relative to the authority of the Pope, that is, the Papacy, was officially promulgated by the Council of the Vatican in 1870. The primacy, it teaches, over the entire Church was conferred by Christ on Peter; and this primacy was one, not of mere dignity, but of full and supreme jurisdiction. This supreme authority is exercised by the Bishops of Rome "for none can doubt; and it is known to all ages, that the holy and blessed Peter, the prince and chief of the Apostles, the pillar of the faith, and foundation of the Roman Catholic Church, received the keys of the kingdom from our Lord Jesus Christ, the savior and redeemer of mankind, and lives, presides, and judges, to this day and always, in his successors, the bishops of the Holy See of Rome, which was founded by him, and consecrated by his blood." Hence, the council continues, the Roman See possesses a

superiority of ordinary power over all other sees; and this power of jurisdiction is immediate, so that to it all bishops, pastors, and the laity, both individually and collectively, are bound to submit, not only in matters which belong to faith and morals, but also in those that appertain to the discipline and government of the Church. In virtue of this supreme power, the Roman Pontiff claims the right of free communication with the bishops of the entire world, and their flocks. To him as to the supreme tribunal, in all causes, the decision of which belongs to the Church, recourse may be had, and from his judgments there is no appeal. The assertion that it is lawful to appeal from him to an ecumenical council is condemned as false. The infallibility of the Pope in doctrinal matters is thus defined:

We teach and define that it is a dogma divinely revealed: that the Roman Pontiff, when he speaks *ex cathedra*, that is, when, in discharge of the office of pastor and doctor of all Christians, by virtue of his supreme Apostolic authority, he defines a doctrine regarding faith or morals to be held by the Universal Church, by the divine assistance promised to him in blessed Peter, is possessed of that infallibility with which the divine Redeemer willed that his Church should be endowed for defining doctrine regarding faith or morals: and that, therefore, such definitions of the Roman Pontiff are irreformable of themselves and not from the consent of the Church.

It is not now maintained that the full significance of the Petrine primacy was manifest from the first in the life of Christianity; but rather, that there was, from the beginning, to borrow Cardinal Newman's words, a certain element at work, or in existence, divinely sanctioned, which for certain reasons did not at once show itself on the surface of ecclesiastical affairs, but gradually with the expansion of the Church, and in response to the needs of the times, developed into full vitality. What was the date of Peter's first appearance in Rome is not clear. Critics of all shades agree that Peter was in Rome in 64, when the Christian community was already established, and that he suffered martyrdom there during the reign of Nero. Roman Catholic writers lay stress on the testimony of Eusebius and Jerome who refer to tradition in proof that Peter had been in Rome before 64. The earliest picture that we have of the Christian Church presents the community rather than the bishop. The writings of Clement seem to point out the community as the seat of authority: the letter ascribed to Ignatius of Antioch addresses the Church of the Romans; and Pope Soter in 170 speaks as in the name of the community, rather than in his own. But the march of events rapidly brought about two results, the domination of the bishops over the various churches and an active preeminence of Rome over the others. After the fall of Jerusalem, Rome, the political mistress of the world, soon became the centre of Christianity; other bishops begin to consult Rome on ecclesiastical matters. Polycarp, the disciple of Saint John, had recourse to Anicetus on the vexed question of the Paschal celebration, though, it is true, he declined to abandon the Asiatic for the Roman custom. In 194 Pope Victor took steps to enforce the Roman discipline by the excommunication of recalcitrants. From the middle of the 2d century, the Gnostic and Montanist controversies served to bring the Roman authority into prominence. To the Church of Peter, as



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to the witness of traditional doctrine disputes were referred. The imperial government, too, recognized the precedence of the Roman bishops over all others; the Emperor Aurelian, in 274, decided that the Christian Church property in Antioch should be dealt with as the bishops of Rome and Italy thought fit. In 256 Cyprian of Carthage speaks of Rome as the seat of the Primacy. During the 4th and 5th centuries the Roman Primacy looms larger and larger. The facts which indicate this rising domination are admitted by Protestant historians as well as by Roman Catholics. Newman cites as sufficient evidence for the 4th century the following passage from the Anglican Bishop Barrow:

The Pope's power was much amplified by the importunity of persons condemned or extruded from their places, whether upon just accounts or wrongfully, and by faction; for they, finding no other more hopeful place of refuge and redress, did often apply to him; for what will not men do, whither will not they go in straits? Thus did Marcion go to Rome and sue for admission to communion there. So Fortunatus and Felicissimus in Saint Cyprian, being condemned in Africa, did fly to Rome for shelter; of which absurdity Saint Cyprian doth much complain. So likewise Martinus and Basilides in Saint Cyprian, being outed of their sees for having lapsed from the Christian profession did fly to Stephen for succor, to be restored. So Maximus the Cynic went to Rome to get a confirmation of his election at Constantinople. So Marcellus, being rejected for heterodoxy, went thither to get attestation of his orthodoxy, of which Saint Basil complaineth.

Many other instances of Papal interference for the restoration of bishops, or the appointment of new bishops, and the designation of others to act as vicars of the Pontiff are also cited from Barrow. While the apologists of the Papacy and its antagonists agree upon the facts, they differ in their respective interpretations of them. What one side considers as evidence of the universal recognition accorded to the primacy, the other treats as evidence of an ever widening policy of "papal aggression." The Protestant theologians, besides, throw emphasis upon a few notable cases of remonstrance addressed by bishops of other sees to the actions of Roman Pontiffs, and see in Cyprian's acknowledgment of the primacy nothing more than an acknowledgment of pre-eminent dignity. The definitive recognition of the spiritual primacy is found in the great council of Chalcedon, presided over by the legates of Leo I. (451). The 630 bishops there assembled accepted as authoritative the profession of faith imposed by the Pope; they are reported to have unanimously exclaimed: "What Leo believes we all believe; anathema to him who believes anything else. Peter has spoken by the mouth of Leo." The removal of the empire to Constantinople was fraught with far-reaching results on the Roman world in temporal as well as in spiritual affairs. In the 9th century writers is found a story that, on his withdrawal from Rome, Constantine granted to Pope Silvester Rome, Italy, and the Western islands. This famous Donation of Constantine was treated as authentic by the canonists and jurists of the Middle Ages. "It is," says the latest English Roman Catholic historian of the Papacy,

a prophecy after the event. Paganism, abandoned, and soon to be persecuted by its Pontifex Maximus, without the conviction that makes martyrs, and long a hollow formality was dying. Christians had the State in their hands. What was more, they showed the fiery zeal, the proselytizing spirit, the exuberance in quarrels

among themselves, which are signs of a youth rich in hopes, bent upon shaping its own victorious future. Heathen Rome invited them to subdue it. Public policy required that the centre of administration should be at the heart of the Empire. The balance of power was displaced. Neither Pope Silvester, nor any Pope for centuries, dreamed of disowning the Imperial rule; from the Goths in Italy they suffered grievous things as the first subjects of Constantinople. But Rome left to herself was Rome in the hands of the Papacy; fronting the west and the barbarians. Constantine had imitated Alexander, who in setting up his throne in Babylon in 330 B.C.—a curious coincidence—and assuming the tiara, left Europe free to follow its own fortunes. Such was the real Donation, not understood at the time by Pope or Emperor, which never lost its force until the northern nations grew into a world as rich, as cultivated and as haughtily self-conscious as the Greek.

The capture of Rome by Alaric in 410, the subsequent invasions of Italy by Attila the Hun, and Genseric the Vandal, reduced the imperial authority to the shadow of a great name, and the wane of Byzantine influence was accompanied by a corresponding growth of political power in the Papacy in whom the people found their only protection and succor against the barbarians. For a brief interval the genius of Justinian, with the military successes of Belisarius and Nares, brought the Popes once more under the sway of Constantinople. With the rise of the Lombard power in Italy the doom of the Western Empire was sealed. By his vain effort to extirpate the use of images in worship the Emperor Leo the Isaurian (726) drove the Roman and Italian populations to transfer their civil allegiance to the Papacy, which, through the wisdom, administrative ability, virtue, and apostolic zeal of Pope Gregory the Great (590-604) had become the national centre of Italy. The pontificate of Gregory is a luminous phase in Papal history. It witnessed the rise of the Benedictine Order whose monks established Christianity in England and initiated the work of civilizing Europe. The Anglican Bishop Creighton summarizes the immediate and subsequent results of this mission:

While dangers were rife at Rome, a band of Roman missionaries carried Christianity to the distant English, and in England was founded a Church which owes its existence to the zeal of the Roman bishop. Success beyond all that he could have hoped for attended Gregory's pious enterprise. The English Church spread and flourished, a dutiful daughter of her mother-church of Rome. England sent forth missionaries in her turn, and before the preaching of Willebrod and Winifred heathenism died away in Friesland, Franconia and Thuringia. Under the new name of Boniface, given him by Pope Gregory II., Winifred, as Archbishop of Mainz, organized a German Church, subject to the successor of Saint Peter.

The middle of the 8th century saw the alliance of the Papacy with the Franks. The last of the Merovingians had become a puppet in the hands of Pepin, the Mayor of the Palace. The nobles offered the crown to Pepin, who consulted Pope Zachary. The Pope replied: "Let him be King in name, who is in fact so," and Pepin was anointed by the deputy of Zachary (751). This fact became a precedent, in the public law of Europe, for the Papal claim of indirect authority over temporal sovereigns.

The grateful Pepin bestowed on Pope Stephen III. large territories which he had wrested from the Lombards; and in return he received from him the title of Patrician of Rome, an event that opened the way to the establishment of the empire which with the Papacy was to constitute the unity of Christendom. Pepin's son, Charlemagne, was crowned emperor by



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Pope Leo III., in Saint Peter's, at Rome, on Christmas Day, 800. When under the descendants of Charles, the short-lived unity of the empire was broken up into separate states the Papacy stood forth in the minds of men as the paramount authority in the political, as it was in the spiritual world. "The Church," writes Barry,

instead of breaking up as Charles' monarchy had broken up, into petty and opposed principalities, is centralized in the West. A Supreme Court of Appeal is set up in the sight of mankind, its charter the Bible, its weapons spiritual, but entailing penalties in this world. For deposition, interdict, excommunication, greater or less, carry in their train forfeiture of dignity, good, life, and the Holy See can reckon on sentiments which become the foundation of order, in the State and in the Church.

Pope Nicholas I. exercised his supremacy in both realms (858-867). He obliged the Frankish King Lothair II. to take back the wife whom he had attempted to divorce. He deposed the powerful archbishops of Cologne and Trèves who had sided with the King, and against the opposition of the Byzantine emperor he condemned Photius, who had intruded himself into the Patriarchate of Constantinople. About this time appeared the famous False Decretals, which were embodied in the canon law of Europe. This collection of decrees was first presented at the Synod of Quercy in 857, when the Frankish bishops were contending for alleged rights and privileges against their metropolitans. It purported to be the work of Isidore of Seville. There had been a genuine collection edited by this author. But the present volume contained, besides some authentic decrees, the Donation of Constantine, several forged decrees, and acts of spurious synods. The author is generally supposed to have been a Western Frank. His object was to set up an entire immunity for the clergy, and to present the Pope as not only supreme ruler in ecclesiastical affairs, but also the supreme appellant judge in even secular causes. The bishops were exalted, and protected against their immediate superiors, but, on the other hand, they were reduced to something like a condition of feudal vassalage to the Pope. In short, the rights of synods, metropolitans, clergy, and laity were swept away. The general conception embodied in these Decretals was woven into the laws of Christendom during the Middle Ages.

The middle of the 9th century was characterized by a rapidly spreading confusion and civil and moral disorder throughout Europe. The most signal exercise of Papal authority was the conferring of the empire on Charles the Bald by John VIII. The Saracens, the Normans, and the Slavs were carrying their victorious arms into southern, western, and central Europe. Italy was the scene of incessant strife. The popes were unable to resist the attacks and oppression of Italian nobles and Norman chiefs. As the power of the great vassals of the crown increased, the disintegration of the empire continued its course; and something akin to anarchy prevailed. The condition of the Papacy reflected the evils of the times. Disorders in elections, corruption in administration, license in morals, mark the Papal history of this period. In the House of Theophylact the Papacy almost assumed the character of an hereditary monarchy. The lowest depths of degradation were reached when Alberic of Tusculum made his

son, a vicious boy of 12, Pope under the title of Benedict IX. After holding the position for some time, Benedict sold it to Gregory VI., in order to get married. There was another claimant known as Silvester III. Benedict endeavored to resume the sovereignty. Monks like Peter Damian and Hildebrand deplored and endeavored to mitigate the universal disorder. The empire had passed to the German House of Otho. Henry III. endeavored to put an end to the degradation by deposing the three unworthy claimants, and appointing a German to the throne of Peter (1046). Notwithstanding the powerful influence and resolute endeavor of the monk Hildebrand the reign of misrule continued till he himself became Pope, under the name of Gregory VII. He set about the reformation not only of Rome but of the entire Church, recalled the clergy to the vows of their profession, took severe measures against the universal vice of simony, and asserted the Papal claims against the secular powers. A long struggle of much vicissitude against the imperial power ended by the humiliating capitulation of Henry IV. at Canossa (1076). The influence of the universities, especially those of Paris and Bologna, contributed, by their teachings in law, philosophy and theology, to establish the majesty of the Papacy as the supreme authority in the opulence of power ascribed to it by the Decretals of Gratian. The Crusades gave exercise to the Popes' claim of suzerainty over all the temporal rulers of Europe. The Papal dominions were enriched in 1115 by the Countess Matilda's bequest of her extensive possessions. A long quarrel with the emperors concerning the right of ecclesiastical investitures ended in a further triumph of the Church over secular feudalism; the Concordat of Worms, however, conceded to the emperors the right to send deputies to the election of German bishops, and of investing them with the regalia before episcopal consecration. This was the first of the Concordats between the Papacy and the States which indicate the growing restlessness of the civil powers. About the middle of the century a more serious conflict arose between the Popes and the Hohenstaufen emperor, Frederick Barbarossa, who undertook to restore the imperial authority over the Italian states, and establish his sway over both clergy and laity. The genius of Alexander III. triumphed; and Frederick, like Henry IV., was obliged to submit (1177). Everywhere, however, the young nations of Europe, developing their national codes, and becoming conscious of their strength, were, at the end of the 12th and the beginning of the 13th century, showing signs of restiveness under the dominion of the Church. In England Henry II. began his struggle with Thomas of Canterbury. The Constitutions of Clarendon claimed almost as much for the civil power as was demanded afterward by Henry VIII. Fearful that Henry might join hands with Frederick, the Pope temporized. But when the death of Becket stirred up the people against the King, the Plantagenet was compelled to sue for peace no less humbly than the Hohenstaufen. In the reign of Innocent III. the power of the Papacy reached its zenith. A man of lofty character, indomitable courage, and great political insight, he dictated to the rulers of France, Germany, and England. For a short time the arms of Venice



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brought Constantinople under his spiritual sway. By the help of the crusaders he crushed, with great severity, in northern Italy and southern France the sects which disputed the authority of the Church. The new orders of Saint Francis and Saint Dominic, powerful in their primitive fervor and virtue, renewed the religious spirit in every country, and awakened in the consciences of the people the old devotion to the Church and its sovereign ruler. Innocent, more conspicuously than any of his successors, acted as an independent Italian prince, expelled the imperial officers from the domains which Matilda had given to Rome; and, under him the States of the Church became an autonomous kingdom. Thenceforward we see the Pope strengthened and burdened with a temporal sovereignty; and more than once, in subsequent history, the necessity of defending it becomes a serious embarrassment to him in the discharge of his office of Spiritual Father of Christendom. Though Innocent was successful in asserting his feudal authority, the resistance offered to him indicated that the mediæval awe of the Papacy was rapidly passing away. Some of his acts rankled in the hearts of the peoples, and bore fruit in later times. To trace the effect of his intervention in the affairs of England, by absolving the nation from its allegiance to King John, and by annulling, as vile and base, Magna Charta, the foundation of English liberty, would carry us to the days when, in a darker hour, another Pope, by a similar act of absolution, and of deposition of the sovereign rendered definitive the breach between England and the Holy See.

Another and a final struggle between the Papacy and the German emperors opened with the reign of Frederick II. Frederick attempted to reduce the Popes to a state of dependence, on the imperial authority. Gregory IX. and Innocent IV. vigorously resisted and after a long and demoralizing struggle overcame him; and the Popes did not rest easy till the last of the Hohenstaufens, a mere youth, was beheaded (1286). With Frederick perished the empire which, under Charlemagne, had arisen as the temporal element that in union with the spiritual Papacy had formed the theocracy of the Middle Ages. Though the feudal Papacy had conquered the empire it was not destined long to survive it.

The French influence introduced into Italy soon dominated the elections, and Popes were chosen with a view, not to the interests of the Church, but to those of the French king. In the reign of Boniface VIII. (1294-1303) the Papacy and the secular power closed in a death struggle from which the State rose victorious in the person of Philip the Fair of France. Already, by the instrument known as the Pragmatic Sanction, Louis IX. had claimed for the Gallican Church freedom of patrons from Papal interference, freedom of election to chapters, and immunity from Papal taxation without the consent of the Crown and the Church. The chief sources of revenue exacted by the Popes about this period were the fruits of the first year taken from vacant livings and from money left by previous incumbents; the annates taken from benefices conferred by the Pope; taxes for the confirmations of bishops, and for Pallium fees; taxes for dispensations; Peter's pence;

tributes from secular princes and religious institutions placing themselves under the protection of the Pope; the feudal tax from the vassals of the Pope. The Popes widely exercised the right of presenting to benefices; granting "expectances" to benefices; nominating to certain reserved prebends, and bestowing others in *commendam*. When Philip imprisoned a Papal legate the great struggle was on. In reply, Boniface issued the Bull *Clericis Laicos*, declaring that the civil authority possessed no jurisdiction over ecclesiastics. He summoned the leaders of the French clergy to Rome. Philip and his lawyers answered that the Pope had no authority on temporals, and that his collations to benefices were null and void. Another letter from Boniface told Philip, "Let no one persuade you that you are not subject to the chief of the Heavenly hierarchy." Philip burned the letter. Then came the Bull *Unam Sanctam*, declaring that every human creature is subject to the Roman Pontiff. The end came when, after being maltreated at Anagni by the minions of Philip, he died, in prison, abandoned by all, 11 Oct. 1303. With him the mediæval Papacy passed away. For centuries afterward canonists and theologians continued to recite the right of the Pontiff to take away and to give crowns; but the world took no notice of the claim. Henceforward the Pope is for history the spiritual ruler of the Catholic Church and the sovereign of a small and gradually diminishing Italian state which, in 1870, was, against the protest of the Pope, absorbed in the kingdom of Italy. Even the most hostile historians of the Papacy concede it as much merit as is given it in the temperate words of Barry:

While it leaned on the people its triumph was assured; when it submitted to the feudal system, it courted disaster. Then the royal authority took away its rod of dominion; the King became Pope; the Pontifex Maximus retired into the holy place before him. Crimes, abuses, usurpations, scandals, and a secret change about religion in the thoughts of men account for this latter-day revolution. But it is difficult to imagine how Europe could have survived from the Fall of the Empire to modern times, had there been no central, supreme, and acknowledged power like the Papacy, guardian, at once, of faith, learning, and civilization. That it always rose to the height of that great enterprise will not be maintained by the historian, but its benefits outnumbered by far its abuses; and the glory is not dim which hangs round its memory, when we call to mind that it consecrated the beginnings of a peaceful Christian Europe, and watched beside the springs of art, science, industry, order and freedom.

By the transfer of the Papal Court to Avignon the Papacy passed under French influence, which along with the relaxation and disorders that attended its residence there, seriously impaired its prestige (1305-77). Its return to Rome was the signal for the great schism of the West, in which Pope and anti-Pope contended for the allegiance of a distracted Christendom; till the Council of Constance restored order by the election of Martin V. in 1417. With the passing of the temporal Papacy, the spiritual supremacy of the Pope in the Roman Catholic world became more emphasized. The extent of Papal authority and prerogative in the Church was explicitly defined by the Vatican Council. A decree of the Council of Constance, which assembled in 1414, in order to terminate the Western schism, had declared the Pope to be inferior to a general council. The French clergy, in 1682, subscribed to a set of formulæ, known as the Gallican Articles, which affirmed



that the consiliar authority is above the Pope, and, consequently, that *ex-cathedra* Papal utterances are not irreversible until confirmed by a General Council. After a prolonged debate, during which it was manifested that the decrees of Constance were intended to apply only to the occasion which gave them birth, and that the Gallican doctrine had been repudiated by the Church, the Vatican Council settled the question by the definition given above.

The long endurance of the Papacy, during ages which have seen the disappearance of every other European institution that was in existence when the Papacy arose, and of so many others that were, but are no longer, while it stands, is a fact which has arrested the attention of every serious historian. It is appealed to by the Catholic apologist as evidence that the Church is not a mere human institution. To arrive at an impartial estimate of the Papacy, the historical student needs carefully to distinguish its spiritual element — essential and abiding — from its secular adjuncts, which wax large and wane with the vicissitudes of time. A classical explanation and defense of Papal supremacy will be found in Cardinal Newman's 'Anglican Difficulties,' Vol. II. (1898); or in 'The Chair of Peter,' by John Nicholas Murphy (1883).

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**Pa'pain**, a digestive ferment isolated from the juice of the half-ripe fruit of the tropical papaw tree (*Carica papaya*). The juice is used in the West Indies to make meat tender. Papain is a grayish powder, soluble in water and glycerine, insoluble in alcohol, ether, and chloroform. It digests fibrin and albumen more readily than pepsin, and in alkaline, neutral, and acid solutions. It is used in some forms of dyspepsia, as a solvent of false membranes in croup and diphtheria, and for the removal of warts. As a solvent it is used in solution (5.15 per cent) in equal parts of water and glycerine. It has been recommended as a galactagogue and an anthelmintic.

**Papajo** (pä'pä-hō) **Indians**, an American tribe of the Piman family originally occupying a large part of Arizona. Branches of the tribe extended into Mexico. They were early christianized by the Jesuits and Franciscans and are nearly all devout Roman Catholics. They were once recognized as citizens by Mexico, but after the annexation of the Arizona country by the United States, the Papajos lost not only their citizenship but their lands and water rights, and were persecuted by the white settlers. During the early part of the 19th century they were almost constantly at war with the Apaches. They now number about 4,000, live on reservations and are devoted to agriculture.

**Papal Guarantees, Law of**, a law passed in 1871 by the Italian legislature with a view to adjusting the disputes between the papal curia and the civil government. It had all the appearance of a liberal, even generous, attempt at conciliation and the establishment of mutual independence. Its principal provisions were as follows: (1) The pope was secured the standing of a sovereign power with a court, special ambassadors at Rome, separate postal and telegraphic communication with other countries, and an annual salary of 3,225,000 francs from the

national exchequer. (2) The Vatican and Lateran Palaces, etc., were settled on Pope Pius IX. and his successors. (3) The *placet* or *exequatur* of the king was not to be required as a ratification of acts of papal authority in ecclesiastical matters. Bishops were not obliged to take oath of allegiance to the king. (4) The clergy were granted the right of assembling. (5) While the ecclesiastical courts were to have the right of deciding cases brought before them without any appeal against their decisions to the civil courts, the aid of such courts in enforcing her decisions was to be denied to the church. The opinion of the Liberals was that this measure gave the pope too much independence, and when it was submitted to the Powers England refused her sanction. Finally the pope decided not to consider the Law of Papal Guarantees but to remain at Rome in his own right, without asking anything of the civil government.

**Papal States.** See CHURCH, STATES OF THE.

**Papantla**, pä-pänt'lä, Mexico, town in the state of Vera Cruz, 115 miles northwest of Vera Cruz, on a well-watered plateau. It is in the centre of the vanilla district and has a population of 10,000. About seven miles from the city is a famous teocalli with other ancient ruins, all overgrown with tropical vegetation.

**Paparrhigopulos**, pa''pä - rē - göp'oo - lös, **Constantine**, Greek historian: b. Constantinople 1815; d. Athens 26 April 1891. His father, uncle, brother, and other relatives having been beheaded after the revolution of 1821, he left Turkey and was educated at Odessa under the patronage of the Czar. In 1851 he became professor of Greek history in Athens. He wrote various monographs in Greek history, and collected in 1858 and 1890, and, in Greek, a 'History of the Greek People' (1860-74), which he abridged and rewrote in French under the title 'Histoire de la Civilisation Hellenique' (1878). Both these works aim to show the unity and continuity of Greek history, and especially to rehabilitate the iconoclastic emperors and show the importance of their reigns.

**Papavera'ceæ.** See POPPY.

**Papaw'**, a popular name for several distinct fruits. The papaw of the tropics (*Carica papaya*) is a small palm-like tree of the natural order *Passifloraceæ*. It has usually an unbranched stem, which bears a crest of alternate leaves, in the axils of which are borne racemes of small flowers, followed by yellow fruits sometimes a foot long and containing a large quantity of black seeds. The immature fruits are cooked like squashes, and some persons eat the ripe ones raw. In climates free from frost the plants are grown as a home vegetable or fruit.

Other papaws are members of the genus *Asimina* of the order *Anonaceæ*. The best known of these is probably *A. triloba*, a small tree native to the southern United States, but represented as far west as Kansas and as far north as Michigan and New York. The flowers, which are two inches in diameter and appear with the leaves, are at first green but change to purplish-red with yellow centres. The fruits are dark brown, from two to six inches long, and highly aromatic. As a garden fruit this species seems worth attention; selection should



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reduce the size of the large stones and modify the flavor. A few improved varieties have been disseminated. Apart from its fruit the tree is of considerable value for ornamental purposes.

**Papeita**, pā-pā-ē'tē, or **Papeete**, Society Islands, capital of the French islands of Polynesia; on the northeastern coast of the island of Tahiti. It has a good harbor, is the commercial centre of the neighboring islands, and has a large export trade; it is also the most important French naval station in the Pacific. It contains a cathedral, a court-house, and other French government buildings. Pop. 3,000.

**Papeline**. See POPLIN.

**Paper** (Fr. *papier*; Lat. *papyrus*; Gr. *παπυρος*). Paper is a material composed of vegetable fibres formed artificially into thin sheets.

*Papyrus*.—The word paper is derived from papyrus, probably the Egyptian name (with a Greek termination) of a sedge or bulrush of the Nile and marshes of Egypt. The plant was used by the Egyptians to make thin sheets primarily for writing upon, though some were used for wrapping. They stripped the rind from the long stems, exposing the pith which was then cut into thin strips. These were laid out flat side by side, forming a layer upon which other strips were laid at right angles to the first. The two layers were then compressed so as to adhere to each other. Sometimes, perhaps generally, three layers were superposed. The article thus formed was called papyrus.

The existence of papyrus has been traced back to 2400 B.C., and no doubt it then had been in use a long time. In China, and other parts of the world, a similar article, made from rice stalks in practically the same way, is known to have been in use several hundred years B.C., and is supposed to have come down from a time even then remote. The Egyptian papyrus—the material, but not the art—was introduced probably about 325 B.C. into Europe as a consequence of the conquests of Alexander of Macedon and was used there very generally until the 8th century, when, together with parchment, it began to be replaced by paper made quite differently upon a principle which has survived to the present day.

*Early Paper*.—Papyrus is lost sight of in the 12th century. The new paper was of Asiatic origin. Its fundamental difference from papyrus was that the raw material in making paper was first reduced to pulp, that is, the natural structure was broken down so as to separate the component fibres, which were then rearranged to form a lamina or thin sheet. In China, Formosa, Korea, and very likely elsewhere in eastern Asia this principle was used certainly before the Christian era. Though, as Pliny truly says, "the remembrance of past events depends upon paper (papyrus)" with the irony of fate, paper has failed to record its own origin, and much of the early history of the art is left to conjecture. The probable course that paper-making took was from China and other Oriental countries to the eastern extremity of the Mediterranean (Persia and Arabia about 620 A.D.), whence the Saracens carried the practice of the art to Spain after their conquests of that country in the 8th century. The consequent disruption of commercial relations with the Egyp-

tians cut off the supply of papyrus and facilitated the substitution of true paper in Spain and other parts of Europe. Paper from Damascus had at about the same time found its way into eastern Europe, but the first paper mill in Europe was established by the Saracens in Spain. The spread of the industry throughout Europe was slow, and its route and early development cannot be surely traced. Italy had its mills soon after Spain; France first learned to make paper in 1189; in Germany the first mill was built in 1390, while for the beginning of paper-making in England 1330 is given as an uncertain date. The western hemisphere was reached in 1690, when a mill was erected at Germantown, Pa., by William Rittenhouse. It is a curious sequel that to-day there is absolutely no paper made in Egypt, which supplied the civilized world for so many centuries with papyrus, and that the Chinese and other Orientals who contributed the fundamental principles of modern paper-making have made little or no progress themselves in developing the art. Although they have characteristically adopted Western machinery to a limited extent, they still in the main cling to archaic methods of making paper, which are of slight commercial importance. The industry is now practically confined to Europe and North America.

*Materials*.—All vegetable growths consist of (1) cells or fibres mainly composed of cellulose ( $C_6H_{10}O_5$ ) and (2) various intercellular matters such as resins, etc. Paper is made of the fibres with more or less of the intercellular matter adhering to them according to the treatment undergone. As early as 156 B.C. the Chinese made pulp from the small branches of the mulberry tree, various barks, bamboo, leaves, etc. In Korea the paper-mulberry was chiefly used and the Japanese having begun to cultivate this tree made paper from it about 610 A.D. It is still to-day almost the only raw material used by them. The portion used is the inside bark. It appears that the Saracens used cotton for paper from a very early time and were probably the first to find that old cloth fabrics also answered the purpose very well. In Spain flax was the first material used, and then cotton. The paper imported into Europe from Damascus was likewise made of cotton; 1085 is set as the date when "rags" were first used in Spain and 1100 for the first appearance of linen paper. The first paper made in America was "rag" paper. From the time rags began to be used in Europe, they rapidly displaced other materials on account of the economy of the double use of the fibre. Rags held sway in the paper industry for many centuries, but not entirely to the exclusion of numerous other materials. Esparto (q.v.), which is a Spanish grass, containing an especially good fibre, and other similar grasses as well as straw, have long been used. In 1765 Schaeffer of Ranslon published a book printed on 60 varieties of paper made from as many different materials. Somewhat more than 100 years ago, under the stimulus of greater demand, the substitution of machinery for manual labor and the development, of chemistry, attention was directed afresh to the use of fibre derived directly from the original growth as a substitute for rags. An impetus



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was given to the manufacture of paper from straw (first used about 1800), which has made it until recently an important factor in paper-making. In 1719 Reaumur first suggested the use of wood. Sporadic experiments to this end were made, but without noteworthy results until finally they culminated in the present mechanical and chemical processes of producing pulp from wood. Since it has been demonstrated that paper can be made from almost any kind of vegetable fibre, it only remains to discover new methods of treatment or improvements in old methods which will render more varieties of fibres commercially available. It is thus merely a question of cost of material and of conversion. At the present time the principal materials used are spruce and other conifers, poplar and similar woods, cotton and linen rags, jute, straw, hemp, esparto, old papers and other waste materials. In the United States the use of straw and rags is relatively, if not absolutely, diminishing and of woods increasing. For many years vast quantities of rags were imported into the United States from various parts of the world, notably Egypt, China, and Japan, but the domestic supply now suffices. Wood fibres, originally substituted for rags, straw, and other materials in the cheaper or lower grades of paper, have gradually, as methods of treatment improved, become suitable for better grades. The finest papers, however, are still made from linen rags.

*Processes of Manufacture.*—Leaving out of consideration papyrus and rice paper, the reduction of the raw materials to pulp has always been a preliminary to making the paper. So far as we know this was done by the Chinese and kindred nations, the first pulp-makers, by beating the raw materials into a pulpy mass, with simple hand tools. They also at a very early date disintegrated the materials by either soaking them or boiling them in lyes. They thus originated two processes of making pulp which, though much modified, are still in vogue. As the Japanese and Chinese still depend principally upon hand implements for macerating the raw materials, we must look elsewhere for the earliest application of machinery for this purpose. Whether paper-makers used machinery before the introduction of rags is not clear, but it is highly probable that they did. Certainly machines driven by water power were in use soon after the adoption of rags. They were a sort of trip hammer which pounded the rags into pulp. In the first mill erected in Germany in 1390, such a machine driven by water power was used to prepare rags. Water power was also used in a paper mill in Tuscany some time in the same century. Whether at first rags were "cooked" before being beaten is not certain, but it was not long before it became customary to so treat them. The fabrics were first weakened with caustic and then macerated in a "beating engine." The "Hollander engine," the precursor of almost all modern types, was invented in 1750, and essentially as originally designed is still used very generally. It consists of a rapidly revolving iron "roll" mounted in an oval-shaped tub and set with dull steel "blades." The roll revolves over a "bed plate" and draws the "stock" through between the roll and plate. When straw, esparto and other similar materials came into use, they were likewise reduced to a pulpy

state by chemical treatment, but the "beating" became of secondary importance. With the introduction of wood there have been evolved from fundamental principles already described various methods of reduction, classed as either (a) mechanical; or (b) chemical.

The conversion of pulp into paper, based always on the same principle, may be divided into two processes: (1) handmaking, (2) machine making. The "hand" process came into existence at a very early period and still survives in some countries, notably in Japan. But the output of hand-made paper is very limited, except in Oriental countries where, in contrast with the high development of the art elsewhere, the adherence for centuries to this antiquated process is a striking mark of their backward civilization. The method of making paper by hand has remained practically the same as it was more than two thousand years ago. The pulp is diluted with water in a vat in which is immersed a "mold" or rectangular frame, on the top side of which are stretched parallel wires near together with others at right angles (woven wire cloth is now generally used). Upon this "mold" is tightly held a "deckle" or wooden frame. On withdrawing the "mold" from the vat in a horizontal position, the water within the deckle drains off, leaving the wires coated with fibres, the operator meanwhile shaking the mold so as to evenly distribute them. The film of fibres or paper is then stripped from the mold and laid upon a felt. Paper and felt are piled alternating, forming a "post," which is then pressed to extract the water. The greatest advance, in the history of paper-making, was made when toward the close of the 18th century a machine driven by power and making paper continuously was substituted for this single-sheet hand process. Modern paper making may be considered to date from that time. Roberts, a Frenchman, working in a hand paper mill in France, is credited with this invention, and in 1799 his machine was installed by François Didot at Essone, France. In 1803, Fourdrinier and Donkin introduced essentially the same machine into England, where it was put into successful operation in the following year. That machine, in principle the same as those in universal use to-day, is known by the name of Fourdrinier, the maker, but not the inventor. It multiplied the productive capacity of labor enormously. Although a continuous web of paper was produced it was invariably cut into sheets, for it was nearly 100 years before the invention of the web printing-press created a demand for paper in the form of rolls. Second only in importance to Roberts' invention was that of Dickenson, an English paper-maker, who, in 1809, invented the "cylinder" machine, a modification of the "Fourdrinier," which has played an important part in the manufacture of wrappings, paper boards and generally the coarser grades, while the Fourdrinier is supreme in the book, news and writing paper fields. The machines in use in the United States were:

In 1872,	Fourdrinier	299,	Cylinder	689.
In 1900,	"	663,	"	569.

Great improvements have been made not only in the paper machines proper, but in the other machinery used in pulp and paper-making, and the use of raw materials has been revolutionized



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1. Machine Room — dry end.

2. Super Calender Room.







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so that paper-making has as a whole made an enormous stride since the day of Roberts, but still his time must be regarded as an epoch in the history of the industry.

*Growth of the Industry.*—The earliest use of paper was for writing purposes. As the art of writing was for so many centuries confined to a small portion of the world's population, and as few copies of books were made, the consumption of paper must have been very limited compared with many other commodities. But the invention of printing which led to the manifold production of books gave a great stimulus to the industry. It is probable that the use of paper for numerous mechanical and practical purposes is of comparatively modern origin except that it has always been used more or less for wrapping. But paper was too much of a luxury to be used freely for wrapping until recent times and even now, for example, in Italy as a usual thing frugal shop-keepers do not furnish wrapping paper, and not uncommonly the buyer, if he wishes his parcel wrapped, takes with him the paper, usually an old newspaper or sheets from a child's copy book; these he uses as long as they will hold together. There has been at all times a reciprocal relation between paper-making and many other arts and industries, progress on the one side stimulating progress on the other. Thus, for example, improvements in printing have not failed to meet a response from the paper-maker with cheaper product. The use of web presses for printing newspapers has stimulated improvements in the process of making paper which reduced its cost and the reduction in price in turn has been a very important factor in the growth of the printing and publishing industries.

The production of paper is now centred principally in the United States, England, France, Austria-Hungary, Belgium, Holland, and Scandinavia. These countries lead both in the methods of manufacture and the quantity of output. In general there is a striking relation between the intelligence and progressiveness of a country and the quantity of paper consumed. It follows as a corollary, that the United States has a greater per capita production than any other country. The total number of paper mills in the world is between 4,000 and 5,000, including numerous small establishments in China, Japan, and other Oriental countries, where paper is made mostly by hand, but no reliable statistics exist to show the total production of the world. A rough estimate would make the world's production upward of 9,000,000 tons annually. This is approximately three times the world's annual growth of cotton; the significance of this comparison is that it indicates the insufficiency of rags as raw material and the importance of the inventions which have led to so general a use of wood pulp.

*Classification.*—The commercial classification of paper is based primarily upon the different uses to which it is to be put. Logically the different kinds of paper fall into two groups: (1) paper for recording and (2) paper for mechanical or practical purposes. The first group may be subdivided into (a) "writing" paper, this being on the whole the best in quality is accordingly known as "fine" paper, and (b) "printing" papers, again subdivided into "book" and "news."

The second group includes many varieties, the most important being "wrapping," but this, too, has many subdivisions. The classification of paper adopted by the United States census of 1900 follows pretty closely this logical idea and is as follows: (1) "news," in "rolls" and "sheets"; (2) "book," including "cover," "plate," "lithograph," "map," "wood cut," "cardboard," "bristol board," etc., (3) "fine," including "writing," "ledger," etc., (4) "wrapping," including "manila" (made from rope or directly from jute hemp and other strong fibres), (5) "straw" (at one time used for printing, but now relegated principally to the wrapping board classes), (6) "bogus manilas" (so called from their being imitations of genuine manilas, although composed of wood fibres), (7) "boards," including "binder boards" (used for binding books), "pulp boards," "straw boards," "news boards" (made from old newspapers). "Boards" in general are used for making paper boxes and for many other purposes; finally (8) "miscellaneous," including "tissues," "blotting," "building," "roofing," "carpet lining," "hanging" (wall), etc.

News paper, in countries where suitable woods are plentiful, is generally made from wood pulp. Elsewhere rags, straw, esparto, and other materials are used. The highest grades of book paper are made from linen and cotton rags, but a very large and increasing percentage is made from wood pulp, principally chemical pulp, mechanical or ground wood pulp being used only in the cheaper grades. The two principal varieties of chemical pulp, namely, "sulphite" and "soda," are both used extensively in book papers. The best quality of "fine" papers are made of linen rags, wood pulp and cotton rags being used for the lower grades. Wrapping papers are made of all kinds of fibres, but in this country rags for this purpose have been practically abandoned. Boards are made of wood pulp, straw, old newspapers and other fibrous waste materials, according to the particular purposes for which they are intended. Tissue papers are made from a variety of fibres ranging from the manila hemp to wood pulp. The papers produced in other countries comprise all those enumerated above and many other varieties or "specialties." Austria and Germany are remarkable in this respect.

Referring to the United States, the value of paper produced for writing, printing and similar purposes compared with that produced for mechanical purposes such as wrapping, boards, etc., is not far from equal. The tonnage of news paper exceeds the tonnage of book paper and fine paper combined and is upward of one fourth of all kinds of paper made.

Pulp is used for many mechanical purposes, but there is an erroneous impression as to the extent to which it is so used. It is generally not formed into paper, but converted directly into various articles. Such articles are, therefore, not to be regarded as paper. So-called paper car wheels, for instance, are steel shells packed with "pulp."

*Sizes.*—In the United States, if not elsewhere, the paper-maker has so conformed to the various demands of the consumer that standard sizes which were originally adhered to, are, except in the case of writing papers, almost obscured by the great variety of special sizes. Four fifths of the news paper is in rolls varying



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in length of roll (that is, width of web or sheet) usually from 30 inches to 75 and, in diameter, from two to three feet. The International Paper Company exhibited at the Buffalo Exposition the largest roll ever made, being 152 inches in length and weighing 4,000 pounds, and the sheet unrolled would reach six miles. Some of the common standard sizes of news sheets are, in inches, 20 x 30, 24 x 38, 30 x 40, 32 x 44, etc. The sheets are put up in bundles generally of two reams of either 480 or 500 sheets to the ream and are either "folded" in quires or put up "flat" or "lapped" (one ream dovetailing into the other). Book paper is generally in sheets, although the use of web presses requiring rolls, is extending to book and magazine publishing. The sheet sizes are many of them the same as news paper. The principal sizes of fine papers are 16 x 21 (demy), 17 x 22 (folio), 17 x 28 (double cap), 19 x 24 (royal), and 22 x 34 (double folio). Wrapping paper and boards are furnished in both standard and special sizes. In recent years, wrapping paper to a considerable extent has been prepared for the market in what are called "counter rolls."

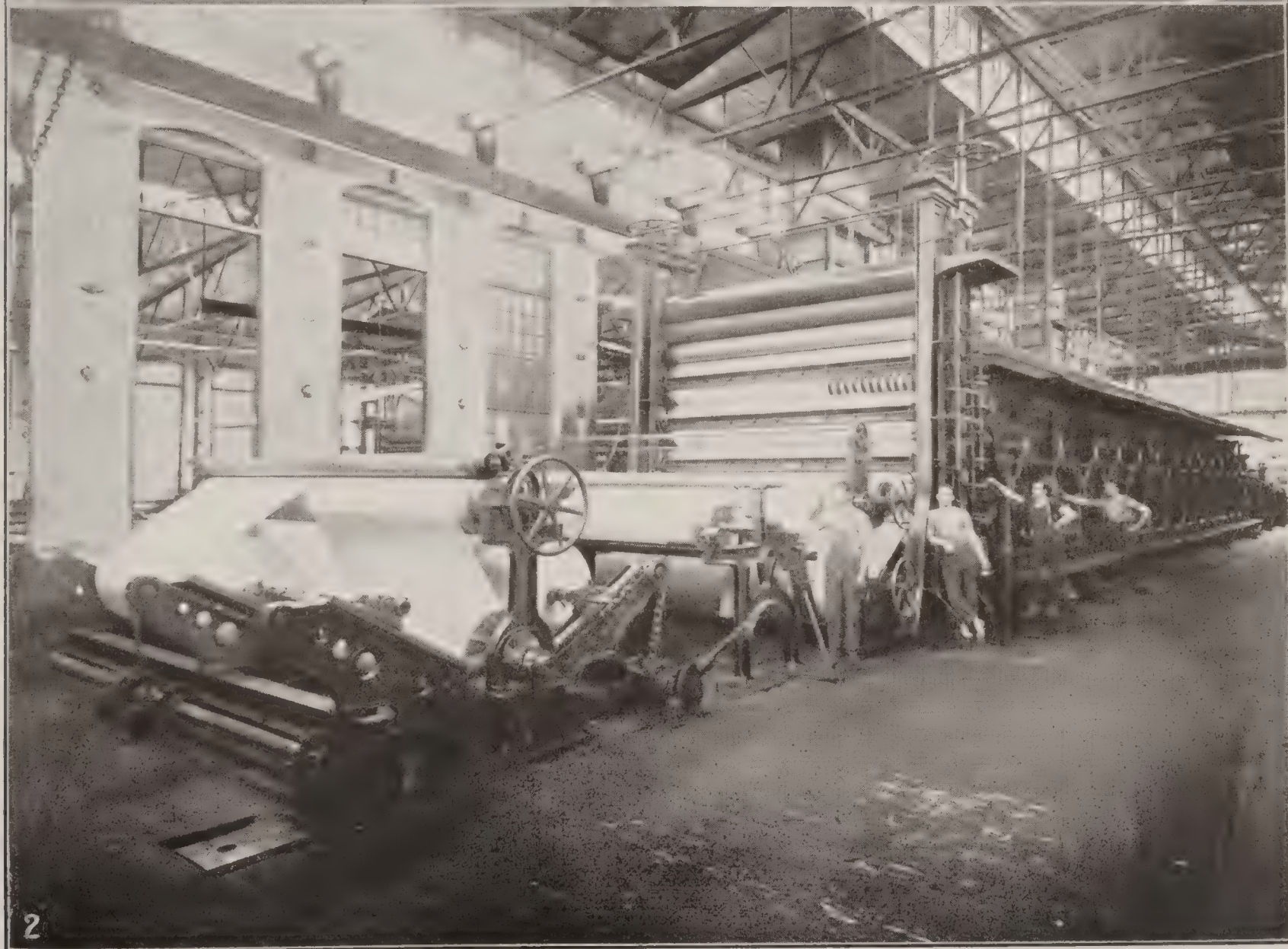
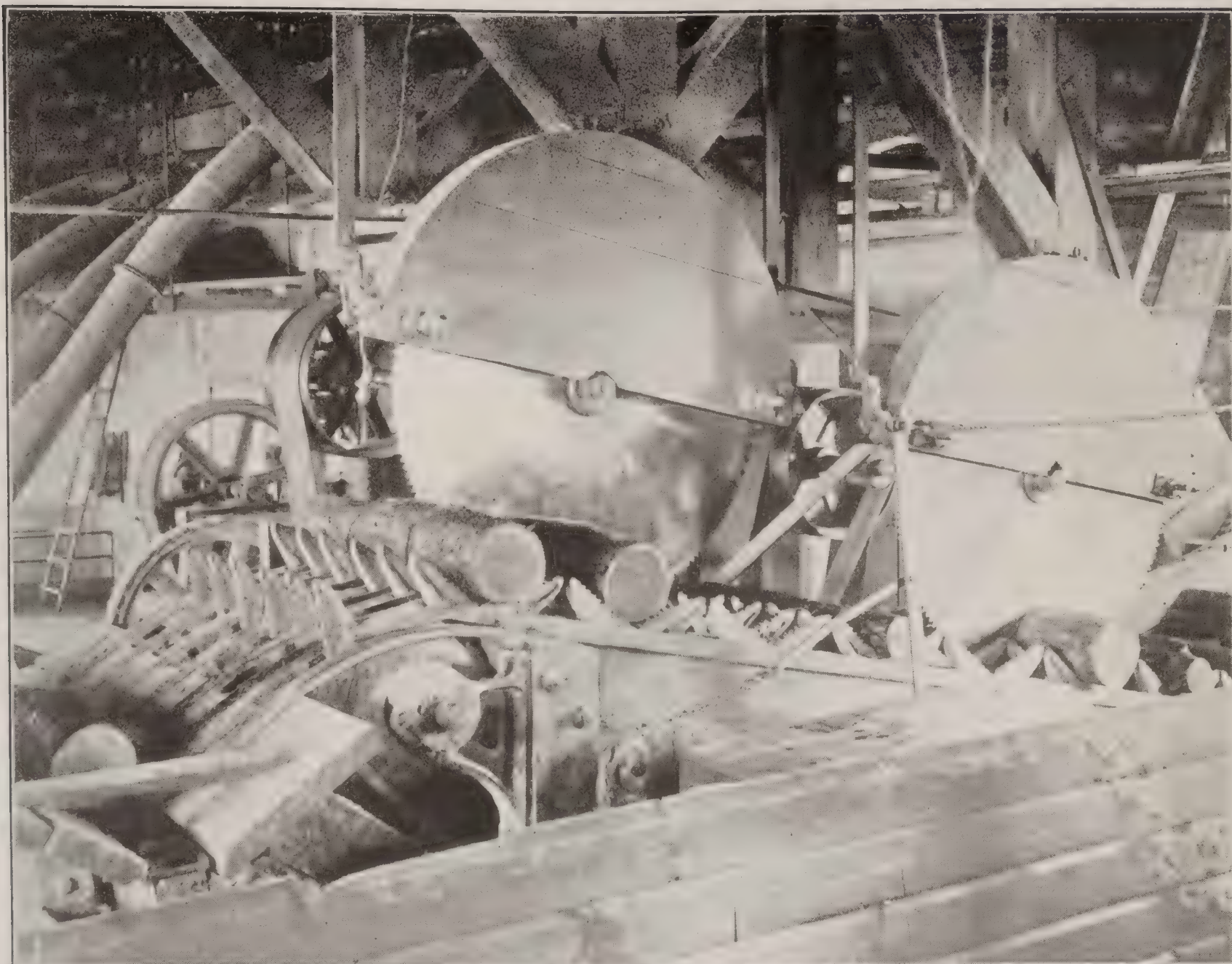
*Modern Conditions.*—If we take the United States as a type the most important factors in paper-making are raw materials (spruce and poplar wood, rags, straw and old papers), water power, and fuel. About three quarters of the total tonnage of paper made in the United States is composed of wood pulp. The percentage made from rags is very small, not more than 5 per cent or 6 per cent, but the value of the rags used in the last census year was \$6,595,000 as compared with \$9,837,000, the value of the wood used, demonstrating that rags are used chiefly in the highest grades of paper. Water power is not only indispensable for making ground wood pulp but is generally relied upon to drive the beating engines and other heavy machinery. (United States census 1900—765,000 H. P.) Coal is required principally for producing heat to dry the paper, but also for additional power.

Other important conditions affecting the production of paper are the existence of good transportation facilities and the proximity of large markets. All these factors combine not only to put the United States at the head of paper-making but to concentrate the industry to a considerable extent in the northern tier of States. New York, Massachusetts, Maine, Pennsylvania and Wisconsin lead in the order named, in the value of the output of their mills. An advantage which American ingenuity itself has created is the superiority of its paper machinery, especially in point of capacity; American machinery being, as a rule, larger and operated at greater speed than that of other countries. It is this fact that more than compensates for the much higher scale of wages prevailing here than in any other paper-producing country, even after due allowance has been made for the superior character of American workmanship. The machine tender, for example, who receives \$3.00 and upward a day in the United States, in England receives \$1.66, in Germany \$0.75, while in Italy, Scandinavia, and other countries even less. The exporting of American paper machinery has a decided tendency to neutralize the advantage that the United States paper-maker might have if it could be kept for his own exclusive use.

*Present Process of Manufacture.*—The United States will again serve as a type, for while other countries may excel in certain specialties and refinements, the United States leads in the production of the most important grades of paper. The underlying principle in making all grades of paper is to first reduce the raw materials to pulp, to dilute the pulp so as to perfectly disintegrate the fibres and then to re-assemble them by quickly getting rid of the water and depositing the fibres in the form of a sheet. All materials are reduced to pulp mechanically or chemically. Beating and grinding are the mechanical methods. Beating is applied to rags (after cooking), to old papers, and other waste materials.

*Ground Wood Pulp.*—Grinding is confined to woods. Spruce is used chiefly, though other kinds of conifers are used to a limited but increasing extent. Trees upward of 10 or 12 inches in diameter are felled and transported to the pulp mill either (1) in logs or (2) sawed into lengths of usually four or two feet. Sometimes the wood is peeled in the forests but usually it has the bark removed by a "barker" or "rossing machine." The "blocks" of wood two feet in length are brought into contact with a rapidly revolving vertical disk set with knives at an angle to the surface which shave off the bark as the block is rotated before them. Imperfections such as knots, gum seams and decayed portions, if left after barking, are removed by placing the blocks under a "splitter" which splits off the imperfect portions, but usually the block is suitable for "grinding" as it comes from the barker. It is then placed in the "grinder." This consists of a grindstone set upon a shaft directly driven by a water wheel at great speed. The "stone" is enclosed in a steel case with openings or "pockets" at two or three points in the circumference. The wood being placed in these pockets, is forced by hydraulic pressure "side-on" against the surface of the revolving stone. The object is to disintegrate the wood by a sort of tearing rather than cutting action and upon the condition of the stone, the relative speed and pressure, the quality of the pulp mainly depends. A continuous flow of water on the stone prevents charring of the wood and carries away the fibrous particles as they are rapidly separated from the block. The continuous use of from 75 to 100 horse-power is required to produce a ton of pulp in 24 hours. Sometimes as much as 500 horse-power is applied to one stone. The pulp-laden streams of water from the different grinders are then converged and directed upon a series of "screens" which strain therefrom the coarse particles. If the pulp is to be used at once for making paper in the same establishment, it either goes to the "reducers" which withdraw a large quantity of the water, thereby increasing the consistency of the liquid to a pulpy mass, which is then stored in tanks; or, if it is to be transported or stored for future use, it passes from the screens in the same diluted condition to the "presses." The press consists of a revolving drum covered with a very fine wire mesh which permits the water to be drawn through and discharged while the pulp fibres are deposited on its surface. The thin film of pulp being allowed to build up layer on layer is removed as fast as it reaches a suit-





1. Cutting logs into Pulp wood lengths.

2. Fourdrinier Paper Machine.







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able thickness for handling. The sheets of pulp thus formed, containing water and pulp in about equal proportions, are folded up into "laps" averaging 25 pounds in weight each, and are then in convenient shape for handling and transporting.

*Sulphite Pulp.*—The two most important chemical processes for making pulp are the "sulphite" process and the "soda" process, both used principally in reducing wood to pulp, although the soda process in a somewhat modified form is used in treating straw, if intended for high grade papers, and in England esparto. In the sulphite process the wood is prepared as for the ground wood process. The prepared blocks of pulp wood are then "fed" lengthwise to a "chipper" or set of knives which, revolving with great speed, transform the wood into small "chips." The purpose of this is to facilitate the permeation of the wood by the "liquor" in which the chips next are immersed in the "digester." The digester is a massive upright stationary steel vessel (of an average capacity of 8 or 9 tons of pulp) usually lined with cement or other material unaffected by acids. The liquor with which the digester is filled after the chipped wood is introduced is a solution of sulphurous acid ( $\text{H}_2\text{SO}_3$ ). The making of this liquor is an important feature of this process as upon its correct chemical composition the quality of the pulp largely depends. It is made by passing the fumes of sulphur which is burned in especially designed "retort furnaces" either into a "tower" filled with limestone over which water is trickling or through "tanks" containing lime in solution with water. The result in both cases is the formation of a solution containing a bi-sulphite. Hence, the name "sulphite" pulp. After the digester is filled with chips and liquor it is closed hermetically, steam is forced in under pressure of 80 to 100 pounds and the chips are allowed to "cook" from 8 to 12 hours. Then the contents are discharged into "blow-pits" or vats beneath and washed by a stream of water which removes all traces of the liquor they have been cooked in. The pulpy mass is then screened and pressed and put up in laps, similarly to the manner in which ground wood pulp is treated. In the process of "cooking" the intercellular portions of the wood are dissolved and the nearly pure cellulose fibre remains. Much care is necessary to stop the cooking at just the right point so as to leave the fibre properly freed from the surrounding substances, but unimpaired in strength. The bulk of the wood is reduced nearly one half, whereas in the ground wood process, both the cellulose and intercellular matter are preserved and the prepared wood (dry) and pulp are nearly the same, weight for weight, the only loss being in the mechanical process of removing the imperfectly ground wood. For high grades of paper "sulphite" is bleached.

*The Soda Process.*—For this purpose poplar is mostly used, although many similar woods may be used. The wood is prepared in chips as already described and cooked in digesters, generally stationary, containing a solution of caustic soda. The pulp is discharged into iron tanks and "washed" thoroughly—to remove the freed organic matter and the alkali. The washing is so done as to use a minimum quantity of fresh

water, as the "recovery" of the soda from the liquor used in washing is an important feature of this process. It is so successfully performed that in some mills as high as 90 per cent is recovered. The liquor is first "evaporated" under a partial vacuum by steam until it is of about the fluidity of melted pitch. In this state it passes into a revolving drum-like "furnace" where combustion is set up by means of a flame from an adjoining fire-box, burning wood or coal, which coming in contact with the pitchy liquor, ignites it. The residue is a "black ash" which is then causticized with lime and becomes suitable for use again. Soda-pulp, partly on account of the nature of the wood itself and partly on account of the drastic treatment, is of a much softer quality than sulphite, has a shorter fibre and therefore less strength and the yield is less. It requires bleaching to fit it for use in all except dark colored papers, as without bleaching it is of a brownish color.

*Rags.*—Cotton rags, consisting as they do of the nearly pure cellulose fibre and linen rags, being composed of fibres which have already undergone a treatment of maceration and "retting" to remove the intercellular matter, have only to be "cleaned" and separated into the individual fibres to prepare them for paper-making proper. The various preparatory steps are threshing, picking, sorting, and cutting into small pieces. These pieces are next boiled from 12 to 18 hours under steam pressure in a weak solution of alkali (milk of lime), contained in revolving boilers, usually horizontal, called "rotaries." This "kills" the colors and "starts" the grease and dirt so that when the cooked stock is placed in a "washer," the impurities are readily separated, leaving the fibres quite clean. It is necessary, however, if the stock is to be used for high-class papers, to bleach them with some compound of chlorine. The "half stuff" is then let down into vats or "drainers" where the liquor is allowed to drain off.

*Converting the Pulp into Paper.*—Paper-making, in the restricted sense, begins with assembling the pulps and other materials, and mixing them thoroughly at the same time further disintegrating the fibres. This is done in a "beater" or oval-shaped tub of an average capacity of about 1,000 pounds of paper in which revolves a horizontal roll with steel blades on the surface, running parallel with the shaft. As the roll revolves the blades draw the "stock" between their edges and a "bed plate" of steel, thus "brushing out" or separating the fibres. It will suffice from this point to describe the process of making news paper which is essentially the same as in all kinds of paper with certain modifications of which the most important will be noted. The beater is "furnished" with sulphite pulp and ground wood pulp in the proportion of about one to three. Other kinds of paper have their appropriate "furnish." Sometimes a small percentage of clay or other mineral "filler" is used, the quantity varying with the kind of paper to be made. The filler improves the color, surface and "feel." "Size" which is rosin in a saponified form is added and has the effect in the final drying process of forming a kind of "varnish," rendering the paper less absorbent. It also helps "fix" or hold the "filler," increasing the strength. Coloring matter, which in news paper is generally



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"aniline blue" is put in, usually in solution. Alum is added as a mordant to "set" the color and also to "free" the resin in the size and "set" or deposit it. After a thorough mixing in the beater the pulpy mass or "stock" is usually passed through a "refining engine," the most common type of which is known as the "Jordan." The purpose of the Jordan is to supplement the brushing out and mixing which has already occurred in the "beater" and to shorten the fibres if desired. It consists of a cone which revolves in a stationary conical case, the outer surface of the cone and inner surface of the case being set with numerous blades, the two sets of which can be made to approach as near each other as desired. The relative position of the blades determines the length of the stock which continuously passes between them. After leaving the "Jordan," the stock is "screened" and then pumped upon the paper machine proper, having been thinned or diluted at various points of its passage so that when it comes upon the machine, it behaves in all respects like an absolute fluid. The Fourdrinier machine on which all news paper is made, may be divided into the "wet" part and the "drying" part. On the wet part the paper is "formed" and given a consistency which properly entitles it thereafter to be called paper, the rest of the process consisting in still further increasing its consistency, drying it, giving it surface, etc. The liquefied stock, having come to the machine, flows from the "head box" through a wide aperture or mouth over an "apron" and upon an endless horizontal wire cloth moving forward continuously. The relative rate of "flow" and "speed" of the machine determine the thickness or weight of the paper. The spread of the stock sideways is limited by two endless rubber straps called "deckles," one at each edge of the "wire." The water immediately begins to drain off through the wire and the fibres to deposit upon its surface. Through various devices so much of the water is removed that when the film of fibres reaches the point where the wire returns on its backward course, it is sufficiently compact or "felted" to be separated from the wire and conveyed by "felts" to and through the "presses" of which there are two or three. The presses are massive rolls in pairs, the paper supported by woolen endless "felts" passing between them. After this the paper readily carries itself and passing over a short gap, it enters the "dryers." They are cast-iron cylinders from 20 to 30 in number varying on different machines from three to four feet in diameter, arranged in two horizontal tiers, one above the other. The paper passes partially around each dryer, going alternately from one tier to another, conveyed by endless canvases called "dryer felts," which serve to press the paper against the surface of the dryers heated by a constant passage of steam inside. Returning to the first formation of the sheet it is interesting to note the variety of means employed for disposing in the quickest possible time and within the most limited space, of the vast amount of water in which the fibre is at first suspended. First, gravitation draws the water through the wire cloth. This is facilitated by a large number of small "table" rolls immediately under and supporting the upper part of the wire which, as they revolve, tend by capillary attraction to

carry away the water and thus hasten its flow through the wire. The "shake" which gives to the wire a lateral movement back and forth, intended to distribute the fibres evenly and prevent their arranging themselves longitudinally or in the direction of the flow, tends also to hasten the draining off of the water. The wire, carrying the paper, passes over a series of "suction boxes" which have perforated tops and are subject to the action of exhaust pumps. The water is drawn through the wire and away through the suction boxes. Before the paper leaves the wire, it passes under a heavy "couch roll" which both presses out the water and by reason of being covered with a "jacket" of felt with exceedingly long nap, constantly absorbs water of which it is ingeniously rid by a "guard." The presses act in the same way as the couch roll, pressing out and absorbing more water. But notwithstanding all these devices, the paper reaches the dryers with usually not to exceed 30 per cent of stock in the sheet, the rest being water which has to be dried out as the paper passes over the dryers at the rate often of 500 feet a minute. From the dryers, it goes through the "calenders," a series of chilled iron rolls with polished surfaces arranged in a "stack," the paper going in at the top and passing out at the bottom to the "reel." This is practically an ironing process and by the regulation of the pressure of these calender rolls the requisite amount of "surface" is given to the paper. Book and fine papers are often "supercalendered" or passed through a second stack of calenders after the paper has been taken from the paper machine. When the paper leaves the calenders and is reeled, it may be considered to be made. All that remains is to trim off the rough or "deckle edges" on the "slitter" where as it unwinds from the reel, it passes between rapidly revolving knife-like disks. If it is desired to divide the width of the sheet it is done at this point by adding one or more sets of "slitter blades" according to the number of divisions of the sheet desired. Finally comes the "winder." If the paper is intended to be marketed in rolls it is wound on either an iron "core" or as is now more usually the case, on a core made from heavy tough paper, until the desired diameter is reached, when the rolls are taken away to the "finishing" section where they are "finished," that is, wrapped in stout paper securely pasted and marked. They are then ready for shipment. "Sheet" paper was formerly cut into sheets by a "cutter" attached to the paper machine, but as the speed of the machines has increased this practice has been almost entirely abandoned and now it is usual to run the paper into rolls which are taken to the finishing section and cut into sheets on a cutter, the sheets then being "counted" and done up into "bundles."

*Machine or Tub Sizing.*—Fine papers, besides sometimes being "sized" in the beater, are usually sized on the paper machine, the web passing through a "tub" of some heated gelatinous mixture ("animal size"). The paper is either dried (1) wholly on the machine or (2) partially, and then after being cut into sheets is hung in "lofts" to complete the drying.

*Water Marks.*—Water marks are produced by a "dandy," a skeleton cylindrical roll covered with wire cloth, mounted over the "wire" be-



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tween the first and second suction boxes, and resting on the web of paper. The design for the water mark is raised on the surface of the dandy and impresses itself on the paper. "Laid" paper is made with a dandy so covered with wires as to make an impression of parallel lines running lengthwise about an inch apart crossed at right angles by lines quite close together. The dandy also helps "form" the paper.

*Coated Papers.*—To meet the requirements of certain kinds of presswork, some papers are "coated" on one or both sides with china clay or other mineral substance, which gives an exceedingly smooth surface without the hardness of supercalendered papers.

*Cylinder Machines.*—The distinguishing feature is the use of a drum covered with wire (instead of the horizontal endless wire of the "Fourdrinier") which operates the same as the pulp press, already described. Several cylinders can be used on the same machine, each making a separate web, all of which are brought together before passing into the presses, thus making paper of as many "plies" as there are cylinders. This principle is taken advantage of to make composite papers, one ply being of one quality, another of another, and also to make very heavy papers.

*Combinations.*—The most striking of recent changes in the industry in the United States is the consolidation of many mills under one ownership and management. Already a majority of the "news," "writing," and "boards" mills have thus come together, forming the largest companies in the world in their respective branches. There is a national organization of paper manufacturers of the United States known as the American Paper and Pulp Association, founded in 1878.

*Exports.*—The export business of the United States was insignificant until 1878 when the "paper and manufactures thereof" exported amounted to about \$1,000,000. For the year ending June 1903, the amount was more than \$7,000,000. The exports consist largely of news paper which goes principally to England and Australia.

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**Paper-birch.** See BIRCH.

**Paper Hangings.** See WALL-PAPER.

**Paper Industry in America.** If the paper-making industry is not one of the largest it is, at least, one of the oldest of the American industries, for it was as early as 1690 that William

Rittinghuysen, an experienced papermaker from Broich, in Holland, entered into partnership with William Bradford, the printer, and together they opened the first paper mill ever established on American soil. It was located on a creek since known as Paper-Mill Run, conveniently near Philadelphia, and here a very fair quality of paper was manufactured out of pulp made from the rags of the home-grown flax. As the colonists had no other paper mill for fully twenty years, when William de Wees, a brother-in-law of Rittinghuysen's son, opened a rival establishment in close proximity to the first one, the enterprise was a profitable one, in spite of the fact that the making of paper by hand—the only method known in those days—was a laborious and costly process. In fact, this primitive system was in vogue in America until 1756, when the first pulp-engine to be introduced in this country was imported from Holland.

As the use of the new pulp-engine materially reduced the cost of production the demand for paper naturally increased in the colonies, and, within less than fifteen years, there were fully 40 mills in various parts of Pennsylvania, Delaware, and New Jersey, that were turning out an aggregate annual product valued at more than \$500,000. In 1794, another large mill was established at Troy, N. Y., by Websters, Ensign & Seymour, and, during the same year, a mill for the manufacture of coarse wrapping paper from the bark of the basswood-tree was opened at Fairhaven, Vt., by Matthew Lyon. As this was the first establishment in the United States to attempt to make use of anything except rags for pulp, the enterprise attracted no little attention.

In the ordinary paper mills, however, the method of manufacture was still a crude process. To make paper the pulp was floated in vats, at the side of which stood the workmen, mold in hand. This mold was of wire cloth, around the outer edges of which a rim was formed by superimposing a thin frame called a "deckle," which prevented the pulp from flowing off, and left the water no other escape than through the bottom of the mold. Into this the pulp was dipped and, as the water drained away, the pulp was left in the form of a thin layer covering the bottom of the mold. At this point it was given to another man—a workman known as the "coucher"—whose duty it was to remove the mold. This was done by the application of a piece of felt to which the pulp adhered in the form of a thin sheet; a second piece of felt was then placed on top of this; to this felt another pulp-mold was applied, and this process was continued until the pile of alternate layers of pulp and felt had attained the requisite height. From this pile, or "post," as it was called, all the water was thoroughly expressed, and the pulp, separated from the felt, was pressed, and hung upon the "tribbles," or lines in the drying room. This portion of the process completed, the sheets were still rough and somewhat like blotting-paper, so it was necessary to dip them in size, and to press and dry them again, before they assumed the character of a finished product. Laborious as this method was, it was the only process known until after the beginning of the 19th century.

The first marked improvement in the art of paper-making came with the introduction of the Fourdrinier machine. This invention was origi-



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nally conceived by Louis Robert, a man employed as an ordinary workman in Francois Didot's paper-mill, at Essone, France. In 1799 he secured a patent for a process of making paper by an endless web-machine, but, as he was financially unable to carry such an idea into effect, he sold his rights to Leger Didot, who took the patent to London. It was nearly four years, however, before he was able to interest the necessary amount of capital, but in 1804 he succeeded in persuading two brothers, Henry and Sealy Fourdrinier, both wealthy London stationers, of the practicability of the scheme, and he finally transferred his interests in the invention to them. As the result, the machine has since borne their name.

In the meantime the paper-making industry in the United States had enjoyed steady growth. By 1810 the number of mills had increased to 185, and their annual product was valued at more than \$800,000. Already the demand for rags had become so great that the manufacturers, finding the domestic supply utterly insufficient, had commenced to import them. In 1817, the first power-mill in the country began operations at Pittsburg, Pa., and, about the same time, Thomas Gilpin & Co., of Wilmington, Del., commenced to make paper by machinery. These machines, however, were of American invention.

Although the Fourdrinier machine was in use in England as early as 1806, it was not introduced in the United States until 1820. That it had revolutionized the making of paper there could be no doubt. By its use a seven-vat mill which had previously been operated at an annual expense of \$13,000, could now be run for a sum not in excess of \$3,600, and yet, while the American manufacturers knew all these facts, the cost of such machines was so great that they hesitated to introduce them. They consisted of an endless web of wire cloth. As it revolved a stream of liquid pulp flowed over it evenly, the precipitation of the water through the cloth being so nicely adjusted that it was completed at the very moment in which the pulp-sheet met an endless belt of felt, which not only removed the pulp from the wire, but bore it on, through the heavy metal rolls which pressed it, separated it from the felt, and passed it over the steam heated cylinders upon which it was dried, expelling it, at last, in a condition ready to be polished and cut into sheets.

As rag pulp is still used in the making of expensive grades of paper, the preliminary process to which rags are subjected is interesting. First cleansed and softened by being boiled in a strong lye of caustic alkali or lime, the rags are then placed in a washing machine, in which a heavy cylinder, with knives attached, partially macerates them. Everything except the vegetable fibre itself is then removed, a solution of bleaching powders is added, and the mass is left in stone vats to bleach as long as may be necessary. This process completed, the substance left is taken to the beating engines, where, after it has been thoroughly washed with water to remove all trace of the chlorine, it is reduced to pulp and transferred to the Fourdrinier machine. Of course, during the past hundred years, so many changes have been made in this mechanism, so many modifications and improvements, that it is difficult to realize that it bears any relationship to the original invention. In spite

of this, however, the process is practically the same, although, to-day, the pulp that goes in at one end comes out at the other a finished product.

In 1809, an English manufacturer named Dickinson perfected another invention for making paper. It was called a "cylinder-machine," and differed from the prior invention by being fitted with a hollow, perforated, wire-gauze-covered cylinder, which operated directly in the pulp-vat by drawing out the water and leaving the sheets of pulp on the gauze, by which it was conveyed to the felt belt, and, thus, through the couching-rolls. In other respects it followed the principles of the Fourdrinier machine.

The American invention, which was first used in 1817, was of similar construction, but no other machine was known in this country until 1820, when the Gilpins imported machinery for making paper. The story of the next ten years is one of invention and improvement. In 1822, John Ames, of Springfield, Mass., invented a new cylinder-machine, and, in 1829, this invention had been so improved that its general use was assured. It was in this year that straw and grass were first used in making paper by Shryock, of Philadelphia; in 1830, the manufacture of Fourdrinier machines was commenced in Connecticut by Phelps & Spofford, and, in 1831, the discovery of the value of chlorine in cleansing pulp-fibre permitted the use of hitherto unavailable substances for paper stock. By 1850, there were only five mills in this country that still clung to the hand-made process of paper-making and paper-machines had been so greatly improved that laid paper was, at last, produced by that method.

The general use of straw paper began in 1857. Some three years previous to this time, a Frenchman named A. C. Mellier, had succeeded in converting several vegetable fibres, notably straw, into pulp which he believed would be suitable for use in the manufacture of paper. The process, which has since borne his name, was neither a difficult nor a costly one. The straw was first thoroughly soaked, and, after it had been cleansed, it was boiled, at a temperature of not less than 310° F., in a solution of about four per cent. of caustic soda. Although Mellier peddled his idea from one end of the country to the other, the big manufacturers of paper did not seem to consider the scheme a practicable one, and three years, therefore, elapsed before he was able to persuade anybody to invest their money in his project. The man who finally undertook to manufacture paper by this process was J. B. Palser, a member of the firm of Howland & Palser, but the factory which they established at Fort Edward, N. Y., for the express purpose of carrying Mellier's idea into effect proved an excellent investment. In 1859, Palser himself patented some important improvements upon the process, and from that day straw paper became one of the staple grades of the market. One of the direct effects of this innovation in the paper industry was the rise in price for rye straw from \$6 to \$20 per ton. Of course, straw paper was by no means a perfect product and was not entirely suited to many of the purposes for which it was used. Thus, for example, the silicious character of the straw was shown in the hard, brittle surface of the paper, a factor which alone represented a great disadvantage, especially from the printer's point of view, for such paper wore out type about



PAPER MONEY — PAPIER-MACHÉ

four times as fast as the softer surfaced papers had done. Moreover, the glassy surface of the paper did not tend to durability, and yet, in spite of all these objectionable features, nearly all the newspapers were printed upon it, even until after the Civil War, but no great regret was felt when it was finally superseded by wood-pulp paper.

The quarter of a century that passed between 1830 and 1855 was largely an experimental period in the history of paper-making. During this time every substance that could possibly have possessed the requisite fibrous qualities was put to the test. Rags were out of the question, even straw was rapidly becoming too expensive, and other fibres had proved generally unsatisfactory. In 1854, however, Wells & Burgess, of London, obtained a patent for a chemical wood-pulp, and, a year later, Hugh Burgess, of Pennsylvania, invented a process by which the wood of the poplar might be used. The use of ground wood-pulp dates from 1844, when a German, named Keller, invented a wood-grinding machine of such practicability that Voelter, the manufacturer, quickly purchased the invention. It was Voelter himself, however, who first conceived the idea of grinding wood by stones and it is due to this development of the original machine that he is so commonly credited with having been its actual discoverer. It was about 1847, that, having perfected his improvements, Voelter began to use the ground wood-pulp, not only in the making of newspaper, but for many other purposes, and, about two years later, the same system was adopted by the French manufacturers at Souche. The use of this material in the United States was first made by Alberto Pagenstecher, whose factory was located at Stockbridge, Mass., but, while he was very successful in making paper from ground wood, it was not put into printing-paper until 1867, when Wellington Smith, Warner Miller, and William E. Russell adopted that process. Since the introduction of wood-pulp, however, the paper industry has grown with great rapidity. Whereas, in 1850, the 500 mills, with their capitalization of about \$18,000,000, were producing paper to the value of about \$17,000,000 per annum, in 1870, the number of mills had increased to 669, and the annual production to \$48,436,935. The following table, compiled from the last report of the United States Census, shows the status of the industry since 1870:

AMERICAN PAPER INDUSTRY.

	1880	1890	1900
Number of establishments.....	742	649	763
Capital.....	\$48,139,652	\$89,829,548	\$167,507,713
Wage earners.....	25,631	31,050	49,646
Wages.....	\$8,970,133	\$13,204,828	\$20,746,426
Value of product.....	\$57,366,860	\$78,937,184	\$127,326,162

Another indication of the development of the industry may be seen in the statement of the exports and imports. In 1850, for example, the importation of rags amounted to \$750,000, while the imports of paper also aggregated nearly \$500,000. By 1870, trade conditions had so changed that while the importation of rags aggregated more than \$4,000,000, the imports of paper amounted to scarcely more than \$350,000. In 1870, the amount of paper exported represented less than \$20,000, whereas, to-day, Amer-

ica's exportations of paper are far in excess of \$2,000,000.

**Paper Money.** See MONEY, PAPER.

**Paper-mouth,** a fish. See CRAPPIE.

**Paper-mulberry.** See MULBERRY.

**Paper-nautilus.** See ARGONAUT.

**Paper Pulp.** See PAPER AND PAPER MAKING.

**Paphlagonia,** păf-lă-gō'nī-a, an ancient geography, a division of Asia Minor, bounded on the north by the Black Sea (*Pontus Euxinus*), on the east by the River Halys, separating it from Pontus, on the south by Galatia, and on the west by Bithynia. Besides the Halys (now Kyzyl-Irmak), the waterways were the Amnias (Goek-Irmak), and the Parthenius (Bartin-Chai). The coast was fertile, the interior well wooded, game abundant, the principal industry sheep-raising, and the people famous horsemen. The region was subject nominally to Lydia, Persia, and Macedonia in succession, still keeping its own actually independent princes. After Alexander's death Paphlagonia and Cappadocia became a part of Pontus, and then a Roman province. The chief city was the Greek colony of Sinope.

**Paphos,** pā'fōs, two ancient cities on the island of Cyprus. The earlier, called "Old Paphos" (Palæpaphos) was founded by the Phoenicians on the southwest coast near the mouth of the river Bocarus, possibly in the 10th century B.C., and was the sacred city of Aphrodite, probably not the Greek goddess but the Semitic Astarte, whose famous temple, the object of pilgrimage in the pre-Christian era, is now entirely destroyed, save for a fragment of the cyclopean masonry still preserved at Kuklia, the present town. The new city (Neapaphos), ten miles northwest of the old, was a Greek colony, of great marine and commercial importance; in Roman times it was the capital of the island; it is now called Baffo. Consult: Cobham, 'Bibliography of Cyprus' (1886); Ohnefalsch-Richter, 'Kypros' (1893); Enlart, 'L'Ile de Chypre' (1897, in 'Bulletin de la Société Géographique').

**Papias,** pā'pī-as, Christian writer, bishop of Hierapolis. He is described by Irenæus and later writers as a "hearer of John and a companion of Polycarp." He suffered martyrdom at Pergamus in 163 A.D. He was one of the earlier believers in the millennium, that is, the personal reign of Christ on earth for a thousand years after the resurrection of the dead, and was the author of five books of commentaries on the saying of our Lord (Λόγων Κυριακῶν Ἐξηγήσεις) a few fragments of which are extant. It is from them that we learn that Saint Matthew's Gospel was traditionally believed to have been written in Hebrew, and the evangelist Mark to have been the interpreter or amanuensis of Peter in writing the Third Gospel. Consult: Hall, 'Papias and His Contemporaries' (1899); Weissenbach, 'Das Papiasfragment bei Eusebius' (1874); 'Die Papiasfragmente über Marcus u. Matthäus' (1878).

**Papier-maché,** păp-ī-ă' mā-shā, a manufacturing material or substance made of cuttings of white or brown paper boiled in water, and beaten till they are reduced into a kind of paste, and then boiled with a solution of gum arabic or of size to give tenacity to the paste. Sulphate



of iron, quicklime, and glue, or white of egg, are sometimes added to enable the material to resist the action of water, and borax and phosphate of soda to render it to a great extent fire-proof. It is used for making all sorts of useful and ornamental articles that can be formed in molds. When dry the objects are usually covered with a mixture of size and lampblack, and often ornamented with colored designs, or inlaid with mother-of-pearl, and lastly they receive a coat of varnish. Sometimes the papier-maché is made by pasting or gluing sheets of paper together, and pressing them when soft into the form which it is desired to give them.

**Papil'io**, a genus of butterflies (q.v.), popularly known as "swallow-tails" from the prolonged appendages of the posterior margin of the hind wings. The technical characters of the genus are found in the venation of the wings: Internal vein of hind wing wanting, its place occupied by the submedian; median and submedian veins of fore wing united by a cross-vein, from the submedian end of which a short internal vein arises. The caterpillars are smooth and fleshy, and when disturbed protrude from the region of the thorax a pair of soft filiform "stink-horns" giving an offensive odor. The chrysalids are angulated and naked, and are suspended by a loop of silk passed about the middle and by a silken button at the caudal end. Although the imagos vary greatly, they are usually of large size and showy colors. Probably upward of 500 species are known, abounding in tropical countries; the genus is very poorly represented in Europe, but North America has nearly thirty species. Among our best known eastern species are *P. asterias*, a handsome black and yellow form; *P. turnus*, with the wings a rich yellow bordered and barred with black, and *P. troilus*, generally rusty black with the posterior half of the hind wing greenish blue. The Ajax butterfly (*P. ajax*) is one of those interesting species which exhibit seasonal polychromatism. It somewhat resembles the *Asterias*. The *P. philenor* is another black species, but it lacks the yellow spots and shows a beautiful greenish reflection on the upper surface of the wings. The caterpillars of papilios are somewhat destructive to particular plants, but have not the economic importance of the cabbage butterflies (*Pieris*, etc.), which, like them, have the front legs well developed and are placed with them in the family *Papilionidæ*.

**Papil'iona'ceæ**, a division of plants, usually treated as a family of the *Leguminosæ*. They comprise both herbs and woody plants, and many are stem- or tendrill-climbers. The leaves are generally oddly pinnate. The flowers are disposed in racemes, more rarely in heads, and their distinguishing characteristic is that when the corolla is full blown, the superior petal resembles the extended wings of a butterfly (Latin, *papilio*). Examples are the blossoms of the pea and bean. The papilionaceous corolla consists of five petals. The superior petal, which usually folds over the inferior ones in æstivation, is called the *vexillum* or standard; the two lateral ones are called the *alæ* or wings; and the two inferior ones, which are often united slightly by their lower margins so that their union resembles the keel of a ship, are called the *carina* or keel. These last two petals are usually

wholly or partially enfolded by the *alæ*, and themselves enfold the reproductive organs. The *Papilionaceæ* form an extensive group, divided into seven tribes and containing more than 300 genera. They occur in all parts of the world, but are especially well represented on the steppes of southern Russia and western Asia. The family includes several cultivated plants of importance (peas, beans, lentils, soy-beans, etc.; yield gums and dyes; and in one case (*Laburnum-seeds*) furnishes a poison.

**Papil'la**. See SKIN.

**Papin**, pā'pīn (Fr. pā-pān), **Denis**, French physicist: b. Blois 22 Aug. 1647; d. England about 1714. He practised medicine for a time at Paris, but turned his attention to physical sciences, assisted Huygens in the construction of the air-pump, and during a visit to England was admitted a fellow of the Royal Society. Being a Protestant, the revocation of the Edict of Nantes prevented his return to his native country, and on leaving England he settled at Marburg, in Germany, in 1687, as professor of mathematics. But he again came to England in 1707. The real importance of Papin's many researches and experiments was long unperceived. He invented the double air-pump and the air-gun, a "digester" for cooking by means of liquids under produced atmospheric pressure, and the safety-valve, first used in the "digester." In 1690 he constructed the first steam-engine with a piston, and in the same year a boat with a paddle wheel revolved by a water-wheel supplied by means of a pumping-engine. Consult: Thurston, 'Growth of the Steam Engine' (1878); Gerland, 'Life' (1881).

**Papineau**, pā-pē-nō, **Louis Joseph**, Canadian politician: b. Montreal, P. Q., October 1789; d. Montebello, P. Q., 23 Sept. 1871. He was educated at the Seminary of Quebec, studied law, and was admitted to the bar in 1812, but while still a student in 1809 he was elected to represent Kent in the Canadian assembly. During the War of 1812 he was captain of militia. In 1811 he had succeeded his father as member of assembly for one of the districts of Montreal and in 1817 he was elected speaker, which office he held for 20 years as leader of the French-Canadian party. He was continually at variance with the royal governors and in 1827 Lord Dalhousie adjourned parliament and resigned rather than allow Papineau to take his seat as speaker. He disapproved the union of Upper and Lower Canada and in 1834 framed the "Ninety-two Resolutions" which were sent to England in exposition of the grievances and demands of his party. In 1834 he consulted with William Mackenzie, the revolutionary leader of Upper Canada, regarding the consolidation of their forces and in 1837 was deprived of his office of captain in the militia. In that year he attended the meeting in which a revolution was decided upon, and a warrant was issued for his arrest for high treason, though he had fled to the United States at the outbreak of the rebellion. He escaped to France, but was pardoned in 1847 and returned to Canada. He again entered parliament, but finding himself without influence retired in 1854. See Read, 'The Canadian Rebellion of 1837' (1896); Kingsford, 'History of Canada' (1887-98).



**Papinianus**, pā - pîn - ĭ - ā'nūs, *Æmilius*, Roman jurist: b. about 140 A.D.; d. 212. He accompanied the Emperor Septimius Severus as prætorian prefect to Britain, and was put to death by Caracalla. Papinianus was the chief of all the Roman jurists. His most important writings were his 37 books of 'Quæstiones' (legal questions) and 19 of 'Responsa' (decisions). A few fragmentary portions exist as excerpts. These works were, until the preparation of the Pandects by Justinian the main repository of jurisprudence connected with the exposition of original authorities. In the Pandects (q.v.) many extracts from him appear, forming about one twelfth of the total number there given. Consult Brinz, 'Die Berliner Fragmente vor-justinianischer Rechtsquellen' (1884).

**Pappenheim**, pāp'pĕn-hĭm, **Gottfried Heinrich**, COUNT, German military officer: b. Franconia, Germany, 29 May 1594; d. Leipsic, Germany, 7 Nov. 1632. He was educated at Altdorf and Tübingen, entered the army, and as a colonel in the battle of Prague, 1620, was distinguished for his bravery. In 1623 he was appointed by the emperor to the command of a regiment with which he served in Lombardy until 1625, and in 1626 he crushed an insurrection in Upper Austria in which 40,000 peasants were killed by his forces. At Magdeburg with Gen. Tilly in 1830 he is charged with great cruelty; he fought with Wallenstein at Leipsic in 1831, and was fatally wounded at the battle of Lützen in 1832. He was a man of indomitable courage but rash and impetuous. Consult Hess, 'Gottfried Pappenheim' (1855).

**Pap'pus**, Greek mathematician. He lived at Alexandria toward the end of the 3d century of the present era. His great work, 'A Mathematical Collection,' is the source of all our knowledge of ancient Greek mathematics. Only a mutilated portion of the original eight books is extant, and this contains, besides geometrical problems and theorems, an essay on mechanics. These fragments were published by Hultsch at Berlin in 1876-8.

**Pappus**, the downy appendage that crowns many single-seeded seed-vessels, such as the down of the dandelion, etc. It represents the calyx of the flower, and may be pilose, with the threads unbranched, or plumose, with feathery threads; sessile, with the threads resting directly on the achenes; or it may be supported on a longer or shorter beak. It acts as a parachute in directing the fruit when it becomes separated from the parent plant. The term pappus may also be applied to other forms of a persistent calyx, as a crown or a circlet of scales. In such plants as the dandelion the interweaving of the stipitate pappi produces an extremely beautiful and delicate arrangement.

**Pap'ua**. See NEW GUINEA.

**Papuan Subregion**, a faunistic subdivision of the Australian Region which embraces the mountainous, heavily forested islands of the Papuan archipelago, north of Australia. See ZOOGEOGRAPHY.

**Papy'rus**, a species of sedge (*Cyperus papyrus*), a native to Egypt and Palestine, but now extinct in the former country, though found higher up the Nile Valley. It has been introduced into many warm countries, where it has

spread in damp soils. It has a perennial rootstock which is tough, woody, and aromatic. From this arise the long sharp-edged, sharp-backed leaves and the stout, smooth, erect, bluntly three-angled stems which often exceed six feet in height. They bear a large umbel of attenuated branchlets but no leaves. Because of its striking appearance the plant is a favorite in aquatic gardens, but not being hardy it is started in the greenhouse during early winter and transplanted to its summer quarters. Root-division is the favorite method of propagation, the plants for this purpose being brought in from the garden as soon as frost approaches in the autumn. The plant has been used for many purposes such as for making boats, baskets, boxes, and wicker work; its fibres, for making twine, rope, sailcloth, and mattings; the pith of the stems for food; and the dried rootstocks for fuel. It is far more famous, however, as the material from which Egyptian "papyrus" or paper was made, a use which has suggested its most popular name — Egyptian paper-plant. It is the *gome* of the Hebrew Scriptures, translated "bulrush" in King James' Bible. For making paper the thin fibrous skin was removed, the white substance of the stems cut into long thin sheets, and pressed together, after being laid crosswise in double layers, when it adhered by its own gluten and made continuous sheets of any desired length. See PALÆOGRAPHY.

**Pará**, pä-rä', **Gran Pará**, or **Grão Para**, grown pä-rä', maritime state of the Brazilian Confederation, lying on either side of the Amazon, bounded on the north by the Guianas (except Brazilian Guiana, a part of Pará) and the Atlantic, on the east by the Atlantic and the states of Goyaz and Maranhão, on the south by Matto Grosso, and on the west by Amazonas. Its area is 443,700 square miles. It has mountain ranges and plateaus on its interior boundaries, but its most striking physical characteristic is its great alluvial plain traversed by the lower waters of the Amazon and Tocantins systems, so that the state is unusually fertile and has remarkable facilities for commerce and transportation. There are settlements on nearly all the rivers: San Jose on the Jary, Almeirin on the Paru, Cametá on the Tocantins, Souzel, Porto de Moz, and Villarinho on the Xingu, Santarem on the Tapajoz, Obidos on the Trombetas, Macapá on the mouth of the Amazon, and Pará or Belem on the Pará. The india rubber trade, which now exceeds 22,000 tons a year, is building up towns in the interior away from the rivers. Cacao, vanilla, sarsaparilla, coffee, sugar, hides, copaiba, and Brazil nuts are the other leading products and exports of the state, which probably has large mineral wealth awaiting capital. The climate is equable and comparatively healthy, in spite of the floods along the river courses. The only railroad is from the capital, Pará (q.v.), to the coast. Pop. (1890) 328,455.

**Pará** (originally SANTA MARIA DE BELEM, that is, St. Mary of Bethlehem; and hence called BELEM, the present official name), Brazil, capital city of the state of Pará, lying northeast of Rio Janeiro on the Rio de Para, south of the Island of Marajo, in lat. 1° 27' S. and lon. 48° 30' W. It is connected with Bragança on the coast nearly 80 miles distant by a railway, and is an important port, the only one of the state; it has regular



# PARA — PARABOLA

steamboat connections with Brazilian, European, and North American ports, and is the seat of several consuls, one from the United States of North America. An episcopal city, it has a cathedral built in 1720, when the city was in its 106th year, a government palace, a library, lyceum, theatre, botanical garden, two seminaries, street railways, and gas-lights. There are several banks. Pará is the greatest rubber shipping port in the world; in 1898 the value of this item was \$68,850,000, out of a total of \$72,000,000, the other items being those mentioned in the preceding article. Pop. (1896) 90,122.

**Pará, Rio de,** arm of the sea, forming the embouchure of the Tocantins River on the northeast coast of Brazil, near the mouth of the Amazon, from which it is separated by Marajo Island. The island's southwestern boundary, the Pa-

circular base by a plane parallel to one of the elements. Its characteristic property is that every point therein is equidistant from a given point called the focus, and a given straight line called the directrix.

*Construction by Points.*—(See Fig. 2). Let F be the focus and the line DN the directrix, and draw FD perpendicular to the directrix. The point A, midway between F and D, will be on the curve, by definition, and is called the vertex. Take any distance  $DM > DA$ , draw PMP' perpendicular to DF, and, with F as a centre and DM as a radius, describe an arc. This arc will intersect PMP' in two points, P and P', which will give two points on the parabola. Proof:  $FP = DM = PN$ ,  $\therefore$  P is on the parabola by definition.

*Construction by Continuous Motion* (See Fig.

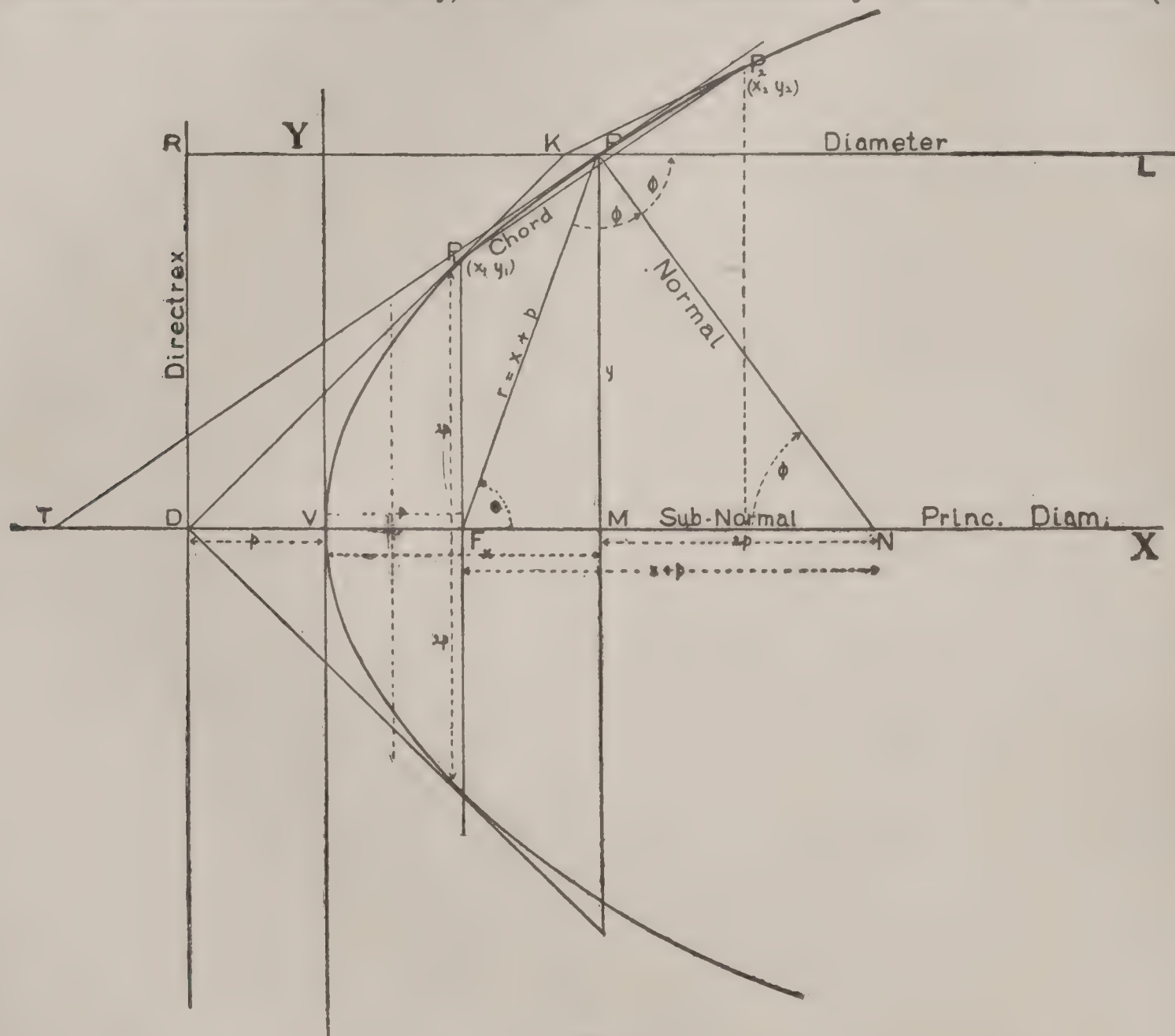


FIG. 1.

ranan, carries some of the water of the Amazon to the Para. The two rivers were no doubt connected even more closely formerly. The Para is 138 miles long, 20 miles wide opposite the city of Para and 40 miles wide at the mouth. It gives its name (which originally meant "river," and occurs in so many compounds, for example, Paraguay, Parana, Paranan, Parananagua) to the state and city of Pará (qq.v.).

**Para**, a Turkish and Egyptian coin, the 40th part of a piastre, valued at one fifth of a cent.

**Para, or Assai, Palm.** See PALMS.

**Parabola**, in mathematics, a plane curve and that one of the conic sections obtained by cutting the surface of a cone with a

2).—Fasten a string at S, one end of a right triangle, and the other end at F, making the length  $SPF = SN$ . With the triangle in any position, with the short side against a straight edge on DN, bring the string taught against the triangle with a pencil point at P. Move the triangle along the straight edge, that is, along the directrix, keeping the string taut and the pencil point against the moving triangle. The pencil will trace the parabola, since in every position  $PF = PN$ .

*History.*—The parabola is, with the exception of the circle, the oldest of the historic curves, tradition ascribing its discovery to the Greek mathematician Menæchmus (350–330 B.C.), as incident to an attempt to solve the problem of the two mean proportionals, to which



# PARABOLA

the famous Delian problem of the duplication of the cube has been reduced by Hippocrates of Chios. The object of this problem is to find two quantities,  $x$  and  $y$ , such that  $a : x = x : y = y : b$ , which requires that the equations  $x^2 = ay$  and  $y^2 = bx$  shall be satisfied simultaneously. Since these are equations of parabolas, the problem requires the determination of the coordinates of the point of intersection of the two curves. The parabola is also remarkable as the first curve whose area, included between the curve and any chord, was obtained. This is considered to be the greatest mathematical achievement of Archimedes (287–212 B.C.), introducing the "method of exhaustions," in many respects the same as that of the integral calculus. The parabola occurs frequently in the arts

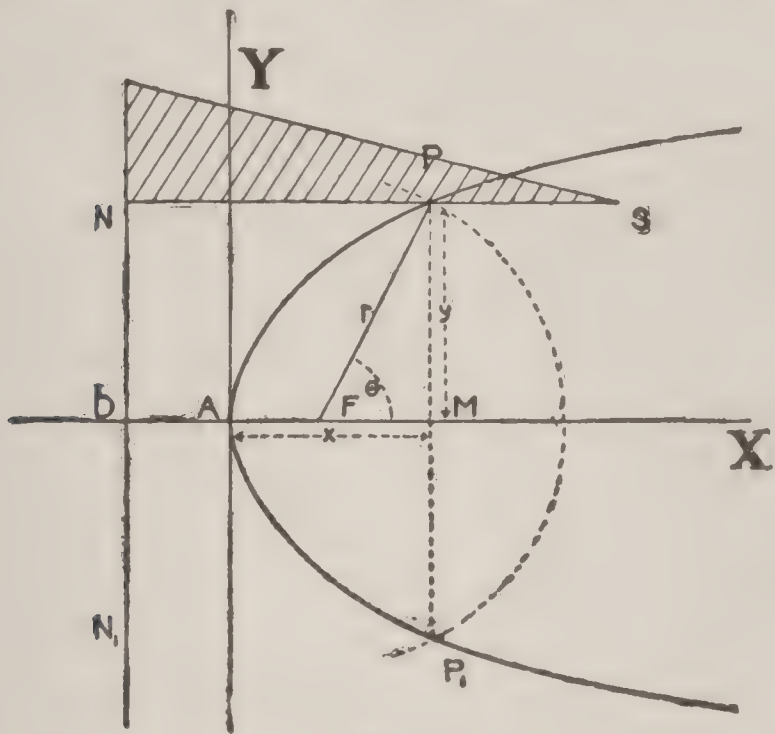


FIG. 2.

and sciences. The cables of a suspension bridge loaded uniformly hang in a parabola; the path of an unresisted projectile, as a cannon ball or a waterspout is a parabola; railway curves are frequently parabolas; and beams loaded in particular ways often bend into parabolic shapes.

*Equation of the Parabola in Cartesian Co-ordinates.*—The normal or simplest form of the equation is obtained by assuming the principal axes, that is, the line through the focus perpendicular to the directrix, as the X-axes and the tangent at the vertex as the Y-axes. (See Fig. I.) Denote the co-ordinates of any point P by  $(x, y)$ , and the distance VF by  $p$ . Then  $FP^2 = (x-p)^2 + y^2$  and  $VP = DM = x + p$  and  $(x+p)^2 = (x-p)^2 + y^2$ , which reduces to the equation of the parabola in the standard form (I)  $y^2 = 4px$ .

*Equation of the Parabola in Polar Co-ordinates.*—Assuming F as the pole and  $r$  and  $\theta$  as the co-ordinates of P, we have  $y = r \sin \theta$  and  $x = p + r \cos \theta$ ; substituting these values in (1) and solving for  $r$  we find as the polar equation of the curve (2)  $r = \frac{2p}{1 - \cos \theta}$ .

*Diameter of the Parabola.*—A diameter of any curve is defined to be the locus of the middle points of a system of parallel chords.

Let  $(x_1, y_1)$  and  $(x_2, y_2)$  be the co-ordinates of  $P_1$  and  $P_2$ , the extremities of the chord  $P_1 P_2$  (Fig. 2) and  $(x, y)$  the co-ordinates of the middle point. Since  $y_1^2 = 4px_1$  and  $y_2^2 = 4px_2$ ,

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{4p}{y_2 + y_1} = \frac{2p}{y} = m, \text{ where } m \text{ is the slope}$$

of the chord. That is, the equation of a diameter

is  $y = \frac{2p}{m}$ , which proves every diameter to be parallel to the principal diameter, whose equa-

tion is  $y=0$ . This occurs when  $m=\tan\frac{\pi}{2}=\infty$ ,

showing the principal axes as bisector of its chords at right angles.

*Equation of the Tangent.*—Since the secant  $\frac{y - y_1}{x - x_1} = \frac{4p}{y_2 + y_1}$  becomes  $\frac{y - y_1}{x - x_1} = \frac{2p}{y_1}$  when  $y_2 = y_1$  the equation of the tangent, defined as the limiting position of the secant as  $P_2$  approaches  $P_1$  reduces to the form (3)  $yy_1 = 2p(x + x_1)$ . The right line  $y = mx + b$  intersects the parabola  $y^2 = 4px$  in general in two points, determined

by  $x = \frac{bm - 2p}{m^2} \pm 2\sqrt{\frac{p^2 - bpm}{p}}$ . These become coincident when  $b = \frac{p}{m}$ , affording as the

equation of the tangent in terms of its slope, (4)  
 $y = mx + \frac{p}{m}$ . By transformation of co-ordi-

nates, the equation of the parabola referred to any diameter, and the tangent at its extremity may be shown to retain the normal form (5)  $y'^2 = 4px'$ , and it follows that (3) will also retain the same form. By assuming  $y$  or  $y'$ , as the case may be, equal to zero we find the  $x$  intercept of the tangent equal to  $x$  or  $x'$ , that is, the sub-tangent is bisected at the vertex.

*To Construct a Tangent.*—By virtue of the foregoing property, when the point is on the curve, construct the ordinate of the point and lay off the length of the abscissa to the left of the vertex. Connect this point on the diameter with the point on the curve. If the point is outside the curve, draw the diameter of the curve through the point, lay off the distance measured on this diameter from the point to the curve to the right of the temporary vertex, and draw the chord through the point thus determined parallel to the tangent at the temporary vertex. The line through the points in which this chord cuts the curve and the given point will be the required tangents.

*The Normal.*—Since the normal is the perpendicular to the tangent at the point of tangency, its equation becomes (6)  $y - y_1 = -\frac{y_1}{2p}(x - x_1)$ , which cuts the axis at the point  $2p + x_1$ .

The Subnormal is therefore constant and equal to  $2p$ . This property enables us to construct the directrix and the focus by laying off  $p$  to the left and to the right of the vertex,  $p$  being obtained by bisecting the subnormal. The focal radius  $FP = FN = x_1 + p$ , whence the angle  $FNP =$  the angle  $NPL$ ; that is, the normal bisects the angle between the focal radius and the diameter through any point. This property causes rays of light at the focus to be reflected in parallel rays, and is made use of in



## PARABOLANI — PARACLETE

parabolic reflectors. The two tangents  $y = mx + \frac{p}{m}$  and  $y = -\frac{1}{m}x - pm$  are perpendicular and intersect at the point whose abscissa is  $p$ ; that is, perpendicular tangents intersect on the directrix.

The *Latus Rectum* is the double ordinate through the focus and is equal to  $4p$ . The tangents constructed at the extremities of the latus rectum intersect on the directrix, and are therefore at right angles. The area of the parabola included between any chord and the curve is given by the formula

$$\text{area} = 2 \sin \theta \int_0^{x'} y' dx' =$$

$2 \sqrt{2p} \sin \theta \int_0^{x'} x'^{\frac{1}{2}} dx' = \frac{4}{3} \sin \theta. (2p)^{\frac{1}{2}} x'^{\frac{3}{2}} = \frac{4}{3}$  of the area of the parallelogram constructed with the chord and  $x'$  as its sides.

*Rectification of Parabola.*—The length of a parabolic arc is obtained as follows (see CALCULUS):

$$S = \int [1 + \left(\frac{dy}{dx}\right)^2]^{\frac{1}{2}} dy = \frac{1}{2p} y \sqrt{y^2 + p^2} + \frac{p}{2} \log (y + \sqrt{y^2 + p^2}) + C.$$

If the arc begins at the vertex, then  $s = 0$  when

$$y = 0, \text{ or } 0 = \frac{p}{2} \log p + c_1 \text{ whence}$$

$$S = \frac{1}{2p} y \sqrt{y^2 + p^2} + \frac{p}{2} \log \frac{y + \sqrt{y^2 + p^2}}{p}$$

*Radius of Curvature.*—The radius of curvature of the parabola at the point  $(x, y)$  is given by the formula

$$R = \pm \frac{[1 + \left(\frac{dy}{dx}\right)^2]^{\frac{3}{2}}}{d^2y/dx^2} = \pm \frac{(1 + \frac{p^2}{y^2})^{\frac{3}{2}}}{\frac{p^2}{y^2}} = \pm \frac{(p^2 + y^2)^{\frac{3}{2}}}{p^2}$$

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**Parabola'ni**, men whose duty in the early church was to attend on the sick and diseased. The term was originally applied to gladiators, and is derived from the Greek *parabolos*, reckless, in allusion to the courage with which these laymen nursed those who suffered from infectious diseases. Such functionaries were attached to all the principal churches of the East, and at Alexandria they formed a corps of 500 men. Theodosius the younger increased this number to 600, because plagues and contagious diseases were common in Egypt. This emperor placed them under the jurisdiction of the chief magistrate, but they were appointed by the bishop, whose directions they were bound to follow. As the parabolani were bold and indifferent to death, laws were enacted to prevent them from exciting seditions which were particularly common at Alexandria. Their number was limited by Theodosius, and they were forbidden to attend at public assemblies, and courts of justice, unless they had some business there sanctioned by the law. More than once they showed themselves deserving of suspicion, as for

example at the Council of Ephesus in 449, when a Syrian monk named Barsumas, at the head of a band of armed parabolani, committed outrageous excesses and terrified the council into granting his demands.

**Parab'oloid**, in geometry, a solid figure traced out by a parabola revolving round its principal axis. It is a characteristic property of paraboloids that they have no centres except in the extreme cases, when they have an infinite number of centres. There are three varieties of paraboloids, elliptical, hyperbolic, and parabolic.

**Paracatu**, pä-rä-kä-too', Brazil, town in the eastern part of the state of Minas Geraes, 450 miles northwest of Rio Janeiro, on the river of the same name, which is an affluent of the São Francisco. The city dates from the middle of the 18th century, in which it was the centre of a rich auriferous district. The gold-washings are no longer of value; cattle, hides, sugarcane, and coffee are its important products. Pop. about 15,000.

**Paracelsus**, pär-a-sel'süs (PHILIPPUS AU-REOLUS THEOPHRASTUS BOMBASTUS VON HOHENHEIM), Swiss physician, chemist, and charlatan: b. Maria-Einsiedeln, Canton Schwyz, 17 Dec. 1493; d. Salzburg 23 Sept. 1541. He acquired considerable real knowledge of medicine and chemistry, but spent his time in searching for a universal specific and the philosophers' stone. In his wide travels, extended to the East, he derived, in addition to the arts of alchemy and magic, a knowledge of certain remedies not then familiar to Continental physicians, and by this means effected numerous cures which brought him high prestige. In 1526 he became professor of medicine in the University of Basel, and there he burned publicly the works of Avicenna and Galen and declared himself the monarch of physic. He drew about him a school known as the Paracelsists, and claimed among his discoveries that of indefinitely prolonging life. In 1528, owing to a quarrel with the magistracy, he left Basel for a wandering existence in Switzerland, Alsace, and southern Germany. His methods of puffing long prevented a just estimate of him; but he is now seen to have enriched medicine and chemistry, and especially to have made great contributions to, if not to have founded, modern pharmaceuticals. A complete edition of his works (Latin) appeared at Basel in 1589. Consult the 'Life' by Hartmann (1887).

**Par'achute**, a mechanism of an umbrella shape, about 20 or 30 feet in diameter, attached to balloons, by means of which the aeronaut may descend slowly from a great height. It has a hole at the top to prevent oscillation. In 1783 the French physician Lenormand made several experiments with parachutes of 30 inches in diameter at Montpellier; and shortly after the machine (enlarged to something like its present dimensions) became well known through the public descents of Blanchard in Paris and London. Garnerin was the first to suggest their use for balloonists in case of accident. See BALLOON.

**Par'aclete** (*parakletos*, a counsellor; encourager; admonisher; or comforter), in the English translation of the Bible, the Comforter, the Holy Ghost. Jesus promised to his disciples (John xiv. 16) that his Father would send them another Comforter the Spirit of Truth, who



should abide with them forever, teach them all things (ver. 26), and bring all his sayings to their remembrance. It is also the name of a monastery near Troyes which Abelard founded and where he was buried.

**Par'adin**, a vegetable poison. See **HERB PARIS**.

**Par'adise**, the garden of Eden. The word is originally Persian, and signifies a park. It has been introduced into modern languages as a name for the garden of Eden (and hence of any abode of happiness). See **EDEN**.

**Paradise-bird**. See **BIRDS OF PARADISE**.

**Paradise Fish**, or **Fish of Paradise**, small Oriental fish (*Polyacanthus viridicaudatus*) allied to the climbing-perch (*Anabas*), which belongs naturally in the fresh-water streams, and is extensively bred in aquariums by the Chinese, on account of its brilliant coloring. Fantastic varieties, with greatly extended and modified fins and tail have been developed.

**Paradise Lost**, an epic poem in 12 books, by John Milton (q.v.), published in 1667. It has for its subject the fall of man. It ranks preeminently first among English epics, and as one of the great works of universal literature. Its vastness is suggested by the statement of a critic that its "horizon . . . is not narrower than all space, its chronology not shorter than eternity."

**Paradise Regained**, epic poem by John Milton, first published in 1671. It is supplementary to 'Paradise Lost,' but lacks somewhat of the strength and force of its predecessor.

**Par'adox**, that which runs counter to general idea and expectation, and appears accordingly to be incredible and incomprehensible, especially in literature or science.

**Paradox'ure**, a civet of the Oriental genus *Paradoxurus*, of which there are 10 or a dozen species popularly called palm-civets (q.v.). The tail is not prehensile but may be curiously coiled.

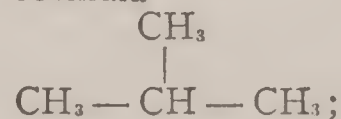
**Paraffin** (Latin, *parum affinis*, without affinity), a white, wax-like substance, solid at ordinary temperatures, which may be obtained by the distillation of carbonaceous materials, or of oily or coal-bearing shales. Crude petroleum oil is now the chief source of the commercial supply of paraffin. The oil is subjected to a process of fractional distillation, by which naphtha, kerosene, light mineral oil, and heavy mineral oil are successively obtained. The distillation is usually carried on until further application of heat would be likely to cause carbonization; and the paraffin is then left in the heaviest, least volatile portions. When the process is correctly conducted, the paraffin crystallizes out when the heaviest oil is allowed to stand in the cold; and it is afterward purified by washing with benzine, and by such further treatment as may be required. Paraffin is somewhat lighter than water, is insoluble in nearly all of the ordinary solvents, and is not affected readily by acids or alkalies. It is not a definite chemical substance, but consists of a mixture of hydrocarbons in varying proportions,—chiefly of those designated as "paraffins" (q.v.). It melts readily and without decomposition, but its melting point varies with its composition, and may range from 120° F. to about 200° F. It is greatly used for making

candles, either alone or when mixed with a small proportion of stearin. It is also used in quantity for coating acid tanks, for waterproofing paper, and other fabrics, for producing a high gloss in fine laundry work, and is an excellent electrical insulator, being used for impregnating the cotton coverings of electrical conductors, being also valuable in this application because it renders the cotton impervious to moisture. Paraffin is often called "paraffin wax." See **PARAFFINS**.

**Paraffins**, in chemistry, the series of hydrocarbons that have the general formula  $C_nH_{2n+2}$ . They are all distinguished by a marked chemical inertness, and derive their name from this circumstance. (Compare **PARAFFIN**.) The paraffins occur in nature in petroleum oil, and they are also obtained by the destructive distillation of coal, peat, carbonaceous shale, and numerous other substances. They may be roughly separated, from petroleum, by fractional distillation; but their exact separation, when mixed in such a general manner, is attended by the greatest difficulty. Many of them may be prepared, however, by heating the iodides of the alcoholic radicals with metallic zinc. Ethane ( $C_2H_6$ ), for example, may be obtained by treating metallic zinc with iodide of methyl,  $CH_3I$ ; the reaction in this case being  $Zn + 2CH_3I = C_2H_6 + ZnI_2$ . The best known of the paraffins are as follows, the temperatures opposite them being their boiling points:

Methane .....	$CH_4$	(Gaseous)
Ethane .....	$C_2H_6$	"
Propane .....	$C_3H_8$	"
Butane .....	$C_4H_{10}$	34° F.
Pentane .....	$C_5H_{12}$	100°
Hexane .....	$C_6H_{14}$	158°
Heptane .....	$C_7H_{16}$	210°
Octane .....	$C_8H_{18}$	255°
Dodecane .....	$C_{12}H_{26}$	396°
Hecdecane .....	$C_{16}H_{34}$	532°

The paraffins belong to the fatty series of hydrocarbons (see **FATTY COMPOUNDS**), and their constitutional formulæ therefore consist entirely of open chains, though these chains may be branched, as will presently appear. The formula for propane, for example, may be written  $CH_3-CH_2-CH_3$ . Any one of the paraffins may be regarded, from a structural point of view, as derived from the preceding member of the series by substituting the radical methyl ( $CH_3$ ) for a hydrogen atom. Thus if one of the hydrogen atoms in the right-hand methyl group of the foregoing formula for propane be itself replaced by  $CH_3$ , we shall have the new compound  $CH_3-CH_2-CH_2-CH_3$ , which is butane. A paraffin which contains only two methyl radicals is said to be a "normal paraffin"; and in the table of boiling points given above, the corresponding paraffins are all supposed to be "normal." Methane, ethane, and propane are not capable of existing in any but the "normal" form; but the higher paraffins may also exist in isomeric forms. In introducing the methyl radical in propane, for example, we replaced one of the hydrogen atoms in the right-hand  $CH_3$  group; but we might equally well have replaced one of those in the central  $CH_2$  group, and in that case the resulting compound would have had the structural formula





## PARAGUA — PARAGUAY

and while this compound still has the empirical formula  $C_4H_{10}$ , and is still known as "butane," there is obviously no reason for supposing that it would have the same physical and chemical properties as the butane which contains only two methyl groups. There are, in fact, two butanes known. One of these ("normal butane") boils at  $34^\circ$  F., has a specific gravity of 0.600, and may be prepared by the action of zinc upon ethyl iodide at  $300^\circ$  F. The other (known as "iso-butane," "trimethyl-methane," or "secondary butane") boils at about  $3^\circ$  F., and may be prepared by heating aluminum chloride with iso-butyl iodide; the iso-butyl iodide being prepared by the action of hydriodic acid upon iso-butyl alcohol, which, in turn, is obtained by the fermentive action of "*Bacillus butylicus*" upon sugar or glycerine. The higher members of the paraffin series admit of an increasingly great number of isomeric modifications, many of which have not yet been studied, nor even prepared. Dodecane, for example, may exist in as many as 355 different isomeric modifications.

**Paragua**, pä-rä'gwä, Philippines, a province including the part of the island of Palawan that lies north of the 10th parallel of latitude, the Calamianes Islands (q.v.) and the Cuyo Islands (q.v.); area of the mainland, 1,366 square miles, with the dependent islands, 1,635 square miles. The mainland of Paragua is mountainous, the central mountain range of Palawan extending from northeast to southwest; the rivers are numerous but short, as in the rest of the island. The staple crops are tobacco, rice, sugar, and vegetables, but nothing is raised for export; the forests are valuable and extensive; and gold, lead, and other minerals are found. The most important industries are stock-raising and the gathering of edible bird's nests. Cowries are also gathered in the islands and exported. The only mechanical industry is the weaving of textiles for home use. Civil government was established in this province in 1902, and the capital located at Cuyo, island of Cuyo. Pop. of the entire province, 49,850; of the mainland, 25,000.

**Paraguari**, pä-rä-gwä-rē', Paraguay, department, and capital city of the department in southern Paraguay. The city, 35 miles southeast of Asunción, is situated on an eminence overlooking a tributary of Lake Ipoa, and is on the railroad between Asunción and Encarnación. There is much trade in tobacco from Villa Rica and the surrounding country. The city, founded in 1775, was the scene in 1811 of a victory over an invading army from Argentina. Its growth has been remarkable. Pop. (est.) 7,000.

**Paraguay**, pä-rä-gwī' or pär'a-gwä, **Republic of**, a country of South America, enclosed between Brazil, Argentina, and Bolivia, extending from lat.  $20^\circ 10' 14''$  S. to  $27^\circ 35'$  S., and from lon.  $54^\circ 37'$  W. to  $62^\circ$  W. The total area is given as 121,973.68 square miles.

*Political Divisions, etc.*—The country is divided into two sections by the Paraguay River, the eastern section being called El Paraguay Oriental and the western El Gran Chaco (see CHACO, EL GRAN) or El Paraguay Occidental. For the purposes of government, Paraguay is divided into 84 departments, which are grouped to form 24 electoral districts, three of the districts being comprised in the capital and one

consisting only of Villa Hayes and its territory. The largest city and capital of the republic is Asunción (q.v.), pop. (1900) 51,719, including 4,541 foreign residents. Other cities and towns are: Villa Rica (25,074 inhabitants), connected by railway with the capital; Villa Concepción (13,654), commercially important, a port of entry and delivery on the Paraguay River; Caazapá (14,914); Luque (14,777), San Estanislao (10,920); Villa del Pilar (5,740); Villa Encarnación (10,742); Yuty (9,800); Capiatá (9,207); Carapeguá (13,930); Ytauguá (6,624); Villeta (7,072); Villa San Pedro (7,987); and Paraguari (9,128). A consequence of the government's efforts to encourage immigration and colonization is seen in the establishment of the following colonies:—Villa Hayes Colony, nearly opposite Asunción in El Gran Chaco, settled by families from Switzerland, France, Italy, Belgium, Germany, Austria, and Spain; San Bernardino Colony, settled principally by Germans; Colonia Nacional, on the railway from the capital to Villa Encarnación; Nueva Alemania Colony, in the department of San Pedro; Elise, or San Antonio, Colony, in the department of San Lorenzo de la Frontera; Nueva Australia Colony, containing Australians, English, and Paraguayans; Colonia Cosme, in the department of Caazapá, also inhabited by Australians; Colonia Guillermo Tell, a Swiss settlement; and the Hohenau Colony, a small community of German, Brazilian, and Paraguayan coffee planters. See also under the subtitle *Population*.

*Topography and Hydrography.*—The general level of El Gran Chaco and the lowlands of the western part of El Paraguay Oriental is approximately 250 or 300 feet above that of the sea; the eastern side of Paraguay is, however, much higher, with the exception of the extreme southeast, which is a low-lying, swampy region. An extension of the plateau or highlands of Brazil is seen in the northeast, the so-called Sierra of Amambay and lateral spurs running toward the Paraguay River. Through the centre of the country, from Villa Encarnación toward the northeast, run the cordillera of Villa Rica and the Caaguazú Mountains; and a transverse range, crossing the Paraná River into Brazil, forms the great cataract of Guayrá (q.v.). These ranges have an elevation above sea-level of 1,500 to 2,000 feet. The position of Paraguay Oriental has been aptly compared with that of the State of Illinois, for its southern boundary is at the confluence of two great rivers, and more than 800 miles above Buenos Ayres and the La Plata estuary. Of these rivers, one, the Paraguay, forms the western boundary below Asunción, while, above the capital, it passes between the eastern and western divisions of the republic, as already stated; the other, the Paraná, separates Paraguay from the Argentine Republic and Brazil on the south and southeast. A large part of the territory lying between these great streams is not yet well known. The Pilcomayo River, flowing southeastward from Bolivia, forming the southern boundary of Gran Chaco, and joining the Paraguay below Asunción, is navigable for a distance of 150 miles from its mouth. The Paraná flows 1,367 miles from its source in Goyaz, Brazil, before uniting with the Paraguay; the latter is about 1,800 miles long; both have large tributaries in Paraguay Oriental.











## PARAGUAY

*Mineral Resources and Soils.*—The northern part of Paraguay is covered with limestone, while the southern is of sandstone formation. Marble is abundant in the north, iron in the south. Several veins of copper have been found. Other minerals are: kaolin, in the department of Caápucú, Ibicuí, Quiquío, Villa Rica, Cordillera, Villeta, and Luque; talc; graphite; serpentine stone; basalt, near Villa Encarnación; porphyry, and arsenic. There are four distinct varieties of soil, namely, (1) sandy, either white or red, the latter being fertile; (2) a good agricultural soil, consisting of clay and quartz, oxide of iron, lime, and miscellaneous substances; (3) humus, characteristic of forest lands; and (4) the black alluvial deposits, prevailing in western Paraguay.

*Climate.*—Paraguay is regarded as a sanitarium by the inhabitants of some of the neighboring countries. The mean temperature at Asunción is about the same as that of Cairo, Egypt; Hongkong, China; and Caracas, Venezuela, while the mountainous interior regions are decidedly cooler. Rain is abundant throughout the year; snow is entirely unknown; storms, with accompanying high winds and very severe thunder and lightning, occur frequently.

*Forests and Agriculture.*—Woods which are valuable on account of their extraordinary durability and powers of resistance are characteristic forest products; many of these being so heavy that they sink when thrown into the water. Dyewoods of many varieties, medicinal and resinous trees, wild vanilla, etc., are found. The chief and most distinctive product of the country is yerba, the "Paraguayan tea," also called yerba maté; sugarcane, cotton, tobacco, mandioca, rice, maize, coffee, textile plants (caraguatá, ibira, etc.), oranges, bananas, and grapes are successfully cultivated. For cattle-raising, the conditions are even more favorable than those of Argentina. The live stock at the beginning of 1901 numbered 2,743,665 head of cattle, valued at \$100,286,835.

*Commerce and Manufactures.*—Exports from Asunción in 1902 were valued at \$2,931,204.77 gold, the largest item, being yerba maté, hides, tobacco, extract of ironwood, and beams of hard wood. In 1901 the exports were valued at \$2,529,307 gold, and the imports at \$3,003,658 gold. The total foreign trade of Paraguay during 1902 was given as follows: exports, \$3,252,652 gold, and imports, \$2,050,000 gold. In 1900 the value of exports was \$2,555,924 and of imports \$2,652,067. In the same year there were in the entire country 2,298 business houses, with a capital of \$66,673,000, currency; and 1,094 industrial establishments, capitalized at \$135,448,066, currency. The most remarkable industrial product is the famous *ñanduti* (cobweb) lace. Cotton and woolen fabrics are manufactured in a primitive fashion. Wines are made from grapes or oranges. There are manufacturing factories of cigars, ice, soap, and matches; also a number of tanneries, potteries, and flour mills.

*Navigation, River Service, Railway, etc.*—In 1900 the arrivals at the Paraguayan ports were: foreign (that is, Argentine, Brazilian, Uruguayan, German, and English) steamers and sailing vessels, 2,996; Paraguayan, 1,342. Communication with Buenos Ayres and Montevideo is furnished by a great number of steamboats.

The Paraguayan Central Railway runs from Asunción to Pirapó, 155 miles. Government telegraph lines extend from Asunción northward to Villa Concepción, and southward to the Argentine frontier, connecting with the lines of that republic at El Chaco. Telephone systems have been established in several of the larger towns. The postal movement of 1901 was 2,099,640 pieces.

*Weights, Measures, and Money.*—Arobo = 25 pounds; cuadra = 78.9 yards; league (land) = 4.633 acres; quintal = 100 pounds. Paraguay has no gold or silver coins of its own stamping. The silver *peso* of the other South American countries circulates there, and has the same value as in the issuing country. For value of paper money see below: *Finances*.

*Government, including Judiciary.*—The constitution of 24 Nov. 1870, now in force, vests the powers of the government in three co-ordinate branches, the legislative, executive, and judicial. The National Congress, consisting of Senate and Chamber of Deputies, meets each year at Asunción. Senators, elected by the people, by universal suffrage, one senator for each 1,200 inhabitants, serve for six years. Deputies, similarly chosen, but in the proportion of one for each 6,000, serve four years. "The executive power," says the constitution, "shall be vested in a citizen, to be called President of the Republic of Paraguay. In case of sickness, absence from the capital, death, resignation, or dismissal of the President, the executive power shall be exercised by the Vice-President." Both president and vice-president are chosen by an electoral college, serve for four years, and "cannot be re-elected except after the lapse of two presidential terms." Numerous provisions of the constitution are designed to guard against the revival of dictatorships, or undue extension of the powers of the executive (see below: *History*). In regard to the cabinet, Article 104 provides: "Five ministers or secretaries, respectively called of the Interior; Foreign Relations; the Treasury; Justice, Worship, and Public Instruction; and War and the Navy, shall attend to the business of the nation, and legalize with their signatures the acts of the President. Those acts without their signatures shall have no efficiency." These Ministers are responsible to Congress. The judicial power is vested in a supreme court, consisting of three justices, and having "the right to inspect and supervise the action of all inferior courts"—that is, in practice, the courts of appeal, and criminal, police, first instance, and justices' courts.

*Finances.*—The government's revenue for 1903 was estimated at 11,532,576 *pesos* (currency of Paraguay), consisting of revenues from imports to the amount of 725,000 *pesos*, gold, and export taxes, etc., 352,350 *pesos*, gold, or a total of 1,077,350 *pesos*, gold, equal to 9,157,475 in paper dollars, or *pesos* represented by the currency of Paraguay, gold being at a premium of 850 per cent. Other revenues of the nation (from internal taxes, sale of sealed paper, stamps, patents, mines, etc.) were estimated at 2,375,101 *pesos*, currency. The receipts of the nation from all sources in 1902 were given at 11,007,222.05 *pesos*, currency. During 1901 the government redeemed 775,154 *pesos* of paper currency, and the whole amount of paper in circulation 31 Dec. 1901 represented



## PARAGUAY

only 10,566,171.19 *pesos*. Expenditures, as shown by the budget for 1903, were: for the legislative department, 601,759.92; executive department, 114,000; interior department, 1,715,928; treasury, 2,508,096.48; department of foreign affairs, 717,420; department of justice, worship, and public instruction, 3,379,002; department of war and marine, 815,484; other liabilities and expenses, 1,564,510; total, 11,416,200.40 *pesos*, currency. Prior to the war with the Triple Alliance (see *History*) Paraguay had no debt, either domestic or foreign. Her first foreign loans were negotiated in 1871-2 at London; and on 31 Dec. 1901 the debt thus contracted amounted to \$4,787,077.86. On the same day, the Brazilian and Argentine indemnities, results of the war, amounted to \$9,876,466 and \$9,563,990, respectively. There is an internal debt which, at the end of 1901, had been reduced to 827,300 *pesos*, currency.

*Army and Navy*.—The army (infantry, cavalry, and artillery) in 1902 consisted of 1,500 men. There is a National Guard for service in any emergency. Small steamships, doing police and revenue service, constitute the navy.

*Population*.—The census of 1899 showed the total population to be 635,571, of whom 18,188 were foreigners. The inhabitants are (1) white people of Spanish descent, or the offspring of Spaniard and Indian, or immigrants who have arrived since 1870; (2) pure Indians, descendants of the aboriginal Guaraníes, of which nation only one tribe remains wholly uncivilized; and (3) members of wild tribes inhabiting El Gran Chaco, possibly 100,000 in number. To increase such colonization as that referred to in the second paragraph, the government has offered the following inducements:—Free transportation from Montevideo or Buenos Ayres; entry free of duty of individual luggage, furniture, tools, seeds, and one gun for each immigrant; free lodging and board for five days at the Immigrant Hotel; free passage from Asunción to destination, if on railway or river; a grant of 16 squares of land to each married immigrant at a nominal price—about 8 cents an acre—or of 8 squares to an unmarried immigrant.

*Education and Religion*.—Article 3 of Part I, chapter 1, of the constitution provides: "The religion of the state is the Roman Catholic Apostolic; Congress, however, shall not have power to forbid the exercise of any other religion within the territory of the republic. The chief prelate of the Paraguayan church shall be a Paraguayan." Article 8 declares: "Primary instruction is compulsory," directing Congress to "promote by all possible means the instruction of the citizens." Professors at the university and colleges are appointed by the President of the republic, though nominated by the councils of those institutions. The entire educational system was, from 1609 to 1767, entrusted to the Jesuits; the tendency to nationalize it has grown strong principally during the last 30 years. In all schools the Spanish language is taught, and the Guaraní, though still the tongue of the common people everywhere outside of the larger towns, is gradually being displaced; it is even prohibited within the precincts of the university and colleges. The number of schools—normal, high, primary, and private—is 369 (compare NICARAGUA and COSTA RICA), with an aggregate attendance of more than 25,000. A

school of agriculture and five colleges are supported by the government. The National University, founded 1890, has faculties of law and social sciences; medicine; mathematics; and notarial training. Nearly 700 students attend the university and national colleges. There is a national library, containing about 6,000 volumes.

*History*.—Sebastian Cabot, in 1527, explored the Paraná, and sailed up the Paraguay to the mouth of the Bermejo in the following year. Hoping that a passage to the land of gold and silver mines, Upper Peru or Bolivia, would be found in some part of this great river-system (a hope which still leads explorers along the courses of the Pilcomayo and Bermejo), 300 Spanish adventurers, in 1536, proceeded up the Paraguay to the site of the present city of Asunción, where they built a fort. This outpost became a centre of military enterprise, and, after 1609, of missionary work among the natives. The Spanish province of Paraguay embraced the whole region south of the Portuguese possessions in Brazil and east of the Andes until 1617; but when Buenos Ayres was made a provincial capital the jurisdiction of the governors, afterward viceroys, at that city extended over the settlements on the Paraguay and its tributaries, as well as those on the Paraná and La Plata. The Argentine general, Belgrano, incited the Paraguayans to revolt against Spain in 1810. On 14 May 1811 Pedro Juan Caballero with a few companions took possession of the Spanish barracks, and the next day compelled Governor Velazco to divide his authority with two leaders of the revolution. An assembly which began its sessions on 11 June 1811 renounced allegiance to Spain, and this declaration was ratified by the Congress which assembled for the first time on 1 Oct. 1813, and on the 12th vested the executive branch of the government in two consuls, Gaspar Rodríguez Francia, a doctor of theology, and Sr. Yegros. Dr. Francia became dictator (1814-40). After his death the Paraguayans experimented with a government of four military officers, which was superseded by a triumvirate on 23 Jan. 1841; the triumvirate in turn was replaced by two consuls on 12th of March, and next, from 1844 to 1870, the whole power of the state was grasped by Carlos Antonio López and his son and successor Francisco Solano López (see *DICTATORSHIPS IN LATIN-AMERICA*). The younger López made deliberate preparations for a war of conquest. When the time was ripe for action, he issued, through Congress, a declaration of war against Argentina, 18 March 1865. Argentina, Brazil, and Uruguay formed an alliance to oppose him. Paraguay was defeated and almost depopulated in a struggle which ended with the death of López, 1 March 1870. A comparison of the official census of 1857 with that of 1873 shows, allowance being made for increase at the normal rate between 1857 and 1865, that Paraguay lost more than 1,200,000 inhabitants during the war—her entire population, except 28,746 men and 202,333 women and children. It is proper to assume exaggeration in the earlier census, while the later one was undoubtedly defective; but, even so, the disaster must be regarded as the severest that any small nation in recent times has sustained, rising from such a trial still resourceful and independent. To Brazil, Paraguay



## PARAGUAY RIVER — PARALLELISM

ceded the territory on the north and northeast; to Argentina, by the treaty of 3 Feb. 1876, the district south of the Pilcomayo. But the President of the United States, 12 Nov. 1878, awarded to Paraguay the district north of the Pilcomayo, which Argentina claimed (see HAYES, VILLA; also cash indemnities mentioned under subtitle *Finances*).

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**Paraguay River**, South America, the largest affluent of the Paraná River (q.v.), with its source in the plateau of Matto Grosso, Brazil, about lat.  $14^{\circ} 24'$  S., near the town of Diamantino. It flows southward through Brazil, forming for some distance the boundary with Bolivia, and enters Paraguay at Confluencia, where the three states meet, then continues the remainder of its course southward through the Republic to which it gives its name. At Tres Bocas on the Argentina frontier the Paraguay flows into the Paraná. Its total length is about 1,500 miles.

**Paraguay or Brazil Tea**, or **Maté**, a tea-like beverage, an infusion of the leaves of several South American species of holly (*Ilex*), prepared by roasting the leafy branches over a wood-fire, then beating them with sticks, and gathering and powdering the fallen leaves.

**Parallax**, a term used in astronomy to designate the displacement in the apparent direction of a heavenly body caused by a change in the position of the observer. Let A and B be two points from which the body P is conceived to be viewed. An observer at A will see the body as if on the celestial sphere in the direction A P. An observer at B would see it



in the direction B P. It is evident that the difference of these directions is equal to the angle at P between the lines A P and B P. It follows that if the length of the line A B, and its direction, are accurately known, and if the observers can determine simultaneously the exact direction in which the body, P, lies, the angle P of the triangle will also be known. Then the distances A P or B P of the body from either of the observers can be computed by trigonometric methods. The following are the principal applications of Parallax in astronomy:

The distance and direction of a planet, or other heavenly body, has to be calculated by the astronomer, in the first place, as if they were measured from the centre of the earth. But the observer is necessarily on the earth's surface. Parallax is then the difference between the direction from the centre, and that from any station which the observer may chance to occupy. The right ascension, declination, and distance of the body will all be different according as it is measured from the earth's centre, or from the eye of the observer. We thus have Parallax in R. A. and in Dec., which

is mostly used in the case of the moon and planets.

*Annual Parallax* is that due to the motion of the earth in its orbit. It is applied only to the fixed stars. By the parallax of a fixed star is meant the difference in its direction, as seen from the sun, and from either extremity of the earth's orbit. It is therefore equal to the angle subtended by the radius of the earth's orbit when seen from the star.

The only method of determining the distance of the heavenly bodies by direct measurement is through observations of their parallax. It is evident that the nearer the body, the greater will be its parallax. Hence, in order to measure a distance in this way, it is necessary to choose the times when the body is nearest to the earth. The moon, being much the nearest of all the heavenly bodies, has the largest parallax of all. Its average value is a little less than  $1^{\circ}$  (about  $57' 2''$ ); but, when nearest the earth, it exceeds  $1^{\circ}$ . Being so large, even the ancient astronomers were able to measure it and thus determine approximately the distance of our satellite. Measures of the moon's parallax in modern times have been made by comparing its altitude, or declination, as it passes the meridian, at different observatories in the two hemispheres. The Greenwich Observatory and that of the Cape of Good Hope have used their observations for this purpose.

Determinations of parallax can be made without the observer changing his position on the earth's surface, because as the earth rotates on its axis the observer is carried around with it. He thus sees the moon or a planet in different directions, according to the different points of its apparent diurnal course. The general effect of parallax, as we can readily see, is to make the moon or a planet appear somewhat nearer the horizon than it really is. If a body is rising in the east, the change thus produced in its apparent direction from the observer increases its right ascension. In the west the same effect diminishes the right ascension. Thus, by making observations of the moon or a planet in the east and in the west alternately, its parallax, and therefore its distance, can be determined. This change is called the *diurnal parallax*. The diurnal parallax of Mars has thus been determined by various observers. If the position of the sun on the celestial sphere could be determined with the utmost precision, its distance could be measured by its diurnal parallax. But as this luminary cannot be seen at the same time with the stars in its immediate neighborhood, it is not possible to make any very exact determination of the sun's parallax by direct observation. What is done instead of this is to measure the parallax of various planets, using the principles explained in theoretical astronomy. (See ASTRONOMY, THEORETICAL.) In recent times those asteroids which came nearest to the earth have been mostly used for this purpose.

SIMON NEWCOMB.

**Par'allelism**, a parallel or comparison used in any sense of the word parallel. By Spinoza the term is used to suggest that every material object has corresponding to it an ideal counterpart. In psychology the word is used of the connection between matter and mind, notably between brain processes and mental processes.



## PARALLELOGRAM — PARAMECIUM

In literature parallelism is a double statement of the same notion, either by simple variation of the idea or by negation in the second member of the opposite of the statement in the first.

**Parallel'ogram**, in mathematics, a quadrilateral rectilineal figure which has its opposite sides parallel. See GEOMETRY.

**Parallelogram of Forces**. See MECHANICS.

**Parallels**. See GEOMETRY.

**Parallels of Latitude**. See LATITUDE.

**Paralysis**, a loss of muscular power, whereby contractility is either abolished or greatly diminished. Loss of sensation, general or special, was formerly spoken of as sensory paralysis, to distinguish it from a loss of muscular motion, or motor paralysis. At the present time the term paralysis is usually limited to denoting motor paralysis, and defects in sensation are considered under the head of disorders of sensation.

Palsy is a term rarely used by physicians, but popularly, it is a synonym for paralysis. Paresis is a partial or incomplete motor paralysis, but the term is seldom used by physicians except as referring to a disease of the insane, known also as general paresis (q.v.) or paretic dementia, in which gradually increasing motor paralysis and disorders of sensation are prominent.

Paralysis may affect either the voluntary or the involuntary muscles. It may be limited to one muscle or group of muscles, constituting a local paralysis, or it may involve those of various parts of the body, or nearly all the voluntary muscles, and is sometimes associated with sensory disturbances, such as impairment of common sensation, or alterations in the temperature of the skin. Paralysis is not a disease, but the result of some mechanical obstruction, of some functional disorder or structural damage in the nervous system (to nerves, nerve-centres, nerve-cells or other constituents), or of degenerative atrophy of the affected muscles. As a consequence of the conditions named, either the proper transmission of motor nervous impulses is prevented, or the debilitated muscles are not capable of contracting, though the impulses may be normally transmitted.

If paralysis is long continued, degenerative changes occur in muscular and nerve fibres, resulting in wasting of the parts supplied by the nerves affected, and consequent permanent inability of these parts to perform their functions. Some of the causes of paralysis are: pressure of a tumor, or of a broken bone, as of the skull or a vertebra; an exudation of blood (due to diseased arteries, external injuries, etc.); an embolus; disintegration of nervous tissue by softening or thickening; an accumulation of serum, or other results of inflammation. It may occur without any discoverable lesion, as in hysteric or emotional paralysis, in alcoholic paralysis, in decubitous paralysis, due to pressure on a nerve from lying for a long time in one position, and in temporary paralysis due to drugs or hypnotic or hysteric conditions.

The forms of paralysis are numerous. The names assigned to them usually refer to the situation in the neuromuscular apparatus of the damage, lesion, or defective activity producing the paralysis; to the condition of the muscles affected; or to the extrinsic causes of certain paralysis or the discoverers of those causes.

The forms of paralysis include: Acute ascending (Landry's paralysis), often fatal, beginning in the muscles of the feet and ascending to the other muscles of the body—cause not known; birth, due to injuries at birth; bulbar, due to changes in motor centres of the medulla oblongata; Bell's, a facial paralysis (see BELL'S PALSY); central, due to a lesion of the brain or spinal cord; cerebral, due to an intercranial lesion; crossed, paralysis of one side of the face and the other side of the body; crural, chiefly affecting the thigh or thighs; diphtheritic (also post-diphtheritic), a partial paralysis chiefly of the muscles of the soft palate and throat, often following diphtheria; Cruveilhier's, or progressive muscular atrophy; divers', or caisson disease (q.v.); galloping, a rapidly progressive form of general paresis; Indian-bow, paralysis of the thyro-arytenoid muscles; infantile, or poliomyelitis anterior; ischemic, a local paralysis due to a stoppage of the circulation by an embolus, a thrombus, etc.; lead, due to lead-poisoning; multiple, a complication of local paralysis; neural, originating in the nerves; and spastic, a variety marked by rigidity of muscles and heightened tendon-reflexes.

Paralysis is further distinguished with reference to its course, as syphilitic, traumatic, toxic, etc., according to the nerve, muscle, or part specially affected; as, obturator, ulnar, brachial, dental, etc. A paralysis may be reflex, due to peripheral irritation. Monoplegia is a paralysis of a single part of the body; diplegia, a bilateral paralysis, affects like parts on either side of the body.

The two most extensive forms of paralysis are hemiplegia (q.v.), paralysis of one side of the body, and paraplegia, paralysis of the legs and lower part of the body. In both forms there may be a loss of sensation as well as of motion. Although hemiplegia is usually the result of a cerebral hemorrhage or embolism, it may result from lesions of the spinal cord, or as a hysteric complication. Paraplegia is due to some lesion in the spinal cord.

The treatment of paralysis must depend very largely upon the cause, and should be in the hands of a physician, although the patient can assist materially by faithful attention to hygienic measures, and by exerting the will-power upon more delinquent muscles. Passive movements of the muscles by various forms of massage and the use of electricity are of value, but must be carefully employed, or they may do harm.

**Paramaribo**, pār-a-mär'ī-bō, Dutch Guiana, South America, the capital of the colony, on the west bank of the estuary of the Surinam River 16 miles above its outlet on the Atlantic Ocean. It is a well laid out town with substantial buildings, and an excellent harbor defended by two forts. The whole trade of Dutch Guiana centres in Paramaribo. Pop. (1900) 31,817.

**Paramat'ta**. See PARRAMATTA, NEW SOUTH WALES.

**Parame'cium**, or **Slipper Animalcule**, an oval, flat infusorian very common in pond water or in vegetable infusions. Each paramecium is covered with rows of cilia which lash it through the water and drive food-particles into an aperture which serves as mouth. As the food-particles enter they take bubbles of water with them, and are moved round and round in the



## PARAMETER — PARANAHYBA

living substance until they are digested or got rid of. There are two (excretory) contractile vacuoles; the large nucleus has a small one (paranucleus) lying beside it; beneath the thin rind there are remarkable eversible threads. A paramecium often divides transversely into two; these two repeat the process, and with continually diminishing size rapid multiplication may thus proceed for a while. It has its limits, however, and then two individual Infusorians conjugate, exchange some of the material of their paranuclei, and separate. Thus they seem to renew their youth. See INFUSORIA.

**Param'eter**, in mathematics, a term applied to a constant quantity entering the equation of a curve. The term is principally used in discussing the conic sections.

**Paraná**, pä-rä-nä', state of the Brazilian Confederation, bounded on the north by São Paulo, on the east by the same state and by the Atlantic, on the south by Santa Catharina and the northeastern tip of Argentina, and on the west by Paraguay and Matto Grosso. The main northern and western boundary is the Paraná (and the Paranapanema); and the Iguassú forms the greater part of the southern boundary. The Ivahy and Piquiry flow northwest into the Paraná; but, like the Iguassú, they are filled with rapids and unfit for navigation. The short coast line has the excellent harbor of Paranagua; and the coast is picturesque, but hot, humid and fatal with its yellow fever. In the forest-covered interior, which is only partially explored the climate is more equable and much cooler; the temperature averages about 17° C., with a winter mean of 14° and a summer mean of 18°; and the rains are abundant. Manioc, Indian corn, coffee, and cotton grow on the coast; and the cereals and fruits of the northern and central United States in the interior. There are valuable (but unexplored) supplies of iron, mercury and gold. The port of Paranagua is connected by a railroad with the capital city of the state, Curitiba. The area is 85,430 square miles and the population, largely increased by German and Polish immigration, was 249,491 in 1890. Consult Lange, 'Süd-brasilien' (1885).

**Paraná**, or **Bajada** (bä-hä-dä') **del Paraná**, Argentina, capital of Entre Rios province, on the left bank of the Paraná, the terminus of a branch railroad from Concepción. It is connected by daily steamer with Santa Fé on the west bank of the Paraná. It is well laid out, with straight unpaved streets, telephone and street car service, and other modern improvements. The city was founded in 1730; was the federal capital 1852-61; and has steamship connections with Buenos Ayres; many ocean steamers come up the Paraná as far as this. But the city is not so prosperous as it was 50 years ago. Pop. (1895) 24,261.

**Paraná**, the second largest river of South America, with a length greater than that of the Mississippi and a drainage area nearly as large. It is the principal tributary of the great estuary called the Rio de la Plata, which it forms by its juncture with the Uruguay. The Paraná itself is formed by the confluence of the Parana-hyba, which is sometimes considered its upper course as being the axial stream, and the Rio Grande, the true upper course. The latter rises

only 60 miles from the coast on the west slope of the Sierra de Mantiqueira, near Itatiaya; flows east across Minas Geraes; separates that state from São Paulo; and receives the Sapucahy and the Mosy-Guassu before its juncture with the Parana-hyba (q.v.) at the meeting point of Matto Grosso, Minas Geraes and São Paulo. The Rio Grande itself is sometimes called the Pará or Paraná, but the latter name is more properly used of the double stream, which flows southeast across the Brazilian plateau with several splendid cataracts and many great rapids, the most notable being at Salto Guaira, the beginning of the river's middle course, in which it is the boundary between Brazil and Paraguay, and then between Paraguay and Argentina. It joins the Paraguay River (q.v.) just above Corrientes, which takes its name from this juncture, and then flows a little west of south through Argentina, turning to the east at Rosario, and a few miles above Buenos Ayres joining the Uruguay. In general the upper course of the Paraná is navigable save at the falls of Urupunga and Guaira and at the rapids extending 150 miles below Guaira; most of its minor tributaries join it with cataracts, that of the Iguassú, which, apart from the Uruguay, is nearly the only confluent from the left, being the most majestic. Through the Argentinian plain the river is broad and easily navigable; near the embouchure there is a constantly shifting delta, the main difficulty in navigation. Ships of 4,000 tons easily make their way 400 miles from the ocean to Rosario. Smaller vessels, with draft of 6 or 7 feet can go as far as Corrientes at any season and at high water to the juncture of the Iguassú. The depth of the river varies greatly with rains and melting snows, and the volume is much greater at Corrientes than below. The Paraná is 2,720 miles long from its source to the Plata. Consult Hutchinson, 'The Paraná' (1868).

**Paranagua**, pä-rä-nä-gwä, Brazil, port of the state of Paraná (q.v.), southeast of Curitiba, the capital, and on the southern side of the Gulf of Paranagua, which is navigable for vessels of 300 to 400 tons and is separated from the Atlantic by the Ilha do Mel. Railroads built by French enterprise connect the city with Curitiba and with the harbor at Antonina; and there is regular steamboat connection with Hamburg, because of the German colonists in the state and the valuable exports of maté (averaging 50,000 tons annually), hardwoods, cereals, and sugar. Pop. (estimated) 6,000.

**Paranahyba**, pä-rä-nä-ē'ba, or **Parnahyba**, pä-rä-nä-ē'bä, Brazil, (1) a city and seaport of the state of Piahy, on the river of the same name, about 10 miles from the coast. It is an unhealthy town, but of importance as the seaport for the region. It ships cattle, hides and cotton. Pop. (estimated) 12,000. (2) A river of northeastern Brazil, rising between the Serra das Mangabeiras and the Serra Gurgueia, and forming the boundary between Maranhão and Piahy. It is more than 630 miles long, has no rapids in its course to the northeast, and is navigable for 400 miles. It empties into the Atlantic through six mouths, forming a large delta, to the east of which is the city of Parana-hyba (q.v.). The affluents of the river are the Gurgueia, Piahy, Poty and Longa from the



## PARANOIA — PARAPET

right, and the Balsas on the left. (3) An affluent of the Paraná (q.v.), rising on the boundary of the states of Goyaz and Minas Geraes in the Serra dos Vertientes. It forms the line between the two states mentioned, receives at the left the Velhas and the Tepico rivers and on the right the Corumba and the Meia Ponte, and joins the Rio Grande de Paraná (or Paraná), with which it forms the upper waters of the Paraná (q.v.). The Parahyba occupies the axis of the Paraná basin, but cannot be reckoned the true headwater of the Paraná because of its short course and small volume of water as compared with the Rio Grande. Above its juncture it forms several cascades and rapids. It measures altogether more than 520 miles.

**Paranoia**, one of the types of the insanities. It is characterized by a marked hereditary predisposition, a slow development of persecutory ideas, almost from childhood, with increasing inability to get on in the world, and it usually terminates in a mild type of mental disintegration. Its subjects are the people with mental twists. The disease is one of great importance, and yet the conduct of those affected is often so closely allied to the normal conduct of the environment that it becomes extremely difficult to come to the decision of mental irresponsibility in many of these cases. Although a rare disease, it is particularly important to recognize it, since paranoics are often very dangerous lunatics. The murderer of Garfield was an example. A typical case usually starts wrong in the world, with a mental instability inherited from intensely neuropathic parents. Some type of insanity, or extremism, or pronounced crankiness, or violent temper, is present in the ancestors of most of these cases. Throughout the developing period these children are different from other children; their intellects may be as bright as others; very often they are precocious, but irregularly so, being generally below par; they are apt to be less gay, less expansive; are characteristically introspective, egoistic, frequently very egotistic, and inclined to live within themselves. They think that their parents are less fond of them and show favors to their brothers and sisters. They thus come to be very subjective and live in a realm of fancies and ideas, are notoriously poor observers of fact as entities, and poor scholars in the exact sciences. If they are recognized as defective in these early stages much may be done for them by appropriate training. After reaching years of independence these patients find it difficult to get along with people. They are suspicious and quarrelsome, and soon come to believe that they are the objects of special plots and persecutions. The early childhood ideas may be a nucleus for this delusion. This false interpretation of conditions about them becomes more and more fixed in their minds until it is systematized, and everything is woven into the fabric of this belief. Many persist in this state for years. They may be engaged in business; they are often found among the people of "artistic temperament." Here their eccentricities, if coupled with a small modicum of talent, are put up with, and they go along as actors, painters, musicians, writers, inventors, etc., earning perhaps a bare living, or being half supported by friends, while they are laying the foundations of a "career." Often the ideas of persecu-

tion lead to the development of intense hatred, it may be of an individual as a personal oppressor, or as a hindrance to the cause of truth, of liberty, of freedom, etc. It thus comes about that many paranoics are attracted by the doctrines of anarchy, and it is notorious that regicides are prominently represented in this diseased type. Many of these patients suffer from hallucinations; they see faces, hear voices plotting against them, etc. Sometimes these voices seem to accuse them of immoral acts. From ideas of persecution they often graduate into ideas of grandeur (see GENERAL PARESIS). Sometimes the voices appear to tell one of these that he is elected by God to be the savior of his people, and in response to either set of hallucinations he may kill. Mystico-erotic ideas are very frequent in women of this nature, and many are found studying Oriental philosophies and mystic symbolisms from fakirs who hold their hands and teach them breathings and various forms of massage—all of which contribute to their erotic tendencies. One feature is very characteristic in this disease—its onesidedness. On many of the topics of general conversation the paranoic is rational and often a charming talker; but touch the core of his delusional state and he is transformed. Some part of his brain necessary to bring about mature judgments along certain lines is defective. This defect has never yet been seen by the microscope, but there seems to be little doubt that there is some organic brain-defect. Most of these cases are hopelessly incurable. A few remit, are apparently self-controlled for a time, and then develop. The majority go on to a mild form of dementia, but the breakdown is very slight, although the delusions usually persist and dominate the patient's whole thought and actions. These patients are best confined in sanatoriums. They are nuisances to all, and are better under the strict regime of an institution. Much can be done by early individual training to render these defectives self-supporting. When able to take care of themselves or when wealthy by inheritance, they may be regarded as incorrigible cranks, but still, bearable; but as dependent they are impossible. Medico-legally these cases are among the most interesting. Consult: Kraepelin, 'Psychiatrie' (7th ed. 1904); Ziehen, 'Psychiatrie'; Ballet, 'Traite de Pathologie Mentale' (1904); Berkeley, 'Mental Diseases'; Maudsley, 'Pathology of Mind.' See DEGENERACY; DEGENERATION; GENERAL PARESIS; INSANITY. SMITH ELY JELLIFFE, M.D.,  
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**Paran'thracene.** See ANTHRACENE.

**Par'apegm**, in ancient times, the name given a tablet fixed to a pillar or wall, and on which laws and proclamations were engraved.

**Par'apet**, (1) in fortification, a work, usually of earth, intended to protect the troops within the ramparts, as well as the pieces of artillery used in the defense. It has three sloping surfaces, an outer, upper, and inner; but the upper surface slopes only very gently downward and outward. It is intended for the defenders to rest their rifles or muskets on when firing. The defenses round the roofs of castles are also called parapets. (2) In architecture the term parapet is applied to the structures



## PARAPLEGIA — PARASITISM AND ANIMAL PARASITES

placed at the edges of platforms, balconies, and roofs of houses, to prevent people from falling over.

**Paraple'gia.** See PARALYSIS.

**Par'asang** (Gr. *παρσάνγης* from Persian *parsang*, or *farsang*), the denomination of a lineal measure among the Persians of antiquity, and still used by them. In Xenophon's account of the Retreat of the Ten Thousand he gives the length of each day's march in parasangs, and modern travelers agree with the estimate he makes of its length, namely, about 30 Greek stadia. Herodotus makes about the same estimate, which in English miles would be a little less than  $3\frac{1}{2}$ . Strabo, the geographer, reckons it as an arbitrary measure of 30, 40 or even 60 stadia, and the nature of the ground traveled over may sometimes have had some influence in determining the question. The derivation of the word, which means "stone-at-the-end," points to the fact that the Persians, like the Romans, marked out their great highways by means of stones, inscribed with the distance in one case from the Persian capital, in the other from the "golden milestone" (*milliarium aureum*) which Augustus set up in the Forum near the temple of Saturn.

**Par'asele'ne**, in astronomy, a mock moon, not unlike the Parhelion, or mock sun. The Paraselene is common in the polar regions. See HALO.

**Parasitic Fishes**, about a dozen very small eel-like fishes, of the sand-eel family *Ophidiidæ*, and the genera *Fierasfer* and *Encheliophis*, are parasitic or commensal in other marine animals, and have some curious modifications. They frequent the hollows in the bodies of jellyfishes, the breathing chambers of starfishes and sea-cucumbers, and sometimes insinuate themselves between the layers of the mantle of pearly mussels and other bivalves. Cases are known where they have become coated over with pearl and so imbedded in the interior of the shell. These parasitic fishes have totally lost their pelvic and caudal fins; and the vent has been moved forward from the ordinary anal position to near the throat. One species (*F. affinis*) is especially common on the pearl-oyster banks of western Mexico. Consult: Günther, 'Study of Fishes' (1880); Putnam, 'Proc. Boston Soc. Natural History' (1874).

**Parasitic Plants**, plants which live upon and at the expense of other plants to which they become attached. The group is not well defined, since many of the lower forms have saprophytic habits also, or may develop them under favorable conditions and since some higher plants exhibit more or less parasitic tendencies. All members of the group are alike in their method of feeding; sucking organs (haustoria) are developed within the host-plant's tissues, their office being to absorb the liquids which the host-plant obtains from the soil and the food elaborated by the green parts of the host. It is assumed by botanists that this habit has resulted in sexual degeneracy, so that in some cases sexuality appears to have been lost entirely. As a consequence of this the vegetative functions are in many cases remarkably developed. In other cases the life-history is remarkably complex, especially among the lower fungi, for instance, apple-rust. (See APPLE,

paragraph *Diseases*.) The flowering parasitic plants may or may not contain chlorophyl, in the former case being able to utilize the carbon dioxide of the air in the manufacture of a part at least of their food; in the latter case being dependent nearly if not entirely upon the host. Familiar instances of the former are bastard toad-flax and mistletoe; of the latter, broom-rape and dodder. This last (see DODDER) is remarkable also because its seeds germinate in the ground, send up slender leafless, thread-like stems, and after becoming attached to a host die at their lower extremities. Single individual plants of some species of dodder have been known to feed upon more than half a dozen different species of host-plants at the same time. From an economic standpoint, the parasitic fungi are of most importance. Among these are the so-called plant diseases; for instance, the smuts and rusts of cereals, the blight of strawberries and potatoes, the mildew of gooseberries and grapes, etc. There are also several diseases attributed to bacteria; for instance, pear blight, and melon wilt. Still other members of this group are parasitic upon insects. The common house fly is frequently found stuck fast to walls and windows and surrounded by a yellowish ring of spores of a plant parasite. Young fish in hatcheries are often destroyed in immense numbers by a slime mold. Horses occasionally suffer from a lung parasite of vegetable origin. And even man is not exempt; he is sometimes attacked by ringworm and barber's itch. The attacks of these parasites are due largely, if not wholly, to unsanitary conditions, carelessness, neglect, or some other similar cause and they may be prevented by proper attention.

**Parasitism and Animal Parasites.** Any organism which obtains its nourishment at the expense of some other living thing and yet so gradually as not to destroy its life at once, may be regarded as a parasite. The line of separation between parasitic and carnivorous species is, however, by no means distinct. One finds forms such as some small leeches, which devour bodily small aquatic animals, but when favored by opportunity extract the blood of larger species, being thus under different circumstances parasitic and carnivorous. It is evident that those organisms which have the parasitic habit, may be either plants (phytoparasites), or animals (zooparasites); equally also the host, that is, that form which is parasitized, may be either plant or animal. Among phytoparasites there are many forms such as the rusts which attack crops, the blights on fruit trees, the fungus causing decay in a tooth, and the bacteria which are responsible for consumption or cholera; but this article will be confined to a discussion of general principles, as illustrated by the animal parasites.

**Origin of Parasitism.**—A wide range is exhibited by various forms, both as to the degree of parasitism and as to the direction the organism has followed in acquiring the parasitic habit. The temporary parasites, such as mosquito, bedbug, or leech, are most independent of all. They remain with the host merely long enough to secure a single meal, and in most respects manifest the characteristics of free-living organisms, while their immediate relatives are carnivorous or carrion feeders. Extreme instances of temporary parasitism result in the



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permanent acquirement of the parasitic habit; thus the so-called sheeptick (*Melophagus ovinus*) is really a highly degraded fly, and not at all intimately related to the ticks. Intermediate between the forms just mentioned stand others like the flea, which can change their hosts and yet possess a structure which, by the loss of wings and the development of leaping and grasping organs, has been more highly modified in the direction of parasitism. This modification goes still further in the case of the lice, which are without special means for effecting a change of host and are usually regarded as stationary parasites.

Another line which indicates the origin of parasitism may be followed through a series of organisms which are ordinarily free-living forms, but which under exceptional circumstances gain entrance to the alimentary canal, for example, and live there under conditions but little removed from those which their natural habitat furnishes; thus Schaudinn has called attention to the ease with which slime-inhabiting species of microscopic animals, especially protozoans, may accidentally gain access to the alimentary system of man, and find there conditions such that they may indefinitely continue their existence. Small roundworms (*Rhabditis nigrovenosa*) thrive apparently equally well in the mud or in the lung of the frog, although the method of reproduction becomes modified in the second instance.

The relations of animals to one another show also many degrees of dependency which suggests another line of origin for the parasitic habit. In the simplest case of dependency the weaker form receives shelter or even only transportation from point to point. Such are the conditions for those forms which take up their abode upon floating objects in the water, the backs of whales, or the outer surface of the shells of crabs and mollusks. Some, indeed, seek more sheltered positions, as for instance among the windings of a snail's shell or within the mouth of the whale. In the latter case the animal secures not only the best of protection but is able to pick up stray morsels of food as well. The dependent secures board as well as lodging from the host, and the relation is known as commensalism (q.v.). In some instances, however, it may be of mutual advantage, and some return may be rendered for the services performed. In the latter case the relation is known as mutualism, or symbiosis. The association here is well illustrated by that of the anemone which is regularly found attached to the shell of a hermit-crab. The anemone secures transport from point to point, greater freedom from injury, together with less dependence upon environment, than is ordinarily true of sessile organisms, while at the same time it appropriates stray morsels which fall from the jaws of the crab while feeding. On the other hand, its presence on the shell favors the concealment of the crab, and its stinging tentacles ward off possible attack. The advantage of the association is demonstrated by the solicitude with which the hermit-crab transplants the anemone when forced by growth to take a new shell for its habitation.

Diametrically opposed to this mutual advantage which has grown out of the association of lodgers and messmates, is that in which the

return is purely one-sided, namely, true parasitism. The parasite lives at the expense of his host without rendering any service in return, and yet with such prudence as not to endanger the life of his supporter until at least his own life-history is completed. The precision of the relation is evinced for instance by the life-history of the ichneumon-flies. The eggs are deposited in cases on the backs of caterpillars; the larvæ penetrate the body of the latter and, beginning with the least important organs, devour the tissue of the host until with its complete destruction each larva is ready to metamorphose into the fly. It is but a short step from the position assumed by some lodgers in the mouth-cavity to that taken by most parasites in some region of the alimentary canal, or in one of the various organs connected with it; and yet the transition is not always to internal parasitism (endoparasitism). Existence on the external surface of the host, which distinguishes the ectoparasite, though rarer on account of the greater dangers involved, presents examples of an equally intense parasitic habit. Beneath the abdomen of the crab occurs often a curious sac-shaped body (*Sacculina*) which is a near relative of the barnacles, a group of typical sessile forms. The relationship is little evident from the inspection of the adult, but is clearly demonstrated by study of the life-history. The young organism settles down on the crab, similar in form and development to a young barnacle, but develops organs of attachment which ramify through the body of the crab as do the roots of a tree through the soil, and are the sole means of obtaining nourishment. Accompanying the assumption of the parasitic habit, comes the striking degeneracy of organs connected with the active life and the development merely of the reproductive function. The adult *Sacculina* consists of little more than a mass of reproductive organs producing large numbers of eggs.

*Effects of Parasitism.*—The effects of parasitism, which are dependent upon the degree to which the animal has acquired the parasitic habit, are equally evident and similar in parasitic forms, whatever their line of origin. The organs and function of locomotion are the first to suffer. Adult parasites possess little if any means of movement and such locomotor organs as are present in the embryo, and are related to a period of free existence or to a change of host, disappear with the attainment of the adult location. Hand in hand with the degeneration of the locomotor organs goes the reduction in the muscular and nervous systems. Organs of special sense, also, become atrophied or are entirely lost, and the parasite is degraded to the level of a mere vegetative organism by the disappearance of these characterically animal structures.

On the other hand, while the parasitic life is an easy existence, it is equally a dangerous one for the species. Were the eggs to be deposited and the young developed at the point where the adult lives, the existence of the parasite and its host would find an evident and not distant limit. The necessary migration to the external world, and search for new hosts involve large elements of chance. Thus for the preservation of the species a superabundant fecundity is required to meet these overwhelm-



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ing odds. In conformity to this the reproductive system of the true parasite reaches an extraordinary stage of development, and produces an enormous number of offspring. It is noticeable that the same changes are brought about in the worm and in the crustacean. Unlike as they are at the start parasitism has degraded them to the same physiological level. Those organs which characterize the animal are lost and there remains merely a superdeveloped reproductive system. It is wise in this connection to emphasize the fact that the parasites do not constitute a group of systematic value. The forms are classified in distinct and separate branches of the animal kingdom, and a given parasite is often more closely related to free-living species than to other parasitic forms. The majority of animal parasites occur to be sure among the lower groups so that the single-celled animals (Protozoa), the worms, and the Crustacea, furnish the larger number of parasitic animals, although instances of parasitism are not wanting in higher groups, even among the vertebrates.

Parasites do not originate in vitiated organs, as the ancient worthies of medicine would have it, nor are they the result of any peculiar temperament, as another school has held in time past. They have been introduced into the body of the host from without, and are found in a given location because the germs or embryos were brought to that point by some chance, and have maintained it during growth. The method of cure is equally evident. No amount of imagination can compass it, for it depends upon the removal of the parasite and the prevention of the introduction of further germs or embryos. The same line of reasoning applies with equal distinctness to other diseases, and if followed will materially aid in dispelling many popular illusions of the day on medical subjects.

*Endoparasites.*—The endoparasites of man have been centres of attention during recent years by virtue of discoveries which have demonstrated their importance in the etiology of disease. To be sure the occurrence of tapeworms, and of the larger roundworms, is recorded in the first medical writings of the Greeks, and also in the still earlier chronicles of the Hebrews and Egyptians, and in a few instances their relation to disease was accurately stated. Now more than 100 species are recorded for the human host, and the discoveries of recent years have been particularly fruitful among the lower groups of these organisms. For instance, it is now known beyond question that a small parasite in the red corpuscles is the cause of malaria (q.v.), one of the most widespread and costly of human diseases. Quite recently also smallpox, yellow fever, and a number of tropical diseases of considerable importance have been attributed to the presence of other minute animal parasites. Although not yet demonstrated it may well be that the causes of many infectious diseases which have hitherto been sought in vain among the bacteria, are eventually to be found among microscopic animal parasites.

In the opinion of the medical profession 200 years ago there was no disease, real or imaginary, which was not due to the presence and effect of some kind of parasite. More careful study has shown the extreme character of this

view, and has given some insight into the actual effects of the parasite upon the host. In general such effect is related to the proportional size and number of the parasites, although there is an evident difference between such parasites as are active and growing, and those which are encysted and passive. The draft on the host is first for food supply, which evidently depends upon the size and fertility of the parasite; in the second place upon the amount of space occupied, which will be of importance only where the number of parasites is large or the space occupied is limited; and in the third place, active parasites produce by their movements a certain irritation and inflammation of the tissues of the host. Certain species which actually devour the tissues of the host introduce an element of danger in the destruction of essential organs and through weakening the walls of blood-vessels or perforating the intestinal canal, so that the secondary consequences may be entirely out of proportion to the actual destruction caused. Excessive effects are, however, due to more intricate causes. The extreme anæmia which is consequent upon the parasitism of certain species (*Uncinaria americana*) is due to the constant abstraction of blood by the parasite, and the consequent great reduction in the vitality of the host. The injuries caused in the intestinal wall afford places of easy attack for pathogenic germs which may be present. Many investigators have also shown that certain species of parasitic worms produce definite poisons (toxins) which affect particularly the nervous system and the formation of blood. The continued production and giving off of such substances explain the apparently excessive results of parasitism, and the production for instance of pernicious anæmia by certain tapeworms, such as *Dibothriocephalus*.

*Causes and Results.*—The life-history of the parasite is intimately connected with the habits of the host, and frequently includes alternation of generations in that one generation is passed within the host and another either outside as a free-living organism or in a different host; or it may be that the larval form occurs in one host, while the adult is found in another. Thus the larval form of one tapeworm occurs in the mouse, and the adult is found in the alimentary canal of the cat. The complications which occur are too extensive to permit of detailed consideration here, but the relation of the two hosts is regularly such that the transition from one to the other is achieved by natural means. The life-history gives a clue to the means by which the parasite gains introduction to the host, and in the absence of knowledge concerning the development it is difficult if not impossible to say at what point the evil may be combated. A rational prophylaxis for malaria was not given until the life-history and the method of introduction of the parasite into the human host were laid bare. In general the causes of human parasites are to be found in the disregard of personal cleanliness on the part of the individual, in too intimate association with pet animals, from which come a number of important parasites, in the contamination of the water-supply by sewage or waste, in lack of care in the preparation of food, and of course, frequently in the element of chance.

The change to communal life led to a large



increase in the number of human parasites and to frequent epidemics, for which an impure water-supply was principally responsible. The development of municipal sanitation, and greater care for personal hygiene, together with the employment of footgear and less intimate association with domestic animals, are constantly tending to reduce the number. The use of good food is an influential factor as is also greater care in the slaughtering of animals and in the raising and distribution of food products in general. The determination of a rational hygiene and its application by the individual are destined to accomplish much toward the limitation of parasitism and of the diseases consequent to it. National prejudice or established custom may temporarily retard the introduction of necessary measures, but general intelligence will ultimately succeed in reducing to their lowest terms the parasitic infections of man and the domestic animals.

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**Par'asol**, an umbrella or covering for the head, which was used among the ancients, not for the purpose so much of preservation from the rays of the sun as in religious ceremonies and processions. In certain festivals the young females who celebrated them bore, among other sacred instruments, the parasol: it was, in fact, one of the most ancient marks of dignity that we find indicated either by relics of art or by authors. In process of time, when the Romans began to lay aside the simple habits of their forefathers, the parasol, by a natural transition, began to be used for the purpose to which it is still applied. The matrons particularly used to be followed by slaves, whose office was to protect the delicacy of their charms by intercepting the solar heat by the agreeable shade of the parasols. They were constructed of wands or twigs, disposed in such a manner as to admit of their being put up or down, in much the same way as those used at the present day. See UMBRELLA.

**Parasu'chia**, an order of extinct crocodiles. See HERPETOLOGY.

**Paray-Le-Monial**, pä - rā - lè - mō - nē - äl, France, town in the department of Saône-et-Loire; on the Bourbince; about 170 miles in direct line southeast of Paris. It is one of the oldest towns in France, and is famous for having been the home for many years of Margaret Mary Alacoque, a Visitation nun, who gave the world an account of remarkable revelations made to her regarding the devotion to the Sacred Heart of Jesus. To this nun may be given the credit, in a great degree, of the present magnitude of the League of the Sacred Heart (q.v.). She died at Paray-Le-Monial 17 Oct. 1690. Pop. (1901) 4,362. Consult: Tickell, 'Life of Blessed Margaret Mary'; Bougand, 'Histoire de la bienheureuse Marguerite Marie' (1894).

**Par'buckle**, a method of raising or lowering any cylindrical body, such as a barrel, by an inclined plane. It consists in throwing a rope round a post fixed on the level from which the object is to be lowered, or to which it is to be raised, making the ends of the rope of the same length and passing them under and round the object to be raised or lowered. In raising or lowering the object one or more men, standing on the higher level, take hold of each end of the rope, and shorten or lengthen the amount of rope paid out according as they wish to raise or lower. By this method the barrel, or whatever else it may be, is made to serve as a pulley for itself. The resistance at the two ends of the rope is just one half of the weight of the object as felt on the inclined plane, or one fourth of that weight at each end separately.

**Parcæ**, pär'sē. See FATES.

**Parch'ment**. See PALÆOGRAPHY.

**Parchment, Vegetable**, a substance first introduced in 1853. It is made by dipping ordinary unsized paper for a few seconds in concentrated sulphuric acid mixed with one half its volume of water, and then quickly removing all trace of the acid. The mixture is allowed to cool before being used. This simple treatment produces a remarkable change in the paper. It acquires a parchment-like texture; turns translucent, especially when thin; and becomes about five times stronger than ordinary paper. Vegetable parchment is also impervious to water, but is rendered soft and limp when dipped into it. A solution of chloride of zinc acts on paper in a similar way. In the manufacture of vegetable parchment a roll of paper is by a mechanical arrangement pulled through a vat containing the sulphuric acid (the time of immersion being from five to ten seconds for thin paper), next through water, then through a weak solution of ammonia, and once more through water. It is afterward passed through felt-covered rollers, and then calendered.

**Pardee**, pär'dē, **Ario**, American philanthropist: b. Chatham, N. Y., 19 Nov. 1810; d. Florida 26 March 1892. He was educated in district schools and in 1830 entered the engineering corps of the Delaware and Raritan canal in New Jersey. He afterward engaged in railroad surveying and in 1838-40 was superintendent of the Hazleton Railroad and Coal Company. Subsequently he became interested in the operation of coal and iron mines and in this field amassed an immense fortune. At the outbreak of the Civil War he equipped a company at his



own expense and later was a munificent benefactor of Lafayette College and other institutions. He was a director of several railroads and at the time of his death was a trustee in Lafayette College.

**Pardee, George Cooper**, American physician and political leader: b. San Francisco, Cal., 25 July 1857. He was educated at the University of California, at the Cooper Medical College, and at the University of Leipsic, Germany. In 1885 he returned to California from abroad, began the practice of medicine as an eye and ear specialist, and was soon recognized as one of the leaders of his profession. He was also active in public life, was a member of the Oakland board of health and city council, and carried on a vigorous and successful campaign in behalf of pure water and against the licensing of poolroom gambling. In 1893 a reform movement in city politics was organized, and he was elected mayor for two years; in this office he compelled the corporation owning the waterworks to reduce its high charges, and dealt with the railroad strike of 1894. In 1898 he was a candidate for the Republican nomination for governor, but was not nominated, and in 1900 was a delegate to the Republican National Convention. In 1899 he was appointed a regent of the University of California. In 1902 he obtained the Republican nomination for governor, and after a vigorous campaign was elected; the most important opposition to his election came from the labor element on account of his action during the strike of 1894. As governor he has favored the extension of the civil service and the preservation of the forests.

**Pardo, pär'dō, Manuel**, Peruvian statesman: b. Lima, Peru, 12 Aug. 1834; d. there 16 Nov. 1878. He was educated in Chile and in Europe, paying much attention to the study of law and political economy. For a time he was in government employ, then retired to private life, but in 1865 was appointed secretary of the treasury by President Prado, which office he filled with great ability. In 1869 he was elected mayor of Lima and in 1872 was elected to the presidency. His inauguration was opposed by Tomas Gutierrez, the minister of war under President Balta, who dissolved congress, imprisoned Balta and declared himself dictator. Pardo was compelled to flee, but when the dictator was killed in an uprising of the populace he returned and took the office 2 Aug. 1872, the first civilian president of Peru. His administration was one of great benefit to the country. He improved the financial condition of the country, aided the advancement of science and literature, crushed a rebellion in Moquegua and upon the expiration of his term of office in 1876 prepared to retire from public life, but was elected to the senate, of which body he was president when assassinated in 1878. His death was mourned as a national calamity.

**Pardo - Bazán, pär'dō - bā - thän', Emilia**, Spanish novelist and critic: b. La Coruña, Galicia, 1852. In 1891 she established and entirely wrote a critical review, 'Nuevo Teatro Critico.' Her literary reputation in Spain was won by her works of fiction, generally classed as naturalistic, most satisfactory in picturesque delineations of Galician landscapes and manners. Among them are 'Los Pazos de Ulloa'; 'La Piedra An-

gular'; 'Pascual Lopez'; the collection of short stories, 'Cuentos de Marineda'—Marineda being La Coruña—; 'Una Cristiana'; and its sequel, 'La Prueba.' Among her critical writings is a prize essay, 'Estudio de las Obras del Feijóo' (1876); 'San Francisco de Asis' (2d ed. 1886), and 'La Revolución y la Novela en Rusia' (1887). The descriptive volumes, 'Mi Romeria' (1888) and 'De mi Tierra' (1888) contain patriotic views of local scenes. Consult Garcia, 'Literatura Española en el Siglo XIX.' (1891).

**Pardoe, pär'dō, Julia**, English author: b. Beverley, Yorkshire, England, 1806; d. London, England, 26 Nov. 1862. She early evinced literary ability, and her first work, a volume of poems which appeared when she was 13 reached a second edition. She was sent to Portugal for her health and while there wrote 'Traits and Traditions of Portugal' (1833), which attracted considerable attention. She was a versatile writer, her books including works of travel, history, and fiction. Some of the best known are: 'The City of the Sultan' (1836); 'Louis the Fourteenth and the Court of France in the 17th Century' (1847); 'Life of Marie de' Médici' (1852); 'A Life-Struggle' (1859); etc.

**Paré, pä-rä, Ambroise**, French surgeon: b. Bourg Hersent, near Laval, department of Mayenne, 1517; d. Paris 20 Dec. 1590. He studied at Paris and in 1536 attached himself as surgeon to the army destined to serve in Italy under Marshal René de Montejean. In 1542 he accompanied the Viscount de Rohan during his campaign at Perpignan. In 1552 he became surgeon to Henry II., under whose successors (Francis II., Charles IX., and Henry III.) he held the same post. His enemies were numerous among the physicians, who accused him of having poisoned Francis II. It was formerly believed that Paré was a Protestant, and that he was saved from the massacre of St. Bartholomew by Charles IX., but M. P. Valet has proved that he was a Catholic. He introduced improvements in the treatment of gun-shot wounds, in the operation of trepanning, and in amputation. He also introduced or restored the practice of tying up divided arteries and operated on articular concretions. A noteworthy edition of his works was produced by Malgaigne in 1840-41. See the 'Life' by Paulmier (1884), and Paget, 'Ambroise Paré and his Times' (1897).

**Paredes, pä-rä'dās, Diego Garcia de**, Spanish soldier: b. Truxillo, Spain, 1466; d. Bologna, Italy, 1530. He served in the Moorish war from 1485 to the fall of Granada in 1492, and then went to Italy where he received from Pope Alexander VI. an important command in the papal army. In 1499 he joined the forces of Gonsalvo de Cordova under whom he served in the war against the Turks in 1501; defended Naples against the French and Spanish in 1502, and in 1503 was at the siege of Ruvo and the battle of Cerignola. At the sieges of Verona and Vicenza and in 1525 at Pavia he won high honor for his courage, and he has been frequently compared with the Chevalier Bayard as regards bravery, honor, and loyalty. Consult De Vargas, 'Vida de D. Garzia de Paredes' (1621).



## PAREGORIC—PARIAH DOG

**Paregor'ic**, an opiate, the camphorated tincture of opium (q.v.); paregoric elixir. It is composed of opium, benzoic acid, camphor, oil of anise, honey, and dilute alcohol. It is an anodyne and antispasmodic, and is much used to allay cough, relieve pain in the stomach and intestines, and to produce sleep. Though a comparatively weak preparation of opium, if given repeatedly or in a large dose it may act as a poison.

**Pareiasau'rus**, or **Pariasaurus**, a genus of extinct reptiles. See THEROMORPHA.

**Parei'ra-bra'va**, the root of a lofty climbing shrub (*Chondodendron tomentosum*) growing in the forests of eastern Brazil, which bears bunches of oval berries resembling grapes. The root is long, branching and woody, of a yellowish to greenish brown color internally, and contains a bitter principle curative in chronic catarrhal affections of the bladder and in calculus.

**Pareja, Juan de**, hoo-än' dā pä-rā'hä, familiarly called "El Esclavo," Spanish painter: b. Seville 1606; d. Madrid 1670. He had, while a mere boy, been purchased by the painter Velasquez as a slave and was a mulatto by race. As he was constantly employed in the painting-room of Velasquez, whom he had accompanied to Madrid in 1623, he became inspired with a passion for painting and secretly copied the works of his master whom he followed to Italy, taking every opportunity of perfecting himself in his art. As Philip IV. was in the habit of visiting the studio of Velasquez and turning every picture the face of which was to the wall, he one day turned a picture which Pareja had completed with great care and placed in the king's way. When the king asked who the painter of the work was, Pareja fell on his knees and asked Philip to protect him. "Such a painter as that," replied the monarch as he turned to Velasquez, "ought not to be a slave." Velasquez gave the newly found artist a deed of manumission, and took him to be his pupil. A fine portrait of Pareja by Velasquez is shown in the collection of the Earl of Radnor. His 'Calling of Saint Matthew' (1661) is in the Prado gallery at Madrid, and in the Hermitage at St. Petersburg is a very beautiful portrait by him. In the chapel of the Recollects at Madrid is his 'Saint John the Evangelist, Orontius and the Madonna'; and the 'Baptism of Christ' is in the Santa Trinidad at Toledo. These pictures exhibit him as a learned and skilful imitator of his master Velasquez.

**Parel'la**, a name given to some of those crustaceous lichens which are used to produce archil, cudbear, and litmus, but which more strictly belongs to one species, *Lecanora parella*, and the red or crimson dye prepared from it. See ARCHIL.

**Paren'chyma**, in zoology and botany the soft tissue of organs; generally applied in zoology to that of glands, and in botany to the substance of leaves, as the green "palisade-parenchyma" of the upper part of a leaf, or the "spongy parenchyma" of the lower part. See CELLULAR TISSUE; LEAF.

**Parent and Child**. See LAW OF FAMILY.

**Parepa-Rosa**, pä-rä'pä-rō'sä, **Euphrosyne Parepa de Boyesku**, British opera singer: b. Edinburgh, Scotland, 7 May 1836; d. London,

England, 21 Jan. 1874. She was educated by her mother and in 1855 made a successful début at Malta, appearing in England in the following year. She possessed a soprano voice of remarkable power, and sang in the title-roles of 'Camille,' 'La Reine Topaz,' 'Victorine,' etc., with great success. She was married in 1864 to an English army officer, Henry de Wolfe Carvel, who died the next year. In 1866 she made her first tour of America and in 1867 was married to Carl Rosa with whom she formed the famous Parepa-Rosa company. Her success continued unbroken until her death, which occurred while she was preparing her part in an English version of 'Lohengrin.' She excelled in oratorio.

**Par'esis**. See GENERAL PARESIS; INSANITY.

**Par'et, William**, American Protestant Episcopal bishop: b. New York 23 Sept. 1826. He was graduated from Hobart College, Geneva, N. Y., in 1849; entered the Episcopal ministry and after successive rectorates at Clyde and Pierrepont Manor, N. Y.; East Saginaw, Mich.; Elmira, N. Y.; Williamsport, Pa.; and Washington, was consecrated sixth bishop of Maryland in January 1885.

**Pargeting**, pär'jēt-īng, or **Parge-work**, a term used for plaster-work of various kinds, but commonly applied to a particular sort of ornamental plaster, with patterns and ornaments raised or indented upon it.

**Parhe'lion**, in astronomy, a mock sun, having the appearance of the sun itself, and seen by the side of that luminary. Parhelia are sometimes double, sometimes triple, and sometimes more numerous. They appear at the same height above the horizon as the true sun, and they are always connected with one another by a white circle or halo. This white circle shows the colors of the rainbow with the red inside, and there are often seen two concentric halos, and rarely even three. The parhelia occur on these halos at the points where they are crossed by another circle parallel to the horizon, and appearing like a diameter of those concentric with the sun. This parhelic circle shows no coloration. See HALO.

**Paria**, pä'rē-ä or pä-rē-ä', (1) gulf of the Atlantic between Trinidad and Venezuela and almost hemmed in by land, being connected with the ocean by the Boca de Dragos, or Dragon's Mouth, at the north, and by the Boca del Soldado, or Serpent's Mouth, at the south. These straits are about 10 miles wide, are very dangerous, and were first sailed through and named by Columbus in 1498. The gulf (sometimes called Golfo Triste) furnishes good anchorage, measures 100 miles in length and 40 in width, receives the northern waters of the Orinoco as well as the Colorado, and is full of fish. (2) A peninsula, jutting to the east from the mainland and forming the northern side of the Gulf of Paria. It is formed by a bold picturesque ridge of mountains. (3) The extreme eastern point of this peninsula is called the Cape of Paria (or Punta Panas).

**Pa'riah Dog**, one of those dogs which are masterless and run wild in many Oriental cities. The name is derived from that given to the outcast or lowest servant class in India where, as also in Constantinople and other cities, such dogs are extremely numerous. In many cities



## PARIAHS — PARIS

they form almost a distinct breed, being of large size and generally of a dirty yellow or blackish color; the hair is short and smooth, and the ears pointed and erect. They possess the canine instinct of running in packs and frequently take possession of certain districts after nightfall. A very useful service is performed by them in Constantinople, where they act as scavengers and devour the garbage which is not otherwise removed. Their wits have been sharpened by this precarious mode of life and they are said to be possessed of unusual intelligence and cunning. By the Mohammedans they are considered unclean and the faithful are defiled by accidental contact with one of them.

**Pariahs**, or **Parias**, the lowest recognized castes of the Hindus of southern India. They number about 5,000,000 and are four times as numerous as the Brahmans. Many pariahs are servants of Europeans, accompanying the regiments over the whole Madras presidency, hence they are more civilized than the castes above them; and a number of them have embraced Christianity.

**Pa'rian Chronicle.** See ARUNDEL MARBLES.

**Pa'rian Marble**, the most celebrated statuary marble of antiquity. It is white, of mellow tone, and large-grained. It received its name from the island of Paros (q.v.), where it was quarried. See MARBLE.

**Parima**, pä-rē'mä or pä-rē-mä', or **Parime**, **Sierra**, mountain range of Guiana in South America, forming a great river divide. The Orinoco flows on three sides of the range, which has as its southwestern boundary the Rio Negro and reaches east to the Essequibo. The eastern part of the range is sometimes called Pacaraima, Parima being reserved for the western. A bare plateau with old sandstone superficial strata and a granite core, the range reaches its highest points in Sierra Maraguaca, Duida, and Yamari, which are over 7,000 (the first two over 8,000) feet high.

**Parini, Giuseppe**, joo-sěp'pě pä-rē'nē, Italian poet: b. Bosisio, a village of the Milanese, 23 May 1729; d. Milan 15 Aug. 1799. He studied theology and was ordained a priest in 1754. His interests were always literary, rather than ecclesiastical. He was an instructor successively in the Scuole Palatine and the Brera College, at Milan. His chief work is 'Il Giorno' ('The Day'), a biting satire on the Italian nobility. He wrote also some excellent odes, and was always most skilful in the arts of versification. There is an edition of the 'Giorno' by Borgognoni (1892). Consult: Dumas, 'Parini, Sa Vie ses Oeuvres son Temps' (1878); Cantu, 'L'Abate Parini' (1891).

**Paris**, pä-rēs, **Gaston Bruno Paulin**, French romance philologist; b. Avenay (Marne) 9 Aug. 1839; d. Cannes 6 March 1903. In 1872 he became professor of French language and literature at the Collège de France, and in 1895 director of that institution. In 1896 he was elected to the Academy. A pupil at Bonn of Diez, he did much to carry forward the study of Romance philology which the former had practically founded. 'A Poetical History of Charlemagne' (1866); 'Poetry of the Middle Ages' (1885); and 'French Mediæval Literature' (1888), are his most important publications.

**Paris**, pä-rē, **Louis Albert Philippe D'Orléane**, COMTE DE, French nobleman, grandson of Louis-Philippe: b. Paris 24 Aug. 1838; d. Stowe House, Buckinghamshire, England, 8 Sept. 1894. His father was killed by an accident in 1842, leaving him heir to the French throne. After the revolution of 1848 he resided for a time at Claremont Park, Surrey, where he was educated by his mother, and where Louis-Philippe died in 1850. In 1861, during the American Civil War, he, with his brother, the Duc de Chartres, served as volunteers in the Union army in order to gain a practical knowledge of military affairs, and were for some time on the staff of Gen. McClellan. On his return to Europe in 1862 he married his cousin, the Princess Marie-Isabelle, eldest daughter of the Duc de Montpensier. On the outbreak of the Franco-German war he desired to serve against the enemies of France, but was not allowed by the French authorities to do so. After the war, however, he was admitted a member of the first national assembly. On the death of the Comte de Chambord, in 1883, the Comte de Paris was recognized as head of the royal house of France. Under the expulsion bill of 1886—a measure due to the fear of the French republicans that the royalist party was becoming too strong—he, and the other royal princes, were forbidden to reside in or enter France. The same year his eldest daughter was married to the crown-prince of Portugal. He published a valued 'Histoire de la Guerre Civile en Amérique (1874-5)', which has appeared in an English translation; and 'De la Situation des Ouvriers en Angleterre' (1864). During his latter years he lived the retired life of an English nobleman.

**Paris**, pär'is, **Matthew**, English mediæval historian: b. about 1200; d. about 1259. He entered the Benedictine order at the monastery of St. Alban's in 1217, and on the death of Roger of Wendover in 1236 succeeded to the post of historiographer and began the continuation of the 'Chronica Majora,' a record of English history kept at the monastery. In 1246 he was invited by Hacon IV. of Norway to adjust the affairs of the abbey of St. Benet Holm in Trondhjem province, and in 1248-9 thoroughly reorganized the establishment and received extensive gifts from the monarch. His great chronicle ends abruptly at May 1259. He carefully revised the work of the early compilers on the 'Chronica,' extending to the end of 1188, and the contribution of Wendover (1189-1235), and prepared an abridgment called the 'Historia Minor' (1067-1253). His narrative is extremely accurate; he wrote brightly and with vigor, noted important happenings of foreign lands, and did not spare his censure when he thought it needed.

**Paris**, or **Alexander**, was the second son of Priam and Hecuba, and is set forth in Homer as the cause of the Trojan War. Before his birth his mother dreamed that she had brought forth a fire-brand, which reduced Ilion to ashes, and Priam, learning this, gave her next son to be exposed by a shepherd on Mount Ida. Here the babe was suckled by a she-bear and the shepherd discovering this after five days, gave him the name of Paris, and undertook his rearing. The name of Alexander was given him



## PARIS

later for his valiant defense of certain heroes. On Mount Ida he fell in love with the nymph C  none, daughter of a river god. Their happiness was interrupted one day by the appearance of Hermes leading before Paris the three goddesses Hera, Athene, and Aphrodite. At the bridal of Peleus and Thetis, Eris, or Ate, goddess of strife or mischief, had thrown down a golden apple on which was inscribed "to the fairest woman." Hermes called upon Paris to decide which of the three goddesses present was entitled to the gift, for each of the three claimed it as hers by right. Hera promised to the beautiful shepherd power and dominion if he would decide in her favor; Athene offered fame and wisdom; Aphrodite pledged herself to send him the loveliest wife in the world. The judgment of Paris was made in favor of the goddess of love, and when he one day brought a bullock for sacrifice at a festival in the city of Troy, he was recognized by his sister, Cassandra, the prophetess, and acknowledged by Priam as his son. With the aid of Aphrodite he carried off Helen, the beauteous wife of Menelaus, king of Laced  mon, and returned with her to Troy. This was the cause of the Trojan war, for Agamemnon joined his brother Menelaus in a campaign in which Troy was besieged for 10 years and eventually sacked. Homer has given us vivid ideas of the beauty of Paris and has described him as fond of minstrels, and of beautiful women, as well as skilful in war. His lightness of character is also dwelt upon by the poet. After the fall of Troy, he returned to Mount Ida and the nymph C  none to be healed of the wound he had received from the arrow of Hercules shot from the bow of Philoctetes. But C  none repulsed her faithless lover, who died of his wound. In Greek art he is represented as a beardless young man of handsome form, wearing a Phrygian cap, and generally seated with the apple in his hand as in the statue by Euphranor in the Vatican. The Judgment of Paris is the subject of vase paintings.

**Paris**, p  r'is (Fr. p  -r  ), the capital and chief city of France, and the political, literary, artistic and social capital of Europe since the decline of Rome, situated in the northern part of France, on both banks of the Seine, in lat. 48   50' N. and lon. 0   00' Observatoire. It is the second city in size in Europe, and the third or possibly the second centre of population on the earth, being surpassed only by London and perhaps by greater New York (with the New Jersey suburbs) in actual number of inhabitants. The population, according to the census of 1901, is as follows: Paris, within the walls, 2,714,068; the northern suburbs (Arrondissement of St. Denis), 569,066; the southern suburbs (Arrondissement of Sceaux), 386,630; total for Greater Paris, 3,669,764. This is the Department of the Seine, with an area of about 184 square miles. By way of comparison we may note that Greater New York, with 327 square miles of extent had at the last census about the same population, that is, 3,682,159. With an equivalent area the population of Paris exceeds 4,000,000. It is the only considerable modern city which is completely surrounded by a wall, and the population, in consequence of the confined area within the fortifications (about 30 square miles), is the densest in Europe.

For a thousand years prior to about the

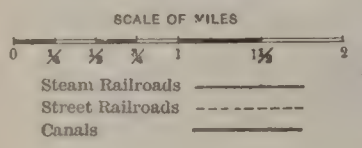
middle of the last century Paris was the largest city in the world. The defense of this huge metropolis is provided for by an elaborate system of fortifications, which were constructed between 1840 and 1845, at an expense of 140 millions of francs. The enceinte, with its 94 bastions, is about 22 miles in length. The ramparts, averaging 32 feet in height, with a parapet 19 feet in width, are environed by a moat 48 feet in width, and a glacis. The approaches to the city are also commanded by 17 detached forts at different but relatively short distances from the walls. A second line of forts at a greater distance from the ramparts has also been constructed on the heights commanding the valley of the Seine. The area included within this elaborate system of fortifications is 400 square miles. The garrison numbers 50,000 men, the pick of the French army. The administration of the city is shared between the Prefect of the Seine, appointed by the Minister of the Interior, and the Municipal Council elected for a term of three years—one from each *quartier*—by universal suffrage. The annual budget runs to 375 or 400 millions of francs. The city is divided into 20 arrondissements, in each of which there is a mayor and a *mairie*, which is the office of the mayor, and constitutes a sort of city-hall for the arrondissement. Each of the arrondissements is divided into *quartiers* corresponding roughly to the wards of an American city. With 20 arrondissements there are eighty of these *quartiers*, each one of which has a distinguishing name, as for example, the quarter of the Champs Elys  es in the eighth arrondissement, or the quarter of the Sorbonne in the fifth arrondissement. These quarters are in general of about the same territorial extent, but the population varies greatly between about 10,000 and 110,000.

*Early History.*—Our knowledge of Paris and its people begins during the Roman invasion of Gaul, in the spring of the year 53 B.C., at which time Julius C  sar convoked at Lutetia an assembly of the Gallic tribes. This is the first mention of what is now Paris in authentic history. Its annals thus commence in the 'Commentaries' of C  sar, wherein, referring to that assembly, he mentions a collection of fishermen's huts on the island in the Seine, which he calls Lutetia—probably and perhaps certainly a Latinized form of the name by which it was then locally known. Strabo writes it *Lucotocia*, and Ptolemy *Lucotecia*, while the Emperor Julian dates a letter from the city calling it *Louchetia*. Of these various spellings, that employed by C  sar is the one commonly adopted, although the hill of the university was known for many centuries as "*Mons Lucotivius*." In modern French it is written *Lut  ce*, and is understood to refer only to the island of the city, while *Lucot  ce* is the French name for the Roman settlement on the left bank. The derivation of the word has been the subject of much research. Scholars have attempted to trace it to Celtic sources, especially to the dialect of lower Brittany. C  sar in the 'Commentaries' states that the inhabitants of the island in the Seine to which he refers formed a division of a clan or tribe, called the *Parisii*. Thus, he says, "The *Parisii* are inhabitants of a tract bordering upon that of the Senones, with whom tradition says they were once allied."





PARIS  
and Vicinity.









## PARIS

In the year 52 B.C., Labienus, the lieutenant of Cæsar, marched upon Lutetia, and after a battle fought with the Parisii in the plain now covered by the southern suburbs, and of which an echo remains to this day in the name of the little village of Vitry (place of the victory)



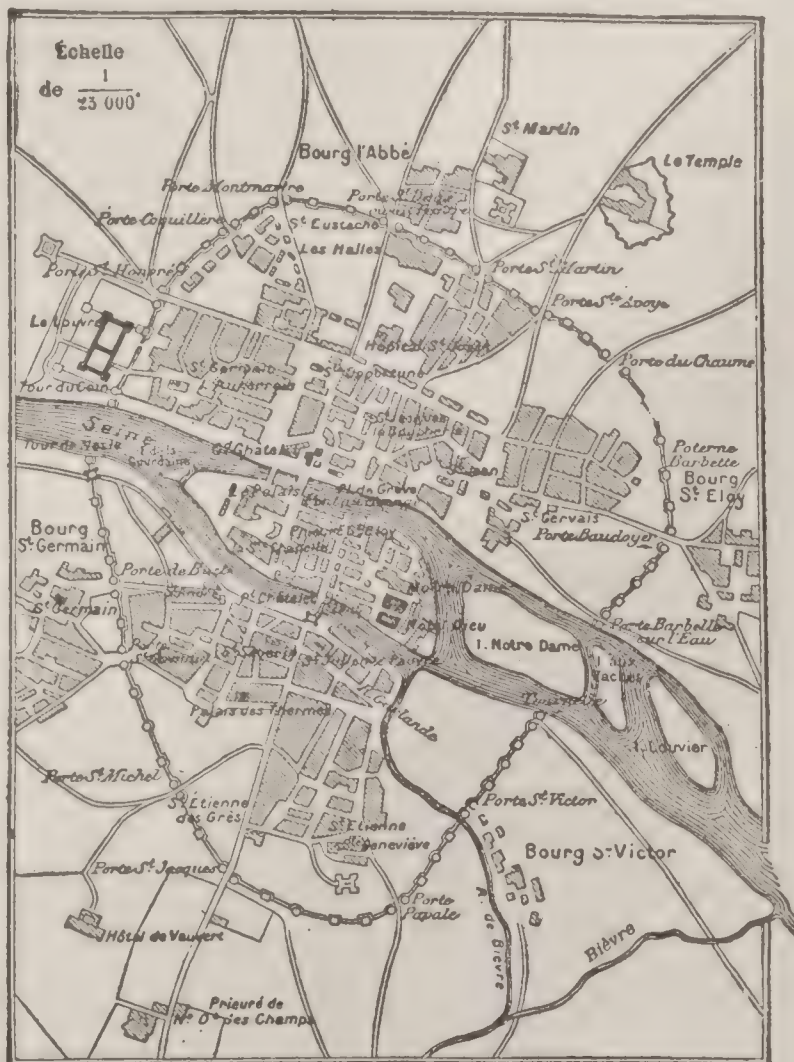
Paris under the Romans.

took formal possession of the island on behalf of the Romans. The etymology of the term *Parisii* has been no less a subject of dispute than that of Lutetia. It is, however, also traced to lower Brittany and to a Celtic word signifying a boat. The ancient, as well as the modern emblem of Paris is a boat, as may be seen by the interesting carving which ornaments the base of one of the vaults of the roof in the Palais des Thermes. Thus the figure of a ship which serves everywhere to identify the property of the city of Paris to-day, and which constitutes the hall-mark, so to speak, of the city, harks back to the *Parisii* of Cæsar and his 'Commentaries.' Hilaire Belloc says, "The triple prows which are seen on the lamp-posts of modern Paris are an emblem 1,500 years old, and without a break of continuity." The Romans occupied Paris for more than 500 years. Extensive remains of their domination are still found on the left bank, notably the Palais des Thermes at the Musée de Cluny, the amphitheatre recently unearthed just out of the rue Monge, the arches of the aqueduct which crosses the valley of the Bièvre at Arcueil—two of the arcades of which are preserved to this day, just outside the southern wall—and the ruins of the reservoir connected with it which were discovered in opening the rue Gay-Lussac.

**Topography.**—A modern traveler looking over the town from the heights of Montmartre, from the top of the Eiffel Tower, or from the

dome of the Pantheon, sees the great city spread out before him like a map, lying in a plain encircled on almost every side by distant and low hills, those on the north and east being further removed than those on the south and west. Paris, therefore, is situated in what geologists call a basin or plain of greater extent than that occupied by any other modern capital, being scarcely ever less than 20 miles in diameter and in some places much more. The Seine enters this plain at the southeast corner, coming from the highlands of Burgundy and Champagne, and, describing a great arch or bow through the city, passes off and out at the southwestern corner of the plain.

On the west rises Mont Valérien, and on the north the hillocks of Enghien and Montmory; the hill of the university or Mont Ste Geneviève on the one hand, and the somewhat more conspicuous eminence of Montmartre on the other rising out of the plain. Paris naturally divides itself into the Cité, the University, or the left bank, and the Ville, or the right bank, and to be understood it must be studied from these three points of view. Originally the town was all on the island, but even in the days of the Romans, villas and country seats were built on either bank, especially on the north bank up toward the heights of Montmartre, while on the south bank the Romans fixed their camp and at the same time the emperor's palace. We note that Julian, the Apostate, who resided much of the time at Lutetia—which began about this time to be called



Paris under Philippe Auguste.

Paris—was crowned emperor of Rome in the year 361 A.D., at a spot in the camp on the left bank, which is now located in or near the boulevard Saint Michel, between the boulevard Saint Germain and the Luxembourg. Julian was very fond of Paris, referring to it in one



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of his letters as "*ma chère Lutèce*" (my dear Paris), and praising it for its vineyards, its mild climate and the figs that the farmers of the suburbs furnished for his table, saying that Bacchus is the god of the Parisians because he is the father of joy. By the time of Philippe Auguste the city had extended on the right bank as far down the river as to what is now the eastern façade of the Louvre, the foundation stones of which were laid by that monarch in the year 1223. The wall of Philippe Auguste extended from his palace of the Louvre in a wide loop northward and eastward to a point about the middle of the island of Saint Louis, as it now exists, and thence, across the river, in a smaller loop which crossed the rue Soufflot at the corner of the rue Saint Jacques, and passed near what is now the garden of the Luxembourg and close to Saint Germain des Prés, to a point on the river at the Tour de Nesle about on the site of the Institute. Great chains were hung across the river above and below to complete the fortification, and towers at either end buttressed the river. A fragment of the wall of Philippe Auguste still stands in a good state of preservation at a point in the rue Clovis near the rue Cardinal Lemoine, just behind the Pantheon, and some less important traces of it are also still to be found on the right bank. Like most river cities, Paris grew down the river rather than up. The size of the city within the walls was increased by the mural enlargement of Henry IV., and later by the new and greater fortifications of Louis XIV. The grand boulevard, on the right bank, from

present the walls are intact and there is a strong disposition on the part of the Parisians to insist upon maintaining the fortifications.

*Civic Art and Civic Charm.*—Paris was the pioneer in the modern scheme of civic regeneration intelligently conceived and carried out in



Paris under Louis XIII.



Paris under Henry IV.

the Bastille to the Madeleine, runs along the line of the northern walls of Louis XIV., which were thrown down and demolished by Louis XV. The present walls were the work of Louis Philippe. A project is now in hand to demolish them, at least in part, but up to the

a large way. Accordingly it is now par excellence the city beautiful, and the leader in the more decoratively æsthetic features of modern civic art. No city equals Paris in appearance, just as no city except Rome equals it in historic interest. Since the work of the third Napoleon and his architect-engineer, Baron Haussmann—a work, it is fair to say, which has been and is zealously and intelligently carried forward under the Republic—in opening new thoroughfares and in the construction of many new and splendid public buildings, in virtue of the essential physical regeneration of the city resulting from this construction and reconstruction which dates from the second empire, Paris has been incontestably the first of cities. Under the operation of the building laws and the regulations as to height, size, general character and style, pursuant to which Paris has been built and rebuilt for the past half century at least, the city may be said to be built to a scale—the form and quality of the construction being prescribed, and each new house as it were commencing as and where the last house left off. Paris is thus made to constitute architecturally a civic entity, an ensemble, "a city with foundations," and not a heterogeneous and promiscuous collection of houses, with a miscellaneous assortment of taste in their construction. There is for example a uniform sky line as much as a uniform street line, with



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no architectural monstrosities, and with everything built under a central intelligent supervision, as part of a preconceived plan, which eliminates lawless individualism and the architectural vagaries resulting from personal caprice. Thus everything is made to conform, as

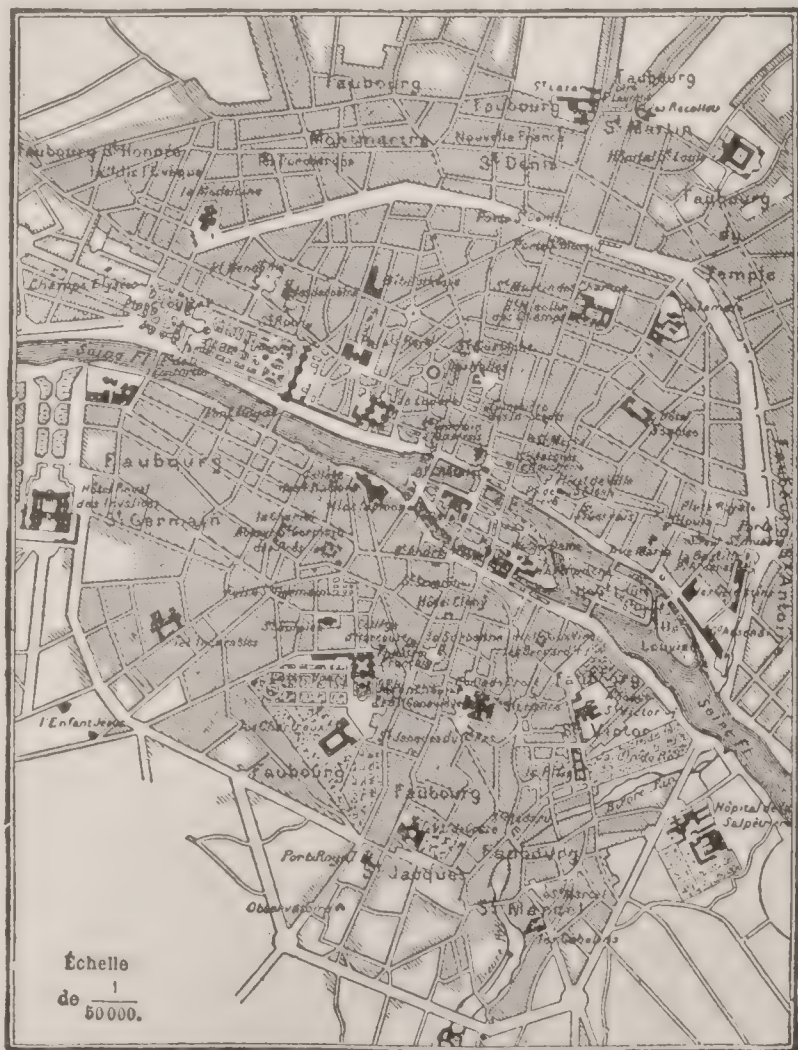


Paris at the opening of the reign of Louis XIV.

part of a substantial uniformity, and to square with prescribed canons of good taste in building. The streets of Paris accordingly display a pleasing elegance which is not the result of accident, and evince a unity in the scheme of construction, which, without being monotonous, delights the sense of order and proportion by its form and fitness. We find men coming from all parts of the globe, and seeing here something better than mere wealth of luxury and amusement, something more than splendid palaces, sumptuous edifices and a multiplicity of promenades, avenues and boulevards. To all men who reflect Paris has a charm quite independent of its external beauty. Among Americans of our heroic age, Thomas Jefferson, Benjamin Franklin, the Livingstons, Gouverneur Morris and Robert Fulton; and among literary Englishmen, Richardson, John Wilkes, Horace Walpole, Gibbon, Hume and Sterne breathed with delight its intellectual atmosphere, and few men of later days are impervious to the fascination.

**The University.**—Alone among the great capitals of the world, Paris is the site of the old university of the nation. The university had its cradle as early as the latter part of the 8th century on the island of the city in the cloisters of the cathedral, between the church and the larger arm of the river on the northernly side. The tradition is that the foundation dates from 780, when Charlemagne called the famous Alquin to Paris, and established a school for him at Notre Dame. An echo of the tradition—whatever the tradition itself may be

worth—has come down all the way from the 8th to the 20th century. Saint Charlemagne is the patron saint of the university, and every year on the 28th of January, which is his day in the calendar, the schools take holiday. The authentic annals, however, seem to commence with Pierre Abelard about 1107. Under him the institution still in the cloisters of the cathedral began to gain that international prestige which it has never lost. The pathetic romance of Héloïse and Abelard lends a sentimental interest both to the time and to the place. The site of the house where these unhappy lovers lived is marked by a plaque on a wall on the Quai aux Fleurs. Abelard is said to have conferred upon himself the degree of doctor of divinity while he was connected with the university. Henry II. of England submitted to the great council of the university his quarrel with Thomas à Becket of Canterbury in the 12th century. In 1200 it received a royal charter from Philippe Auguste; in 1208 Innocent III. gave it a papal charter; and in the 14th century Charles V. conferred upon it the title of "the eldest daughter of the kings." The term "university" as signifying a collection of schools of higher learning originated in Paris. It was first employed in connection with this institution, in the Bull "*Scientiarum fontem*" of Urban IV. in 1264, wherein it is designated as the "*Universitas Parisiensis*." The degrees of bachelor and master of arts also originated here. The university remained on the island and under the shadow of the cathedral until the beginning of the 13th century, when it passed



Paris at the close of the reign of Louis XIV.

over into the rue de la Harpe on the left bank and slowly climbed up the hill of Ste. Geneviève. The first buildings of the faculty of arts were put up in what is now the Latin quarter in the 13th century near the church of Saint Julien le Pauvre in the old rue du Fouarre. The uni-



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versity grew and prospered throughout the latter half of the Middle Ages under the patronage of the church and of the kings. The Faculty of Law and the School of Medicine were both founded in the 12th century, the law school dating from 1160. From the beginning of the 13th century to the end of the 16th the Sorbonne was a sort of international theological parliament which the nations and kings of Europe consulted on great political and religious questions (as, for example, Henry VIII., of England, on the annulling of his marriage with Catherine of Aragon), and which assumed the function of pronouncing upon the orthodoxy of new books, condemning to destruction by fire such as were not conformed to its ideas. As early as the 16th century the university had from 12,000 to 15,000 students, drawn from every quarter of the earth. They all learned to speak an extraordinary mixture of French and Latin, in which the work of the schools was then carried on, and it was not until the end of the reign of Henry IV. that this jargon was displaced by idiomatic French. Because Latin was the language of the university, the region of the schools was called the *Pays Latin*, or, in our modern phrase, the Latin quarter. Then the language was indeed Latin of a sort; now students from every land and all tongues, except Latin, stream through the streets of the quarter. During the Middle Ages there were at the university separate colleges for each of the four nations, France, Picardy, England, and Normandy, with much rivalry between them. After the re-entry of Charles VII. to Paris in 1437, the college of England was changed to that of Germany. The seals of these collegiate "nations" are preserved in the British Museum. The University was governed by a rector for many centuries, who during the Middle Ages was the supreme power in all the territory of "*l'Université*" both in civil and criminal affairs affecting the students. It was the privilege of the students to be condemned and hanged only by the court of the rector. It is an interesting fact that the messengers of the students in the Middle Ages, who carried letters and packages to and fro for them from their homes, were the forerunners of the post-office system of Louis XI., which was the first attempt at a regular postal service anywhere. The annals of this great school reaching far back into the dark ages constitute one of the most fascinating episodes in history. The University of Paris has, ever since about the end of the 12th century, been the intellectual centre of Europe, and the chief seat of light and learning in the world. All the other and later universities, like Oxford and Heidelberg, have been modeled after it. No other university can compare to it in the number of distinguished men it has numbered among its students. Thus, in the long roster are such names as Dante—second poet of mankind—Pierre Abelard, François Villon, Pierre de Ronsard, Tasso, Rabelais, Clément Marot, John Calvin, Ignatius Loyola, Innocent III., Francis Xavier, Erasmus, Melancthon, Pascal, Rollin, Saint-Pierre, Descartes, Voltaire, Rousseau, Robespierre, Diderot, Condorcet, Molière, Racine, La Fontaine, Boileau, Lamartine, Sainte-Beuve, Victor-Hugo, Comte, Taine, Renan, and all the moderns. At present there are ordinarily in Paris from 15,000 to 18,000

students in attendance on the courses of the university (among them about 5,000 in the law school), together with several thousand more in the various technical, art and industrial schools which work independently of the university; for example, the Collège de France, the Beaux-Arts, the Polytechnic School, Ecole des Ponts et Chaussées, the School of Mines, the Normal School, the Conservatory of Music, Arts et Métiers, Hautes Etudes, the Ecole des Chartes, the School of Living Oriental languages, the special schools of art and architecture, etc. Thus there are always in Paris an average of not less than 25,000 students of one sort and another—not including the students in the various lycées and colleges—constituting in the whole a very much greater number from the four quarters of the earth than are to be found elsewhere in any one place in the world; and the university of to-day, as much as ever, is in numbers and in world-wide influence the first of schools of learning anywhere. The 27 libraries of the university contain in the aggregate more than 1,000,000 volumes.

*Public Instruction—the Free Schools.*—The principle of free public instruction in France dates from the Revolution, but the public school system of Paris in its present form is substantially the work of the Third Republic. It commences with the maternal schools (*écoles maternelles*) directed by women, which receive children of both sexes from 2 to 6 years of age, and give them care and elementary instruction in reading, writing, and ciphering. These schools are scattered throughout the city, but of course are especially designed for the poorer quarters where the many young mothers who are employed in shops and factories can place their infant children during working hours. Next come the primary schools, separate for boys and girls, which receive and instruct children from 6 to 13 years of age. Pupils go from these schools to the superior primary schools, and thence for secondary classical courses to the lycées and colleges, which confer the degrees of bachelor in letters and bachelor in science. A French boy usually takes his bachelor's degree when he is about 16 or 17 years of age. It is thus not the equivalent of the A.B. or B.S. in America, representing here on the contrary something like a certificate of graduation from one of our average city high schools. There are ten superior primary schools, six lycées supported by the city, and two by the state, and three colleges; these lead to the university and the professional and technical schools. There is also a system of free public night schools for adults, both men and women. There are about 125 of these schools with some 12,000 pupils.

There are in connection with the various public schools about 400 libraries containing useful and instructive books (no fiction) to be loaned to the pupils. In addition all necessary books and stationery are furnished free to all the pupils in the primary and superior primary schools. The city also furnishes to all the day scholars a *déjeuner*, that is, the meal at the noon hour, consisting of hot soup, meat, and vegetables, prepared and served in the cuisine of the school. The children are supposed to bring in their little baskets, a bit of bread and a bottle of wine, but when they do not, bread is also



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furnished. Some parents pay a small fee, when they are able, for this luncheon, but the poor pay nothing, and by a system of copper checks, which are given out to all the pupils every day and surrendered at each meal, it is impossible to know who pays and who does not. Shoes and clothing are also provided for children whose parents are unable to furnish them. The keynote of Paris public school administration is the absolute equality of the scholars while they are in school. The tendency to clothe school children in blue blouses makes this fairly easy. Elementary education is obligatory as well as free. Mixed schools are not tolerated in Paris. During the summer vacation the city provides excursions—from a day or two to a month in length—for the children of the poor, to the seaside or to the country, sometimes to Switzerland. Each child is required to keep a diary of his excursion whether it is long or short, which is subsequently treated as an exercise in composition. The system of primary instruction is, upon the whole, an admirable one. It cares for and educates all the children of the city.

*Churches.*—Among the monumental buildings that adorn the capital the cathedral of Notre Dame holds the first place. Its foundations were laid upon the ruins of a temple of Jove, first about 375 A.D., and rebuilt again and again; the present edifice upon the original site having been begun in 1163. The choir was finished in 1195, the façade in 1218, and the towers in 1225. It was the first conspicuous embodiment of the Gothic ideal in church architecture—the mother church from which has come down in ordinary generation that prolific family of Gothic churches throughout the world, which stands sentinel about the Ile de France in a widening circle from Rheims and Amiens, from Rouen, Beauvais and Chartres to Cologne and Milan, to York, Canterbury, and Lincoln and to the ends of the earth. Notre Dame de Paris is accordingly not only one of the oldest, largest and most interesting churches of the world, but it is architecturally one of the most impressive buildings ever erected. Victor Hugo well characterized it as a “vast symphony in stone.” Although it is more than 700 years old it is in an excellent, almost perfect, state of preservation, the conscientious and intelligent restoration of the entire structure by Viollet-le-Duc at the middle of the last century leaving little to be desired. Its towers were the most conspicuous monuments of mediæval Paris, and from their base all distances from Paris are calculated.

Next after Notre Dame the most interesting church in Paris from an architectural point of view is the Sainte Chapelle at the Palais de Justice. It is said to be the most perfect specimen of pure Gothic architecture in existence. It was built by Louis IX. in 1245. Here for many generations until recently was celebrated every year at the opening of the courts in October the “red mass,” attended by the bar and the judges in their scarlet robes. This mass is now said at Saint Germain l’Auxerrois. During its long history this beautiful chapel royal has been the site of many coronations and other kingly ceremonies. Saint Julien le Pauvre, which in its origin goes back to the first centuries of the Christian era, is a little church in the Latin

quarter built in the 11th century. It stands just out of the rue Saint Jacques in the rue Galande. It is interesting not only as a beautiful specimen of early Gothic, but also because it was for many years, a sort of chapel to the university, where the council was convoked, and where the rector had his official seat. Saint Germain des Près, in the boulevard Saint Germain, founded by Childebert in 543, with its barbaric tower of the 9th century, is the most venerable monument on the left bank. Saint Eustache, at the markets, begun in 1532, a church of great size and impressiveness; Saint Sulpice, near the Luxembourg, with its great organ and fine music; Saint Roch, in the rue Saint Honoré from the steps of which Bonaparte, then a young officer of artillery, trained his cannon upon the mob at the commencement of the Revolution, and from which he may accordingly be said to have set out on his extraordinary career; Saint Augustin in the boulevard Malesherbes, and Saint Clotilde near the Palais Bourbon, two modern churches of great size and beauty; Saint Thomas d’Aquin, the most fashionable church of the faubourg Saint Germain; Saint Etienne du Mont, under the shadow of the Pantheon, with its beautiful jubé, or rood-loft, of exquisite workmanship, and the two graceful staircases ascending to it, the jubé dating from 1609; the Madeleine, in the grand boulevard; Saint Vincent-de-Paul, with its splendid approach from the rue LaFayette, and Saint Germain l’Auxerrois at the Louvre, are among the most notable of the churches. The new and splendid church of the Sacré Cœur on Montmartre, commenced after the war of 1871, and conceived in expiation of the murder of the Archbishop of Paris by the Commune, is the most considerable religious edifice which has been built in modern times. It has already cost upward of \$5,000,000, and is still far from completion. Paris is divided into seventy parishes, and there are in all about 140 places of worship, of which 86 are Catholic. Almost every sect in the world has a church in Paris, and religious services are conducted in all the principal languages of civilized and semi-civilized mankind. The churches of Paris are among the most interesting features of the city, entirely apart from any religious consideration; so much of the stirring history of the town is written in the stones of her great churches.

*Galleries of Art and Museums.*—The Louvre with its unrivaled collection of *objets d’art* is the chief art gallery of Paris. The Louvre itself was a royal castle from the days of Philippe Auguste until Louis XIV. built the palace at Versailles. The existing structure which superseded the work of Philippe Auguste was begun by Francis I. in 1541, and was added to and extended by his successors down to and including the third Napoleon. As finally completed it constitutes the grandest urban palace in the world, and one of the most extensive and historically interesting buildings on the earth. Since 1793 the greater part of the interior has been occupied by the famous museum and art galleries of the Louvre, although the wing on the rue de Rivoli is occupied by the Ministry of Finance. It may be said to be the most important public building in Paris. It has an unrivaled situation on the Seine and on the rue de Rivoli, facing the gardens of the Tuileries and



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the Place de la Concorde. It covers an area of more than 48 acres, and only the papal palace of the Vatican can be compared to it for size and magnificence. It is interesting to note by way of comparison that the public buildings in Philadelphia cover  $4\frac{1}{2}$  acres, the Louvre being thus in area  $10\frac{2}{3}$  times as large. The galleries contain a vast collection of paintings, sculpture, objects of art and antiquities to which only the collections of the Pitti-Uffizi Gallery at Florence and of the Vatican at Rome can fairly be compared. They are entirely free, and open to the public at fixed hours daily. The next gallery in importance and interest is that of the Luxembourg, in the gardens of the Luxembourg adjoining the palace. It is a museum of no great size of living artists, opened in 1886. There is a plan now in hand to rebuild and enlarge it on the same site. Among the great number of other collections may be mentioned the Musée Cluny, in the boulevard Saint Germain, dating from 1840, possessing not only the interesting Roman ruins of the ancient Palais de Thermes, but also a valuable collection of mediæval furniture and objects of art from the Middle Ages; the Musée Carnavalet — the museum of the city of Paris — containing an invaluable collection of objects connected with and illustrating the history of the city in all its centuries of existence, located in the hotel of Madame de Sévigné, in the rue de Sévigné, in the Marais, once the centre of fashionable life, but now rather a neglected quarter; the Musée of Artillery at the Hotel des Invalides, containing a very large collection of arms, ancient, mediæval and modern, of all sorts, cleverly displayed in a chronological order; also Napoleon's camp bed, some of his uniforms, the famous gray overcoat, and many of his camp furnishings; the Musée of the Trocadéro, which contains a collection of sculpture illustrating various phases of ancient and mediæval architecture, being especially rich in early French churches and royal tombs, together with an interesting ethnographic exhibition; the Musée Guimet; the Musée Galliera, in a new and palatial structure of exceptional artistic beauty, in the rue Galliera, not far from the Trocadéro; etc.; the long list including more than fifty separate public collections of varied and general interest. No city in the world contains a greater number of valuable private collections, many of which are accessible to students and sightseers, on proper introduction.

*Libraries, Books, and Publications.*—No city was ever so rich in books and libraries and literary treasure as Paris. The Bibliothèque Nationale has always been unrivaled. It has been known in its long history successively as La Bibliothèque du Roi, Royale, Nationale, Impériale, and now Nationale again. It was founded in the 14th century by John II., and then consisted of but eight or ten volumes; it was housed at first in the Palais de la Cité. Charles V. is sometimes called its founder because he removed it to the Louvre and increased it to 910 volumes during his reign. Some books of Charlemagne's are said to be included in this first collection. Francis I. transferred it to Fontainebleau, but it was brought back to Paris by Henry IV. Subsequently it was stored in various places in the city, but was finally located in the Palais Mazarin, in the

rue Richelieu, now more than 200 years ago, where it has since remained. Although it is a building of vast size, it has recently been greatly enlarged by a splendid addition in the rue Vivienne. Under Francis I. it contained 1,890 volumes; 16,746 under Louis XIII.; 50,542 under Louis XIV.; and about 100,000 at the time of the destruction of the religious houses during the Revolution, at which time their libraries were incorporated with it. It now contains more than 3,000,000 printed books, 100,000 manuscripts, 2,500,000 plates, engravings, stamps, and maps, and 120,000 medals and inscriptions. It is a public library, free for study, reading and reference, with no vexatious restrictions, at all times except holidays. Other noted libraries are the Bibliothèque Sainte Genviève, with 220,000 volumes and 3,500 manuscripts; the Bibliothèque de l'Arsenal (which, after the Bibliothèque Nationale, is the finest in Paris), with 500,000 volumes, 10,000 manuscripts, 2,500 cases containing papers and documents from the Bastille, and 100,000 engravings; the Bibliothèque Mazarine, with 300,000 volumes and 5,000 manuscripts; and the Bibliothèque de la Ville, with 210,000 volumes, 25,000 manuscripts, and 75,000 engravings and charts. There are also many technical libraries at the various schools and colleges of the university and elsewhere for the use of students and investigators. In addition to the libraries of the the University (1,000,000 volumes), to which reference has already been made, mention should be made of those of the Senate, of the Chamber of Deputies (130,000 volumes), of the Council of State at the Palais Royal, of the Institute, of the School des Beaux-Arts, of the School of Mines, of the Hotel des Invalides, of the Chamber of Commerce, of the several Ministries (War, Marine, Colonies, Justice, the latter containing 40,000 volumes), of the Conservatory of Music, of the Opera, of the Theatre Français, etc. The Archives Nationales must also be mentioned in any enumeration of Parisian libraries. It occupies the beautiful hotel Soubise, in the Marais, and, as its name indicates, contains a collection of national archives dating from the Merovingian kings, an immense number of charters, maps, letters, documents of all sorts, of the kings, of the parliaments, of the empire, and of the ancient Parisian jurisdictions like the Chatelet, the Chamber des Comptes, etc. From this enumeration of the literary treasure of Paris, it is clear that nowhere else are there such facilities for study and historical research as here. The city of Paris, moreover, maintains 79 free public libraries — two or more in each of the 20 arrondissements — for lending books to laboring people and students, at most of which reading-rooms, suitably warmed and lighted, are opened in the evenings for the use of persons who are engaged during the day.

There are 146 daily newspapers in Paris (many of them in foreign languages), which is more than the total number published in New York, London, and Berlin combined. The leading daily papers are *Le Figaro*, a temperately ministerial organ and the organ of society, a paper that had much notoriety from espousing the cause of Dreyfus; *Le Gaulois*, the organ of the Church and the old aristocracy, conducted by Arthur Meyer, a clever Jew who has been Christianized and has lately married into the



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family de Turenne; *Le Matin*, an enterprising, newsy paper, which supports the government zealously; *Le Journal*, a paper in favor with the mercantile and commercial classes; *L'Echo de Paris* and *L'Eclair*, both journals of large circulation and influence; *l'Intransigeant*, the organ of Henri Rochefort, one of the most accomplished men on the Paris press, whose paper is always implacably hostile to the government; *Le Journal des Débats*, a conservative organ of high character but of no very large circulation; *L'Autorité*, the Bonapartism organ of Paul de Cassagnac, the famous duelist, whose skill in journalism was quite comparable to that of Henri Rochefort; *l'Humanité*, a new paper edited by Jean Jaurès, which has come into prominence within a year as the organ of the advanced Socialists. It is supported actively by Anatole France and other literary men of Socialistic tendencies; *La Croix*, the Church organ par excellence, with an enormous circulation in Paris and the provinces; *Le Temps*, the leading evening paper, conservative and serious, and read by the best people; *La Patrie*, a sensational evening organ of strong anti-governmental proclivities, with an immense following; *Le Petit Journal* and *Le Petit Parisien*, the two great organs of the masses, each with a circulation exceeding 1,000,000 copies daily—something far in excess of any other papers in the world; *La Libre Parole*, edited with much ability by Edward Drumont, a violently anti-Semitic organ; *La Gazette de France*, an exceedingly conservative sheet, which dates back to 1631, making it, as it claims, the oldest newspaper in the world in any language. According to 'L'Annuaire de la Presse française et du Monde politique' (Henri Avenel) for 1904-5, there are in Paris 3,442 periodical publications (of which over 1,400 are newspapers), a number at least three times as great as that of any other city. Furthermore, the annual output of books from the Paris press slightly exceeds the total output in the English language from all sources. Nothing suggests better than the foregoing statements the intellectual activity of the French capital.

*Financial Paris.*—Chief among the financial institutions of Paris are the Bank of France and the three great private banks, the Crédit Lyonnais, the Comptoir National d'Escompte, and the Société Générale. The banking business of the city is largely in the hands of these four institutions. The Crédit Lyonnais has a sumptuous banking house in the boulevard des Italiens, a capital of 250,000,000 francs, a surplus of 100,000,000 francs, and real estate of the value of 37,000,000 francs, with deposits, 31 Dec. 1904, of 1,656,000,000 francs. It has 35 branches in Paris and the suburbs, 140 branches throughout France, and 17 branches in foreign countries, including 2 in London. It has behind it the financial power and prestige of the Rothschilds, and its influence is felt in financial circles everywhere. It is unquestionably the largest and most powerful private bank in the world. The Comptoir National d'Escompte has a capital of 150,000,000 francs, 39 branches in Paris and the suburbs, 98 throughout France, and 19 abroad. The Société Générale has a capital of 300,000,000 francs, 72 branches in Paris and the suburbs, 306 throughout France, and 1 in London. These three institutions, with

aggregate capital exceeding \$170,000,000, thus furnish Paris about 150 banks, with 550 branches in France and 40 abroad. There are, of course, many other smaller banking institutions in Paris. The Bank of France, like the Bank of England, is a private joint-stock bank, and not an institution of the State. It has, however, the sole right to issue bank-notes which are guaranteed by the state, and is thus peculiarly subject to governmental control. Its ordinary banking business (aside from the business it transacts for and with the government) is on the most extensive scale. The idea of a Bank of France originated with Francis I., who established, in 1543, at Lyons, the first national bank. But the bank in its present form was organized in February 1803 by the First Consul, with a capital of 30,000,000 francs, which has since been increased from time to time, until it is now 182,500,000 francs. The limit of note issue fixed by the government is 4,000 millions of francs, or about \$800,000,000. This limit is, however, generally exceeded, and, by a late report of the bank, it appears that there were then outstanding notes to the amount of 4,510 millions of francs. The gold and silver treasure of the bank, on the same day, was 4,750 millions of francs, which amounts to the stupendous sum of \$950,000,000. This is far in excess of the treasure of any other bank in the world, being, for example, more than four times that of the Bank of England, and considerably in excess of the combined accumulations of the Banks of England, Italy, Germany, and Austria-Hungary. It is also nearly twice the combined average reserve of the 5,500 national banks of the United States, while the note issue as above is more than twice that of all our national banks put together. The Bank has 125 branches throughout France. The chief office is in the rue de la Vrillière, in the old hotel de la Vrillière, to which extensive additions have been made from time to time. It contains a handsome apartment of the 18th century, called the Galerie Dorée, to which visitors are admitted. The cellars and vaults of the bank are of elaborate construction, and can be flooded with water at a moment's notice on an alarm of attempted burglary. Paris is the world's reservoir of money, the primary market and centre of the credit machinery of international commerce. She always has ready cash in abundance, always a stable bank rate, and consequently always cheap money. She is constantly financing the other two great financial centres of the world. English treasury bills, exchequer bonds, bankers' acceptances, and other sorts of English short-dated securities quickly find their way to Paris, and a volume of the best short-time New York paper is also always found in the thick portfolios of the Paris bankers. The rate of the Bank of France is kept steadily and firmly, year in and year out, at 3 per cent. It is the one stable rate in the whole world, and thus constitutes the monetary balance-wheel of Christendom. France is the only country that never borrows abroad, and thus the Bank of France is the only international financial institution that is never in trouble. It is also the only monetary institution in the world through which, for example, such transactions as the cash payment of \$40,000,000 in gold coin for the Panama Canal, or even the payment of the \$20,000,000 in gold which we



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made to Spain for the Philippine Islands, could have been arranged. Both these payments were made over the counters of the Bank of France.

*La Bourse.*—The Bourse was founded in 1734, but the Change de Paris, out of which the Bourse grew, has a history running back to the first years of the 14th century (1304 A.D.). Stock-brokers, or *agents de change*, operated for many years in the old rue Quincampoix in the Marais, and later in the Place Vendôme and in the hotel de Soissons, on the site of which now stands the Bourse de Commerce, which is the Parisian Produce Exchange. The present Bourse or stock exchange building was begun in 1808, when Napoleon laid the cornerstone. It was completed in 1826 and opened by Charles X. The Palais de la Bourse, as it is called, is a handsome building, in the Græco-Roman style, surrounded by a series of 82 Corinthian columns, 33 feet high and 3½ feet in diameter. The setting and the architectural effect are fine, suggesting the Temple of Vespasian in the Forum at Rome. The length (exterior) is 225 feet; the width, including the new wings, 215 feet; and the height 100 feet. The hall is 105 by 57 feet, with wings on either side in the recent addition, about 40 by 60 feet each in size. It is a shapely and commodious room, and the decorations are artistic. The Bourse stands in a block by itself, facing the fine Place de la Bourse, which is about midway between the boulevard Montmartre and the Bank of France. While there are 1,100 seats in the New York Stock Exchange, and near 5,000 (4,673 in 1901) jobbers and brokers on the London Stock Exchange, there are only 70 memberships in the Bourse. They are, therefore, more valuable than memberships in any other exchange in the world, being worth at present from \$350,000 to \$500,000. The position of *agent de change* is a quasi-governmental one, the appointment to the office being by the Minister of Finance, and the operations of the Bourse being, at least indirectly, under the control of the state. The membership, or, as we say, the seat, is a life estate, which can be disposed of by will to a son or nephew only, and that subject to governmental approval. The hours are from 12.30 to 3 o'clock each business day. The *agents de change* have an exclusive privilege of negotiating transfers of public funds and the sole right of buying and selling securities of all kinds on the Exchange. The annual amount of business transacted is estimated at 100 milliards of francs, or \$20,000,000,000. The foreign list, which is dictated by the government, consists of the obligations of all the other nations of Europe except Germany (Russian, Spanish, and Turkish securities being generally favorites), the bonds of the more solvent and responsible countries of South America, and of Egypt and Morocco. The bonds and stocks of some foreign railways are also listed, as well as those of many foreign industrial concerns, like the Rio Tinto mines in Spain, the Suez Canal, etc. No American securities have yet been listed, but efforts are now being made to that end. German securities are never dealt in, and English investments are not favorites. There is, however, some trading in English consols. The obligations of the Crédit Foncier are also largely dealt in. This is a financial institution of enormous resources — quasi-governmental in

character — organized in 1852, for the purpose of lending money, primarily on the security of real estate. It is said to be one of the fundamental institutions of public credit in France, and is of great service to the communes in advancing them money for public works. Its securities are a favorite investment. *La Coullisse*, a sort of loose association of unlicensed *agents*, whose transactions are purely speculative and carried on during business hours, corresponds in a way to the "Curb" of the New York Stock Exchange. *La Petite Bourse*, a somewhat similar organization, carries on speculative transactions in the daytime, before and after the hours of the Bourse. *La Bourse du Soir* is the name for a group or groups of speculators who meet and trade or speculate in the evening, suggesting roughly the famous evening meetings of stock-brokers at the old Windsor Hotel in New York.

*The American Chamber of Commerce in Paris.*—This institution was founded in 1894, mainly through the efforts and initiative of Dr. Stephen H. Tyng, then the Paris representative of the Equitable Life Assurance Society. It has its offices at 3 Rue Scribe, and represents in its corporate capacity the commercial interests of the United States in France. In 1904 it reported 256 active members (of which 209 were resident) and 67 honorary members, from among the most substantial class of American bankers, professional people, manufacturers, and merchants resident in Paris or interested in French business. The American ambassador for the time being to the French Republic, and the consul-general of the United States in Paris, together with the presidents of the chambers of commerce in most of the chief cities of the United States, are honorary members. A library and reading-room is maintained, and the work of the chamber is efficiently carried on.

*The Hotel de Ville.*—In any history of Paris the Hotel de Ville and the events, political and revolutionary, which have occurred there must have a prominent place. Its history is bound up inseparably with what is best and most inspiring in the annals of the capital. For almost 550 years it has been the town-hall of Paris, the centre of its civic life, and it has at every stage played a conspicuous part in the different revolutions as the rallying place of the republican or democratic party. Indeed, it may not untruly be said that universal suffrage and democracy in the modern sense were born there. It was in 1357 that Etienne Marcel — first of democrats, and the most famous of the ancient *Prévôts des Marchands* — purchased for the city of Paris "the House of Pillars" on the Place de Grève and established there the municipal headquarters, which had theretofore been at the Parlour of the Bourgeois, on the other side of the river. This latter ancient municipal structure — in reality the first Hotel de Ville — dated from the 9th century, and was built against the city wall at a place near the rue Soufflot. The House of Pillars continued to be the seat of the municipality until it was demolished by Francis I., in 1532, to make room for the new Hotel de Ville, begun by him in that year and completed in the reign of Henry IV. It contained the residence and offices of the chief municipal functionary of the city, who was called the *Prévôt des Marchands* down to the



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1. Ile de la Cité.

2. Boulevard de la Madeleine.







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Revolution, and thereafter *Préfet de la Seine*. This building was enlarged and reconstructed from time to time, and was finally destroyed in May 1871 by the Commune. The present building, which may be described as an enlarged reproduction of the original, was undertaken by the Republic shortly after the war of 1871. It is, architecturally, one of the finest buildings in Paris, and one of the most beautiful municipal buildings in the world. It is a rectangular structure in the style of the Renaissance, with the most elaborate ornamentation, exterior and interior. After the Grand Opera, it is the most sumptuous public edifice in Paris. The Place de l'Hotel de Ville, formerly the Place de Grève (that is, river bank), was anciently the place of execution. In 1572, after the massacre of Saint Bartholomew, Catherine de Médicis condemned the Huguenot leaders to perish on the gallows here, and from that time to the close of the Revolution it witnessed a long series of political executions. The colors of the city of Paris—red, white, and blue—have for centuries been the recognized colors of democracy. They became in 1775 the colors of the American republicans, and in 1789 of the French republicans. So that our flag and the French tricolor alike hark back to the banners that Etienne Marcel flung out, as the badge of his mediæval republicanism, from the House of Pillars on the Place de Grève, at the middle of the 14th century. From that day to this the spirit of Paris has been democratic; it has always been more or less at swords' points with the crown, the head and front of the third estate.

*The Senate and Chamber of Deputies.*—Next after the Louvre, the Palais du Luxembourg, which is the seat of the Senate, is perhaps the most notable palace in the city. It was erected in 1615–20 for Marie de Médicis, the widow of Henry IV., and was modeled in general after the Pitti Palace in Florence. Its name comes from the fact that it is built upon the site of the ancient hotel of the dukes of Luxembourg. It has at times been used as a prison, especially during the Revolution and shortly after. The Musée du Luxembourg—a gallery of modern art—and the fine gardens of the Luxembourg adjoin it. The Senate chamber is a handsome room, richly decorated, in the part of the building next to the gardens. It is in form a double hemicycle, the larger with 300 seats and desks for the senators, the smaller for the president of the Senate. The light comes from the dome, and the general effect is dignified and imposing. The Palais Bourbon, in which the Chamber of Deputies has its seat, is situated on the left bank of the Seine, facing across the river to the Place de la Concorde. It was built by the Prince de Condé in 1722 at a cost exceeding 20,000,000 francs. In 1790 it was confiscated, and became national property. Both the Senate and the Chamber of Deputies (the procedure in each being essentially the same) are especially interesting to American visitors, not only as the legislative assemblies of the other great republic of the world, but as exhibiting in their procedure several striking contrasts to our own Senate and House of Representatives. The most notable, perhaps, is that, when the members speak, they address their fellow members (and not the presiding officer) from the tribune, a raised platform or pulpit in front of and a little below

the desk of the president—which seems to have some advantage. They vote by blue and white cards or tickets deposited in urns, which are carried about, when the vote is taken, by the huissiers, the white ballot being for and the blue against the measure under consideration. Another difference is that no member is entitled to speak on any question unless he has given notice in advance by inscribing his name on the list of speakers. The presiding officers wear full evening dress. They call to order by ringing a bell, and the close of the session is announced by the president's putting on his silk hat.

*The Palais de Justice and the Courts.*—Few buildings in Paris are more interesting than the ancient *Palais de la Cité*. Situated near the western end of the island of the city, it was a royal residence continuously from the time of the Roman occupation to the latter part of the 14th century, since which time it has been exclusively devoted to the use of the courts. It was the seat of government under the Romans almost or quite from the commencement of their domination. And thereafter under the successive dynasties that lived and ruled in Paris, for the thousand years from the Roman evacuation to the end of the Hundred Years' war, it was continuously the seat of the king's courts and of the Parliament of Paris, which, in their varying forms, were through the ages the supreme court. Abandoned as a royal residence, and later presented to the Parliament by Charles VII. in 1431, it became the Palais de Justice, thus perpetuating its judicial character. It has therefore been the seat of justice in Paris in one form or another from the time of Christ. Hilaire Belloc speaks of the "square mass of the Palais, whence, uninterruptedly, for 1,800 years the government has held its courts and its share in the administration of the town." It has of course been built and rebuilt again and again. The present building dates from the reconstruction of Robert the Pious in the 11th century, Louis IX. in the 13th century and Philippe le Bel at the commencement of the 14th century made considerable additions to it. The Sainte Chapelle was the work of the former, and the tower at the northeast corner the work of the latter. The great tower clock dates from 1370, having been, however, reconstructed in 1685 and again in 1852. It is the oldest public clock in France. One of the most interesting features of the present building after the Sainte Chapelle, is the *Salle des Pas Perdus*, an immense hall, consisting of two vaulted galleries 240 feet long, 90 feet wide and 33 feet in height, which serves as a sort of vestibule to most of the civil courts of first instance. It is the place where the avocats congregate when not engaged in the trial of their causes, and where they meet their clients. Many historical reminiscences attach to it. It dates from Louis IX., and was long known as the Grande Salle. Booksellers anciently had stalls there, and the clergy were for a long time permitted to perform there moral plays and farces. Visitors are shown the kitchens of Saint Louis, in the oldest existing part of the building, next to the river. Near by and in the same part of the Palais is the Conciergerie, a prison famous in French annals, where, for example, are to be seen the chamber in which Marie Antoinette was imprisoned and



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the cell occupied by Robespierre. Among the numerous court rooms the most notable are the chambers of the Court of Cassation and of the Court of Appeal, both large and sumptuous rooms, with superb decorations. The great hall on the western side next to the Place Dauphine is called the Vestibule de Harlay. It contains statues of the four French monarchs most conspicuous as legislators — Charlemagne, Philippe Auguste, Saint Louis, and Napoleon — and rivals the *Salle des Pas Perdus* in size. Opposite the Palais de Justice, across the boulevard du Palais, is the Tribunal de Commerce, dating from 1866. It has a conspicuous dome 135 feet in height. Most of the courts of general jurisdiction in Paris sit in one or other of these two buildings.

At the head of the judicial system of Paris is the Minister of Justice and Religion. He conserves the ancient title of *Garde des Sceaux*. The Ministry of Justice is in the Place Vendôme. The *Conseil d'Etat*, with 45 members, which in some of its functions is a tribunal, and the *Cour des Comptes*, with 84 members, are at the Palais Royal; but all the other general courts are on the island, at the Palais de Justice or the Tribunal de Commerce. First of the courts is the *Cour de Cassation*, with 45 judges, divided into 3 chambers. Next comes the *Cour d'Appel*, with 62 judges, divided into 9 chambers. Then there is the tribunal of first instance, with 70 judges, divided into 12 chambers. These are the three superior tribunals of both civil and criminal jurisdiction. The *Tribunal de Simple Police*, a general court for petty offenses, sits also at the Palais de Justice; it is held by the *Juges de Paix*, sitting in rotation for short terms. The *Tribunal de Commerce*, a commercial court, with 21 judges, has its seat at the Tribunal de Commerce. There is also in each of the 20 arrondissements a civil court (*Justice de Paix*) of inferior jurisdiction, and in each of the 80 *quartiers* a criminal court (*Commissariat de Police*) of limited jurisdiction. Such is a general outline of the judicial system under which Paris is governed. The jurisdiction of each of these courts is roughly suggested by their names. The tribunal of first instance is the ordinary court of general jurisdiction, from which there is an appeal to the *Cour d'Appel*, and thence in certain cases to the *Cour de Cassation*. Commercial cases, however, between merchants and traders are heard by the *Tribunal de Commerce*, which has exclusive jurisdiction in that class of cases. The procedure in all the trial courts is characterized by directness and simplicity. There are no juries in civil cases, and in criminal cases a majority verdict of the jury suffices.

*The Observatory and the Mint.*—The Observatory has a history going back to 1371. The work was at first carried on in a building which stood on a site northwest of the hotel de Cluny, and which would now be in the middle of the boulevard Saint Germain. Charles V. provided the necessary instruments and charts, and endowed two scholarships there for the study of astronomical science, the holders of which were called "King's Scholars," it being expressly provided that they were to study only such works as were not forbidden by the Sorbonne. The present Observatory, however, was founded by Louis XIV., in 1672. It is an

institution of great reputation, and is in telegraphic communication with the most important of the other observatories of the world. It is situated at the end of the avenue de l'Observatoire, south of the Luxembourg. The meridian of Paris is traced through the large hall on the second floor, and the latitude of the south façade is held to be that of Paris. The intersecting point of these two lines is the base from which all geographical and astronomical calculations are made. The meridian was first accurately calculated in the reign of Louis XV., although it had been fixed at the Observatory in the preceding reign. The Academy of Sciences has traced it in various other parts of Paris; for example, through the church of Saint Sulpice, through the gardens of the Palais Royal, and across the top of Montmartre, at each of which places it is marked. At the Palais Royal, a little cannon is set in the axis of the meridian, so that the sun by an ingenious contrivance can fire it off every day exactly at noon.

The Mint (*Hotel des Monnaies*) is a large and handsome building on the Quai de Conti east of the Institute, erected in 1771-5. The façade is 400 feet long. The work shops where money is coined are well worth a visit. Aside from the French coinage, which in amount is the largest in the world, these ateliers coin much money for other countries, and also many medals of all sorts. The processes are freely shown and explained to visitors. The machines for the coinage of silver are especially interesting, 60 pieces of money being struck by each of them per minute, with a daily maximum capacity of two millions of francs in value. The assaying and stamping of the gold and silver ware of the jewelers is also done here. There is a museum (*Musée Monétaire*) in connection with the Mint, which contains a very complete collection of French coins, arranged chronologically, from the earliest times to the present day; also many foreign coins, among them a good collection of our United States coins, and, by way of a curiosity, a Chinese coin of 1700 B.C.

*The Institute.*—Chief among the literary organizations of Paris is the Institute. It is installed in the ancient College Mazarin, or the College of the Four Nations, founded by Mazarin, situated on the left bank, at the end of the Port des Arts, opposite the Louvre. The building dates from the latter part of the 17th century, and stands on the site of the hotel de Nesle. During the Revolution it was used as a prison; but in 1795 it was ceded by the Convention to the Academies, or Societies of Savants, which had theretofore been housed at the Louvre. The Institute, which was created 25 Oct. 1795, embraces the five academies, namely: the Académie Française, founded about 1629 by Richelieu; the Académie des Inscriptions et Belles-lettres, founded in 1635 by Colbert; the Académie des Sciences, founded in 1666; the Académie des Beaux-Arts, founded in 1819; the Académie des Sciences Morales et Politiques, founded in 1666, but suppressed in 1803 and re-established in 1832. Each of these academies has 40 members, except the Academy of Sciences, which has 66, and all except the Académie Française have honorary, corresponding, and foreign members. They are for the most part independent and separate bodies, but all five



PARIS.



1.—PONT AU CHANGE AND THE PALAIS DE JUSTICE.

2.—PONT DE LA CONCORDE AND THE CHAMBRE DES DÉPUTÉS.







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unite in an annual meeting "under the dome" on the 25th of October, which is one of the great literary solemnities of the Paris year. The Académie Française, the most distinguished of the five — its members being dubbed "the 40 immortals" — is charged with a superintendence of the language, the orthography and pronunciation, and with the publication and periodical revision of the Dictionnaire de l'Académie (last édition, 1878). The functions of the other four are sufficiently indicated by their names. The title "Membre de l'Institut," and especially the title, "de l'Académie Française," are objects of the highest ambition of every literary man in France. No other country has so complete an organization of its literary and scientific men as the Institute de France, and nowhere else are the leaders of thought so bound together and so marshaled for concerted effort under one roof as in these five academies. Vacancies as they occur are filled by ballot of the surviving members, each of the academies for itself, subject to the approval of the government. No one is eligible except French citizens, but they need not be native born citizens. They must, however, live in Paris.

*Assistance Publique.*—Assistance Publique in Paris dates from the tax which Louis XIV. imposed, in 1677, on the gross receipts of the theatres for the benefit of the hospitals and asylums. This tax exists to-day and for the same purpose. Until about 75 years ago it was paid personally by each person who entered the theatre as he bought his ticket, but at a separate window established for the purpose. Now it is 10 per cent of the price of the ticket and is assessed against the theatre itself. Numerous hospitals and asylums existed in Paris during the Middle Ages. The principal one was always the Hotel Dieu, and it is still the first of Parisian hospitals. It is situated on the island of the City near Notre Dame. The present building was erected in 1868-78 at a cost of 45,000,000 francs. It is admirably fitted up with 828 beds. It is said to be the oldest hospital in Europe, having been founded in 660 A.D. under Clovis II. There are about 20 other general public hospitals in Paris, which have an aggregate of upward of 33,000 beds; among which may be mentioned La Pitié near the Jardin des Plantes, with 729 beds; the Charity Hospital, a large and ancient institution in the rue Jacob, and the military hospital of Val de Grace in the Latin quarter, formerly a Benedictine convent founded by Anne of Austria, but converted by Napoleon into a hospital for soldiers. The church connected with it, formerly the convent chapel, is a splendid building, being a reduced copy of St. Peter's at Rome. The dome, 53 feet in diameter and 133 feet high, is one of the most conspicuous monuments of the left bank. Among the numerous asylums, the most notable is the Salpêtrière, undoubtedly the largest such institution in the world. It is situated near the Pont d'Austerlitz on the left bank, and was originally an arsenal built by Louis XIII., which was subsequently converted into an asylum for aged and insane women. It consists of 45 huge buildings, having in the aggregate no less than 4,682 windows. There are 8,000 inmates. It is associated with the reform brought about in the treatment of the insane by Philippe Pinel, whose

statue stands in the Place in front. There is a similar home for aged and infirm men at Bicêtre, and there are numerous institutions for the care of children and for the treatment of special diseases. The number of patients annually received and cared for in the hospitals amounts to about 50,000 men, 40,000 women, and 20,000 children. The average annual deaths are about 7,000 men, 5,000 women, and 3,000 children. The Assistance Publique expends annually about 40,000,000 francs on these hospitals and other allied charities.

*The Hotel des Invalides.*—This great institution was founded in 1670 by Louis XIV. as an asylum for his aged and disabled soldiers. With its high gilded dome, under which are the tombs of Napoleon, Turenne, Vauban, Jerome and Joseph Bonaparte and Marshal MacMahon, it is one of the most conspicuous monuments of Paris. The buildings, which cover about 30 acres, were begun in 1671, and completed in 1675. They furnish accommodation for 6,000 inmates. The façade of this vast structure is 660 feet in length. It stands about 600 yards back from the Seine, facing the Esplanade des Invalides, a fine open place about 900 feet wide, containing several rows of trees and extending to the river opposite the Champs Elysées. Close by is the Military School (*Ecole Militaire*), another great block of buildings covering 26 acres, the façade of the main building being about a quarter of a mile long. It was founded by Louis XV. in 1751. There are about 500 students, the greater part of the establishment being now used as a caserne. It faces the Champ de Mars—another great open square, 1,100 yards in length and 550 yards in width, extending to the river, opposite the Trocadéro—which was originally designed for military maneuvers, and was the site of many imposing ceremonies and pageants during and immediately after the Revolution. The Tour Eiffel is built on the end next the river. It is a full 1,000 feet high (1,062 feet to the very top), being thus the tallest monument ever erected, nearly twice as high as the monument at Washington, and more than twice as high as the Great Pyramid. Commencing in 1867, some of the buildings of the International Expositions have been built on the Champ de Mars. It has, however, recently been condemned and is to be laid out in streets and built up in the near future. The Ministry of Foreign Affairs, one of the handsomest government buildings in Paris, adjoins it on the east along the Quai d'Orsay.

*The Cemeteries.*—There are more than 20 cemeteries in Paris, but at present much the greater number of interments are made in the newer cemeteries without the walls. There are, however, but three within the city of any considerable size or of much general interest. The largest and finest is Père Lachaise (*Cimetière de l'Est*), situated prettily on a hill in the northeastern part of the city, commanding a fine view. It takes its name from Lachaise, the Jesuit confessor of Louis XIV., whose country seat formerly occupied the site. It dates only from 1804, and extends to but 110 acres, but it contains the graves and tombs of a great number of the most distinguished Frenchmen of the last 150 years. Many also of a much earlier date have been moved there, as, for example, the tombs even of Héloïse and



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Abelard. It well repays a visit, and some careful study. Next in interest is the cemetery of Montmartre (*Cimetière du Nord*), situated in the northern part of town not far from the Church of the Sacré Cœur. The cemetery of Montparnasse (*Cimetière du Sud*), on the left bank, dating from 1824, is the third in interest of the Parisian burying grounds. It is not far from the Gare Montparnasse. The little cemetery of Picpus, near the Place de la Nation, in the garden of an ancient convent, contains the graves of many distinguished people of the Revolutionary epoch. It is of especial interest to Americans as containing the grave of Lafayette. These cemeteries are all much alike in appearance, and in general much resemble those of New Orleans, the greater part of the tombs being above ground. There is a crematorium at Père Lachaise—the only one in Paris—with a columbarium in the Italian style as a depository for the ashes of the persons cremated there.

*The Fountains.*—After Rome no city is richer in fountains than Paris. There are dozens of them throughout the city, many of which are veritable works of art, and quite entitled to mention in any attempt to present a general view of Paris. The two large and beautiful fountains in the Place de la Concorde, constructed in 1836, contribute very much to the brilliance of that finest of Parisian squares. They each consist of a round basin 53 feet in diameter, above which rise two smaller basins surmounted by a spout from which a jet of water rises 28 feet in the air. The lower basins are surrounded by tritons and nereids, holding dolphins, which spout water into the second basins. The figures and the upper basins are bronze, and the lower basins granite. These fountains produce a volume of spray, which under bright sunlight is superb. Two handsome modern fountains in granite ornament the Place du Theatre Français. Another of the great fountains is that of Saint Michel in the Place of the same name. It was constructed in 1860, and is 84 feet high and 48 feet wide, built into a wall. It consists of a niche in the form of a Roman triumphal arch containing a group of Saint Michael and the dragon in bronze mounted on a pile of rock, from which water gushes into three basins one above the other, flanked by bronze griffins of heroic size. At the sides of the niche are columns of red marble bearing bronze figures. The whole, though open to criticism in detail, constitutes a very imposing monument. The fountain of the Observatory, constructed in 1874, is a striking and original work, in the fine avenue of the Observatory with its six rows of forest trees. This fountain consists of eight sea horses, a group of four allegorical figures bearing an armillary sphere and water-spouting dolphins and tortoises. The basin is 60 feet in diameter and a great volume of water is discharged into a square reservoir below the basin, with a fine effect. The fountain of St. Sulpice was erected in 1847 in front of the church of that name and consists of three concentric basins of stone one above the other, and is embellished with statues of heroic size of the four most celebrated French preachers: Bossuet, Fénelon, Massillon, and Fléchier. The volume of water is not great, but the fountain is a dignified and hand-

some ornament to the square. The fountain Molière, erected in 1844 to the memory of the famous dramatist, stands on the rue Richelieu near the house where he lived and died. It is 51 feet high and 21 feet wide, with a bronze statue of the poet flanked by the muses of serious and light comedy. Near by in the same street in the small square Richelieu, facing the Bibliothèque Nationale, is the fountain Richelieu, in bronze, dedicated to the four great rivers of France. It stands on the site of the old Grand Opera, to wash away the stain of the assassination of the Duke de Berry in 1820, who met his death there, under very tragic circumstances. The fountain de Grenelle in the street of that name near the rue de Bac, erected in 1739, is one of the finest of the old fountains. It consists of a crescent 100 feet in diameter and 38 feet high, in the centre of which stands a small Ionic portico with an allegorical group in white marble representing the city of Paris with the Seine and the Marne. Alfred de Musset died in 1857 in the house in front of which the fountain is built. The two fountains in the Jardin du Luxembourg—the old fountain de Médicis and the new one in memory of Delacroix—the ancient fountain of the Innocents at the central markets, and the splendid fountain de la Victoire in the Place du Chatelet, erected in 1807 to commemorate the earlier victories of Napoleon, are each of them notable monuments. A mention of the wonderful fountains at Versailles (*“les grandes eaux”*) incomparably the finest in the world, completes the general view of the fountains of Paris.

*The Seine and the Bridges.*—No single feature gives to a visitor a stronger suggestion of the imperial splendor of Paris than the installation of the Seine. The river, which flows for a distance of between seven and eight miles through the city, is contained within high walls of the most massive masonry. On either side of the river from one end to the other there is a broad street, lined with trees, and next to the river on the quai is a sidewalk or pavement. Below the quais and near the level of the water are the ports, also of masonry, where boats can land and freight and passengers be received and discharged. The walks along these shaded quais, with the river on one side and the busy life of the street on the other, are among the most interesting promenades in Paris. The bookstalls on the quais have long been famous. Passenger steamboats (*bateaux mouches*) ply up and down the river, making stops every few blocks and affording an excellent service for a fare of two cents at all seasons of the year. The 33 bridges which cross the river within the fortifications are among the most attractive features of the city, several being imposing works of art. The viaduct bridge at Auteuil is a mile and a quarter long, constructed throughout of masonry, with several galleries for vehicles and foot passengers beneath the railway line, and consists of 234 cross arches. It is a structure of exceptional beauty. The most famous of the bridges is perhaps the Pont-Neuf, which spans the river across the lower end of the island of the City. It is one of the oldest of the bridges, having been first constructed across both arms of the Seine in 1578. On the island, half way across the bridge, rises the equestrian statue of Henry



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1.—THE CATHEDRAL OF NOTRE DAME.  
2.—THE SENATE.







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IV. More traffic passes over this bridge than any other bridge in Paris, and perhaps more than over any other bridge anywhere, except possibly the congested traffic over London bridge. The Pont-Alexandre III. is the newest of the bridges and was one of the notable contributions of the Exhibition of 1900 to the adornment of the city. It is a single steel span crossing the river so as to connect the Champs Elysées and the Esplanade des Invalides, affording a direct passage from the Palace of the Elysée to the Hotel des Invalides. Other notable bridges are the Pont de la Concorde, which at the time of the destruction of the Bastille was paved with some of the stones of that famous prison: the Pont d'Austerlitz, a massive work of masonry, recently widened, which after the Pont-Neuf is the most traveled of the bridges, connecting the two great railway stations, the Gare de Lyon and the Gare d'Orléans; the Pont Notre-Dame and the Petit Pont, which cross the two arms of the river at the island of the City in the line of the rue Saint Jacques and the rue Saint Martin, being thus situated precisely at the places of the first Roman bridges that crossed the river; the Pont des Arts, which is the only bridge in Paris which is simply a foot bridge, connecting the Institute and the Louvre; the Pont au Change at the Chatelet and the Pont Saint-Michel at the Place of that name, which are beautiful specimens of the art of bridge building in stone. By means of locks and dams the river is kept at all stages of water at about the same height, the minimum depth being  $10\frac{1}{2}$  feet, so that boats of 800 tons burden can come to Paris from Havre. This, in connection with the extensive system of canals of northern France which centre in Paris, makes of the capital the second port of the country. It is equaled in tonnage only by Marseilles.

*The Parks.*—Paris is one of the most favored of cities in the matter of parks. Although necessarily within the fortifications the area of parks and open spaces is relatively limited, there are within and without the walls—but within easy distance—including Fontainebleau and Versailles, about 200,000 acres of public parks, of which 20,000 acres are within 30 minutes travel from the centre of the city. The Bois de Boulogne and the Bois de Vincennes are the two largest strictly urban parks, the former being the most thronged and fashionable park in the capital. It extends to upwards of 2,250 acres, and lies between the western fortifications and the Seine. It was laid out in 1852, and since that time it has become the promenade not only of all Paris, but of all Europe. It is most frequented between 3 and 5 o'clock on summer afternoons. There is also a morning hour from 9 to about 11, when many "smart" people drive and ride. The Hippodrome de Longchamps in the Bois de Boulogne is the principal race course in the neighborhood of Paris. Races take place there almost every day, in spring, summer, and autumn. The *Grand Prix* is run on a Sunday at the beginning of June, and is the greatest racing event of the year in Paris. The Bois de Vincennes is on the other and less fashionable side of the city, and is not as frequented as the Bois de Boulogne. It is the forest in which Louis IX. used to hunt and administer jus-

tice. It also contains about 2,250 acres. The other principal parks within the city are the Jardin du Luxembourg—a beautiful garden, in the Latin quarter, in the style of Le Notre; the Jardin des Plantes, dating from 1640 in the reign of Louis XIII., with its museums of natural history and zoology made famous by the labors of Cuvier and Buffon; the Champs Elysées, most famous of city promenades; the Parc Monceau, in an aristocratic quarter, anciently the property of the dukes of Orléans; the Parc de Montsouris, one of the most picturesque pleasure grounds in any city; the Parc des Buttes Chaumont, in a neglected quarter of the city, on the site of the ancient gallows or gibbet of Montfaucon, where from about 1273 until the Revolution an uncounted multitude of malefactors were hanged; and finally the Jardin du Palais Royal and the Jardin des Tuileries in the very heart of the town. The boulevards are lined with trees—some of the wider streets having four or more rows—and many gardens in the courts throughout the city contain fine clumps of trees, so that on a bird's-eye view, as from the top of the Tour Eiffel, Paris seems almost to be built in a forest. There are, within the fortifications, nearly 400,000 trees under municipal supervision.

*The Exhibitions.*—Chief among the annual exhibitions in Paris is of course the Salon. It is held in the spring in the Grand Palais, and is the principal artistic event of the year. Ordinarily about 2,000 paintings and 1,000 pastels, watercolors, etc., are shown, in addition to the sculpture and the bronzes. It attracts artists and lovers and patrons of art from every part of the world. The Concours-Hippique, also held in the Grand Palais, is the Paris Horse Show. It dates from the early days of the Second Empire, and is the model upon which such shows elsewhere have been organized. It, too, is held in the spring. The agricultural show in the Galerie des Machines is what its name indicates—an exhibition of agricultural machinery, farm products, cattle and pedigree stock, horticultural productions, dairy products, poultry, and wine. It is an annual fair. The culinary exhibition, which is held in midsummer in pavilions erected for the purpose in the gardens of the Tuileries, is a curious show, intended to promote competition and excellence among cooks, and to stimulate effort in culinary matters. The *Foire au Pain d'Épice* (gingerbread fair) is held in the Place de la Nation for the four weeks following Easter. It is the fair of the common people, with side-shows and merry-go-rounds and the like. It attracts enormous crowds, and is an interesting sight for visitors. The automobile shows, which for several years have been held in the winter at the Grand Palais, are notable events for persons interested in that industry. They attract the haut monde or "tout Paris," as the phrase is, and like the horse shows are almost as much social functions as exhibitions. International exhibitions have been held in Paris in 1855, 1867, 1878, 1889, and 1900; Paris may accordingly be said to be the home of the International Exhibition. In 1900 there were 50,860,000 admissions to the exhibition—an unparalleled attendance. An *Exposition Internationale des Sports* (International Sports Exhibition) is to be held in Paris, and probably on the Champ de Mars, in 1907,



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for which active preparations are now being made. Plans are already in hand for the next great general international exhibition, which it is proposed to hold in 1921, to celebrate the semi-centennial of the Republic.

*The Monuments.*—First, perhaps, among the monuments that adorn the city is the Arc de Triomphe de l'Etoile, which stands in the spacious Place de l'Etoile, on an eminence at the head of the avenue des Champs Elysées. From this arc radiate 12 great avenues, like the spokes of a wheel, chief among which, after the avenue des Champs Elysées, are the avenue du Bois de Boulogne, leading to the park, and the avenue de la Grande Armée leading to Neuilly. This famous monument is the largest triumphal arch in existence. Its height is 160 feet, its width 146 feet, and its depth 72 feet. It consists of a main arch 67 feet high and 46 feet wide, intersected at right angles by a lower transversal arch. The work was begun by Napoleon in 1806 and finished by Louis Philippe in 1836. It is adorned with colossal trophies 36 feet high, with figures 16 feet high, its cost having been about 2,000,000 francs.

The Arc de Triomphe du Carrousel in the gardens of the Tuileries, built by Napoleon to commemorate his victories of 1805 and 1806, in imitation of the Arch of Severus at Rome, and formerly the chief entrance to the Palace of the Tuileries, is a notable structure. It was originally crowned with the celebrated Quadriga from the portal of St. Mark's in Venice. Somewhat similar to these in general character are the Porte St. Martin, in the grand boulevard—a triumphal arch 57 feet in height, erected in 1674 in honor of Louis XIV.; and the Porte Saint Denis, another triumphal arch near by in the same thoroughfare, consisting of a single archway, 81 feet in height, built to commemorate the victories of the grand monarch in the Low Country. These two monuments are all that remain of the wall of Louis XIV., which was pulled down by Louis XV. to make place for the grand boulevard.

The tomb of Napoleon under the dome des Invalides is a magnificent mausoleum, the tomb itself consisting of a sarcophagus of reddish-brown granite from Finland, weighing 67 tons, and being 13 feet long, 6½ feet wide, and 14½ feet high. With its superb setting under the fine dome, it constitutes a most impressive memorial.

The Pantheon is in some respects the most imposing public edifice in Paris. It stands on the highest ground on the left bank on the site of the tomb of Sainte Geneviève, the patron saint of Paris. It was built by Louis XV. (1764–90) from plans by Soufflot, and was designed to be the church of Sainte Geneviève. But in 1791 the convention converted it into a sort of memorial temple, naming it the Pantheon, and inscribing on its front the words: "*Aux grands hommes la patrie reconnaissante.*" It is of most imposing appearance and dimensions, in form a Greek cross with equal arms, 370 feet long and 276 feet wide, surmounted by a dome 272 feet high and more than 75 feet in diameter, the lantern at the top of which is reached by a staircase of 425 steps. A huge colonnade consisting of 22 fluted Corinthian columns 81 feet in height, resembling that of the Pantheon at Rome, forms the portico, to

which 11 steps ascend. The tympanum, 117 feet long and 23 feet high, contains a fine group of sculpture by David d'Angers. Mirabeau was buried here in the spring of 1791; shortly afterward Marat, Voltaire and Rousseau, and more recently Victor Hugo and President Carnot. The bodies of Voltaire and Rousseau were removed at the Restoration. The vaults also contain a considerable number of tombs of distinguished officers and soldiers of the Revolutionary period. The government is slowly decorating the interior with works of the best contemporary artists.

The Palais du Trocadéro, on the elevation in Passy, opposite the Champ de Mars, upon which Napoleon planned to erect a palace for the king of Rome, is a huge building in the oriental style. It consists of a circular edifice 190 feet in diameter and 180 feet high, surmounted by a dome and flanked by two minarets 270 feet high. On each side extend wings, 660 feet each in length, the whole in the form of a crescent. The main building contains a Salle des fêtes with an immense organ, and has seats for 6,000 persons. This is the largest auditorium in Paris. The palace contains important museums of comparative sculpture and ethnography.

Mention ought also to be here made of the Palais Royal with its garden, built and owned originally by Richelieu (1629–34), where he lived at the end of his life and where he died in 1642, but it was thereafter long the property of the dukes of Orleans. The cafés and gardens of the palace were, during the Revolution, the rendezvous of democrats and malcontents generally. It was here that Camille Desmoulins called the populace to arms in July 1789. It is now government property and the seat of the *Conseil d'Etat*. A proposition is now in hand on behalf of some American merchants to convert a part of the arcades surrounding the garden into a great American apartment store, or general magazine for the exploitation of American goods, wares, and merchandise. The Palace of the Order of the Legion of Honor, instituted by Napoleon in 1802, is situated on the Quai d'Orsay, at the corner of the rue Solférino. It was burned in 1871 by the Commune, but has been handsomely rebuilt. The original building was erected in 1786, and was interesting as the scene of Mme. de Staël's reunions during the Directory.

The Column Vendôme, 142 feet high and 13 feet in diameter, constructed from German cannon captured in the Napoleonic wars, surmounted by the bronze statue of Napoleon as a Roman emperor, stands in the centre of the Place Vendôme. It is one of the conspicuous monuments of the city. The column of July in the Place de la Bastille, erected by Louis Philippe, in 1831, celebrates the heroes who fell in the Revolution of 1830. It is 154 feet high and affords from its top a fine view of that part of the city, particularly of the cemetery of Père Lachaise.

Other conspicuous monuments are the statue of the Republic in the Place de la République, and the equestrian statues of Louis XIV. in the Place de la Victoire, of Etienne Marcel at the Hotel de Ville, of Washington in the Place d'Iéna, of Joan of Arc—two, one opposite the Church of St. Augustin and the other in the



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Place de Rivoli—and of Charlemagne in the Parvis de Notre Dame. The monuments of Gambetta at the Louvre, of Danton in the boulevard Saint Germain, of Molière in the rue Richelieu, of Shakespeare in the boulevard Haussmann, of Marshal Ney near the Observatoire, of La Fontaine in Passy, of Dante at the College de France, of Voltaire on the quai at the Institute, are among the many fine monuments that adorn the city. Another of particular interest to Americans is the reduced copy of Bartholdi's "Liberty Enlightening the World" in bronze, on the Pont de Grenelle, presented to the city by the American colony in Paris, which has carved on its base simply the two great republican dates, "1776-1789."

*Theatres and the Opera.*—The leading theatre of France is the Théâtre Français—"the house of Molière," as Frenchmen affectionately call it. It was founded in 1600 at the hotel de Bourgogne in the Marais, and was under the superintendence of Molière from 1658 down to his death in 1673. The present house in the rue Richelieu, adjacent to the Palais Royal, was built in 1782, after his death. The interior was destroyed by fire in 1900, but it was immediately restored and rebuilt (1,400 seats). It contains a valuable theatrical library, and many theatrical art treasures, notable among which is Houdon's famous statue of Voltaire in the foyer. This great theatre—perhaps the first playhouse in the world, in virtue of its history and what it has contributed to dramatic art in its three hundred and more years of existence—was given its present pre-eminence in 1680, when Louis XIV. suppressed its rival, the theatre of the Marais, and consolidated the troupe of Molière which then still played at the hotel de Bourgogne, with the Theatre Guénégaud in the rue Mazarine, thus creating a single theatre for Paris and eliminating all competition. This became what is now the Théâtre Français, and has had a continued existence from that day to this. It was for a time at the end of the 17th century on the other side of the river near the Institute, where the rue de l'Ancienne Comédie still suggests its former establishment on the left bank. The Théâtre Français—sometimes also called La Comédie Française—stands, however, second in official priority to the Grand Opéra, which is now the first play house in Paris. The opera house, a sumptuous edifice, bearing the inscription, "*Académie Nationale de Musique*," standing at the head of the avenue de l'Opéra, was commenced in 1861 and completed in 1874. It occupies a site prepared especially for it just off the grand boulevard, covering an area of nearly three acres. Although it is much the largest theatre building in the world, it is third among the great theatres in point of seating capacity, coming after La Scala at Milan and San Carlo at Naples. It seats 2,200 persons. The site alone cost more than \$2,000,000, and the building about 30,000,000 francs. It has an annual subvention from the government of 800,000 francs. No description can adequately convey a proper notion of the magnificence of the building and of its lavish decoration. The Opéra Comique, dating from 1761, which was destroyed by fire in 1887, has been splendidly rebuilt (1,500 seats), and stands next to the Grand Opéra in the amount of its subvention. It receives 300,000 francs annually from the govern-

ment. The Odéon (1,420 seats), dating from 1782, on the left bank, near the Luxembourg, ranks in some respects next to the Théâtre Français, and is devoted chiefly to the performance of classical dramas. It is par excellence the theatre of the Latin quarter. The four theatres just mentioned are the subventioned theatres, each receiving from the state a substantial annual subscription. They are consequently open the year round, except for a short time in midsummer. The Grand Opéra and the Odéon give gratuitous performances two or three times a year, in recognition of their public character. Other leading theatres are the Chatelet (3,400 seats), the largest theatre in Paris, dating from 1780, and devoted now mainly to spectacular plays, for which its large stage especially adapts it; the Gaite (2,000 seats), dating from 1753, which affects light opera; the Vaudeville (1,100 seats), dating from 1792, a handsome theatre in the boulevard des Capucines, the character of which is fairly indicated by its name; the Théâtre Sarah Bernhardt (1,699 seats) in the Place du Chatelet, conducted by Madame Bernhardt; the Folies Dramatiques (1,600 seats), dating from 1831; the Antoine (1,000 seats), a new theatre that is attracting a good class of patronage by the uniformly high character of its productions; the Ambigu-Comique (1,500 seats), dating from 1769; and the Palais Royal (850 seats), an attractive little theatre dating from 1789, are each of them well-known places of amusement. There are in all in Paris about 40 theatres of the first class, besides a great number of secondary play houses. Such institutions as the Moulin-Rouge, the Folies-Bergère, the Casino de Paris, the Olympia, the Concerts Rouge, the Concerts Colonne, the Nouveau Cirque, the Ambassadeurs and the Jardin de Paris have a world-wide reputation, while places like the Bal Bullier, the Bal Tabarin, the Palais de Glace, the Hippodrome, and all the rest of the cafés-concerts and cabarets artistiques *et id omne genus*, are not less known and appreciated by *Paris qui s'amuse*.

*The Restaurants, Hotels, and Street Life.*—Paris is the home of high culinary art, and many of the famous restaurants such as the Maison Dorée (like Tortoni and Hardy, now only a memory), Paillard, Café de Paris, Café de la Paix, the Ritz, Voisin, Durand, Marguery, Café Anglais, Foyot, Tour d'Argent (dating from 1582, and thus possibly the oldest of restaurants), Café Riche, and des Ambassadeurs have a world-wide reputation among *bon vivants*. Paris is also the city par excellence of hotels. No city has so many of them. The tendency is to small hotels, many of which maintain the highest standards of culinary excellence, and cater for a very critical clientèle. Nowhere does one take his ease at his inn more perfectly—nowhere is he more absolutely *chez lui*—than in one of the countless *little* hotels of Paris. Among the great hotels, the Grand, with its 1,000 rooms and superb location at the Place de l'Opéra, is pre-eminent. Other large hotels of the first class are the Ritz and the Bristol in the Place Vendome, the Elysée Palace in the avenue des Champs Elysées, the Continental in the rue de Rivoli facing the gardens of the Tuileries, the Terminus at the Gare Saint Lazare, the Regina, the Grand Hotel du Louvre



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near the Palais Royal, the Moderne in the Place de la République, the Scribe and l'Athénée near the Opéra, and the Mercedes at the Place de l'Etoile. Scarcely anything more impresses the visitor to Paris than the brightness and brilliance of the streets. They are kept scrupulously clean, and the wide asphalt sidewalks give opportunity for a life in the streets that is particularly pleasing. The cafés and restaurants set little tables in two or three rows on the sidewalks in front of their establishments under awnings, at which at almost all seasons of the year many thousands of persons daily are entertained either for their meals or for the aperitif which all Parisians seem to take in the late afternoon. Whenever the weather is mild these seats and tables in the streets are occupied by a well ordered throng until well after midnight, eating, drinking, smoking, reading, writing, chatting, and hearing the music. In consequence of this fashion of outdoor life the streets of Paris are especially brilliant. The plan and arrangement of the streets throughout the city, their width and the careful regulation of the traffic, facilitates easy and rapid transit, and consequently—in spite of the density of the traffic—they seldom seem exceptionally crowded. There is almost never a "block" in the movement of vehicles in the streets, although through the grand boulevard and at certain corners elsewhere the traffic is much the densest in the world; as for example, through the rue de Rivoli, where according to some recent figures furnished by one of the asphalt paving companies, 42,025 vehicles pass the corner of the rue du Louvre in 24 hours, while 20,480 pass a corner in the rue Croix des Petits Champs, and 19,592 a point in the rue Saint Honoré in the same length of time. By way of contrast, it may be noted that the densest traffic in London is in King William street, where 26,793 vehicles are reported for a period of 24 hours.

*The Markets and Abattoirs.*—The central markets, the cattle markets, the wine markets and the abattoirs, which supply Paris with food and drink, furnish some interesting statistics. The markets (*Halles Centrales*), of which the name and the location date from the foundation by Philippe Auguste in the 13th century, are vast structures, chiefly of iron, erected in 1874, consisting of 12 pavilions, between which run covered streets, 48 feet wide and 48 feet high, intersected by a boulevard 105 feet wide. The six pavilions on either side of the boulevard occupy a space of 182 by 136 yards, the whole market covering an area of 22 acres. Each pavilion contains 250 stalls, and under each of the pavilions are cellars of similar area. It is estimated that 15,000 vehicles are employed in and about the markets in the traffic incident to the business. In spite of their extent they have become quite inadequate, and the Municipal Council has now in hand a project for enlarging them by condemning the property to the east as far as the boulevard de Sébastopol, consisting of four blocks, for the erection of an extension. In each arrondissement, there are, in addition to these central markets, one or more local markets of the same general character, under municipal control. The cattle market (*Marché de la Villette*), near the fortifications on the rue d'Allemagne, consists of three large

pavilions, covering an area of 10 acres. The central hall is capable of containing 4,600 oxen, the one on the right about 7,000 calves and pigs, and the one on the left 22,000 sheep. About 4,000,000 head of cattle annually enter the market. Near by and adjoining the cattle market are the slaughter houses (*Abattoirs de la Villette*), the buildings of which include 20 courts with 250 scalding-pans. Both the markets and the slaughter houses, which are kept exceedingly clean, are open at all times to the public. The cattle market and the abattoirs together have cost the city upward of 60,000,000 francs and well repay a visit.

*Underground Paris.*—The most distinctive feature of Paris underground are the sewers, which have for centuries been among the wonders of the capital. There were no covered sewers or drains in Paris prior to the reign of Louis XIII. Theretofore there had been only open drains or gutters in the middle of the streets, such as may still be seen in some of the oldest streets of the French quarter in New Orleans, but about 1630 the present system was undertaken. It progressed at first but slowly, and only since about 1854 has it been efficient and relatively complete. It consists of an elaborate network of drains covering the entire area within the walls, constructed of stone and concrete in the most substantial manner, divided into 15 classes, from the great sewers of the first class, which are 18 feet and 2 inches in height by 11 feet and 4 inches wide, down to the little drains a few inches in diameter, that connect each individual house with the street drain. The discharge is carried by a tunnel far down the river below the city, where the liquid portion escapes into the river at Asnières, while the solid parts are collected and utilized as fertilizer in the peninsula of Gennevilliers. The city is divided, for drainage purposes, into four parts, by the two main sewers which run at right angles to the river under the boulevard de Sébastopol and the boulevard Saint Michel, respectively. These are discharged, not into the river, but into eight channels parallel with it, which in their turn receive the contents of fifteen tributaries fed by numerous smaller drains. The total length of the network is in excess of 900 miles, a distance about equal to that from New York to Chicago, or a railway journey of 24 hours by fast express trains, and the system as a whole is without an equal anywhere. The cleaning of the sewers is effected by boats and scrapers, and there is a siphon system at the Pont de l'Alma for conducting the drainage under the Seine. Excursions are made by curious visitors through some of the main sewers in electric boats and tram cars, which start periodically either from a point near the Madeleine or the Louvre, and go a distance of about five miles to the exit near the Church of Saint Laurent in the rue Saint Martin or to the Place du Chatelet, or *vice versa*. The sewers are utilized not only for sewage and drainage, but also as conduits for the water and gas pipes, for the pneumatic tubes that are used by the post-office for the transmission of mail matter, and for telephone and telegraph wires; they are perfectly ventilated and constantly patrolled by the men in charge of the service.

Below the sewers on the left bank are the Catacombs. They are the remains of ancient



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quarries, worked as far back as the Roman period, for the limestone of which Paris is built. They extend under a considerable part of the left bank. They were first used during the Revolution as depositories for bones and dead bodies removed from the cemetery of the Innocents, which was closed at that time. They have therefore been charnel houses and known as catacombs only from that period. They are open to visitors periodically, the entrance being at the Place Denfert-Rochereau. They are extensive and rather curious, but very far from possessing the interest of the more famous catacombs of Rome, Naples, and Syracuse.

The latest and most presently and practically important feature of underground Paris to the average man is the Metropolitan Underground Railway, which was opened in 1900. It consists of lines running in various directions throughout the city, especially of a main line through the centre of town east and west, from the Porte de Vincennes to the Porte Maillot, a distance of about seven miles, and another more northerly line from the Place de la Nation to the Bois de Boulogne, making a loop of about eight miles in length. There are many connecting branches touching the Place de l'Opéra and several of the principal railway stations. Extensions which will soon bring the lines to every part of Paris are under active construction. Thus a line is projected under the grand boulevard, from the Place de la Concorde, through the rue Royale to the Place de la Bastille, and thence across the Seine, through the boulevard Saint Germain to the Chamber of Deputies. The work on the left bank is well advanced, the bridges at the Quai de Grenelle and at the Gare d'Austerlitz to unite with the main lines, being substantially completed, and parts of the connecting lines being already quite finished. Automobile omnibuses, to carry 30 passengers and to weigh but 5,600 kilos, with a speed of more than double that of the present horse omnibus, are in course of construction. These new omnibuses are to run in connection with the Metropolitan, constituting the lesser arteries of the system of intramural transit of which the lines underground constitute the main arteries; the omnibus fare (outside) is to be reduced from 3 to 2 cents. The present 663 omnibuses (employing 10,700 horses), of which 418 are two-horse, and 245 are three-horse conveyances, will thus be superseded.

No description of Paris underground would be quite complete without mention of the new and splendid station of the Orleans railway line on the Quai d'Orsay, and the tunnel that runs under the quais and next to the river connecting it with the main station, two miles distant, at the Quai d'Austerlitz. It is regarded as an almost perfect installation, and has served as a model for the similar work in New York by the Pennsylvania Railroad Company. The canals which traverse Paris, some of them underground for long distances, for example, under the Place de la Bastille and through the boulevard Richard Lenoir, are interesting displays of engineering and building skill.

*Bibliography.*—Among the immense number of books, historical and illustrative, concerning Paris, the following, mainly French and American works, will be found especially valuable: care should generally be taken not to rely much on

information from distinctively English sources — 'Paris à travers les âges' (1875); Robida, 'Paris à travers l'histoire'; Joanne, 'Paris illustré' (1881); Labedolière, 'Le Nouveau Paris' (1871); 'Guide de Paris par les principaux Ecrivains et Artistes de la France' (1868); Martin, 'The Stones of Paris' (1899); Haynie, 'Paris Past and Present' (1902); Lansdale, 'Paris, Its Sites, Monuments, and History' (1899 — an accurate and very readable work); Bayet, 'Précis d'Histoire de l'Art'; Robinson, 'Modern Civic Art' (1903); 'Guide Pratique à travers le vieux Paris' (1903); 'Memorable Paris Houses' (1888); 'Paris and Its Story' (1904); Hilaire Belloc, 'Paris' (1904); Moriac, 'Paris sous la Commune' (1871); Kaufmann, 'Paris of To-day' (1891); Bourdon, 'Petite Histoire de Paris'; Victor Hugo, 'Paris,' 'Les Misérables,' and 'Notre Dame de Paris'; Eugène Sue, 'Mysteries of Paris'; the 'Opera of Louise'; Lacomb, 'Bibliographie de Paris' (1886). The Guides of Joanne and Baedeker to Paris and its environs (the former in French and the latter in English) are mines of accurate information.

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**Paris,** Canada, a town and port of entry of Brant County, Ontario, on Grand River, at the intersection of the Great Western and Buffalo & Goderich branch of the Grand Trunk Railway, 29 miles west of Hamilton. It is a busy industrial centre with potteries, plaster mills, knitting mills, and oil refineries. In the neighborhood are extensive gypsum beds. Pop. (1901) 3,229.

**Paris,** Ill., city, county-seat of Edgar County; on the Vandalia Line and the Cleveland, C., C. & St. L. R.R.'s; about 18 miles northwest of Terre Haute, Ind., and 110 miles east by south of Springfield. It was founded in 1825 and incorporated in 1849. It is in a productive farming section, in which wheat, corn, and broom corn are cultivated extensively. The manufacture of brooms is a prominent industry. The streets are well kept and the city presents the appearance of fine homes of prosperous people. The park has an area of 100 acres, about 70 of which is an artificial lake. The charter under which the government is administered is according to the general law of 1872. The electric-light plant and waterworks are owned and operated by the city. Pop. (1890) 4,996; (1900) 6,105.

**Paris,** Ky., city, county-seat of Bourbon County; on a branch of the Licking River, and on the Louisville & Nashville Railroad; about 20 miles northeast of Lexington. It was settled in 1784 and in 1862 was chartered as a city. It is in an agricultural section, in the "blue grass region." The chief trade is in tobacco, grass seed, whiskey, hemp, and horses. The prominent public buildings are the court-house, built in 1903, and the municipal buildings. There are public and parish schools and a library. The city owns the gas-plant. Pop. (1890) 4,218; (1900) 4,603.

**Paris,** Tenn., city, county-seat of Henry County; on a branch of the West Sandy River, and on the Nashville, C. & St. L. and the L. & N. R.R.'s; about 95 miles west of Nashville. It is



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in a fertile agricultural region, in which cotton and tobacco are the chief products. There is an extensive trade in grain, cotton, several kinds of tobacco and proprietary medicines. There are flour and lumber mills, and railroad repair shops. Pop. (1890) 1,917; (1900) 2,018.

**Paris, Texas**, city, county-seat of Lamar County; on the Texas & P., the St. Louis & S. F., the Gulf, C. & S. F., and the Texas Midland R.R.'s. The town was founded in 1845. In 1875 it had a population of 1,500, and in 1904 a population of 10,142.

*Government and Improvements.*—Its affairs are managed, under a special charter, by a mayor and board of aldermen. Tax rate \$1.19 on the \$100 of assessed values; these are \$6,412,000, while the actual values are about \$10,000,000, property not being assessed at full value. The city has a well-equipped fire department and owns its own waterworks and sewerage system, the latter being on the Waring system and the sewage being disposed of on a sewerage farm. The Federal government has a fine court-house and post-office building, and the county court-house is a magnificent granite structure. There are two telephone systems, an electric railway, and electric light and gas. The city debt is limited by its charter to 5 per cent of its assessed values, and the city and county both pay cash "as they go."

*Banking and Finance.*—Four banks, three of them national and one private, with a capital of \$1,000,000 and deposits of \$1,500,000, several building and loan associations. Homes and business houses are nearly all owned, and very little of the property is mortgaged.

*Schools.*—The city maintains an unsurpassed public school system for 10 months in the year, with ample facilities for all children, white and black, under 18 or over 6 years of age; the high school is affiliated with the State University as one of its preparatory schools. There is an excellent private seminary for girls.

*Churches and Charities.*—The Baptist, Methodist, Congregational, Presbyterian, and Cumberland Presbyterian churches all have brick and stone buildings; the Roman Catholic, Episcopal, and Christian churches have frame structures. The general charities are handled by the King's Daughters and by the United Charities Bureau. The county and city jointly maintain a free hospital. The county has a well-managed poor farm for indigent and helpless poor.

*Libraries.*—There is a private library association, a good library at the high school, and the Y. M. C. A. have a library in their building.

*Parks and Cemeteries.*—The electric railway maintains a park and summer theatre in the eastern suburbs. The Odd Fellows have a well-kept cemetery, while Evergreen, the general cemetery of the city, is one of the best-cared-for in the State.

*Manufactures and Agriculture.*—The lands surrounding Paris are famous for their production of cotton, corn, oats, alfalfa, fruits, and vegetables. There is a fruit and vegetable growers' association of over 200 members. Two large cottonseed-oil mills, one large cotton-oil refinery, with flour mills, iron foundry, candy factories, wood working shops, mattress and broom factories.

W. F. GILL,  
Secretary Paris Board of Trade.

**Paris Basin**, an oblong depression about 20,000 square miles in extent, in the Cretaceous rocks under and around Paris, filled in with richly fossiliferous Tertiary deposits. It was made famous by the palæontological investigations of Cuvier.

**Paris, Declaration of**, in international law, an agreement made in 1856, at a meeting of the representatives of the great powers held in Paris. Four points were established, namely, (1) Privateering is abolished; (2) the neutral flag covers enemies' goods, excepting contraband of war; (3) neutral goods, with the same exception, are not liable to be seized even under an enemy's flag; (4) blockades, in order to be binding, must be effective. The United States refused to accept the first point, because the European Powers declined to affirm that private property should be exempted from capture by ships of war. See NEUTRALITY.

**Paris Green**, a poisonous pigment, a vivid light green in color, extensively used to kill the potato-bug and the cotton-worm. It is a mixture of the double salts of the acetate and the arsenite of copper.

**Paris, Plaster of.** See PLASTER OF PARIS.

**Paris, Treaties of.** Many treaties between France and other nations are known under the title Treaty of Paris. The more important of these were the following: One concluded on 20 May 1303 between France and England, had for its object the restoration of Aquitaine to Edward I. On 10 Feb. 1763 a treaty of peace was signed between France, Spain, Portugal, and England; and by the same treaty Canada was ceded to Great Britain. On 6 Feb. 1778 was signed that between France and the United States, in which the independence of the latter country was recognized. By another, signed 15 May 1796, between the French Republic and the King of Sardinia, Savoy and Nice were ceded to France. One ratified 10 Nov. 1807, between France and Holland, had for its object the cession of Flushing to the former country. Other treaties are: that between Napoleon I. and the allies, ratified 11 April 1814, by which Napoleon was deposed and banished to Elba; the convention between Count d'Artois and the allies for the cessation of hostilities and evacuation of France, signed 23 April 1814; the convention of 2 Aug. 1815, between Great Britain, Austria, Russia, and Prussia, entrusting the charge of Napoleon to the British government; the treaty between France and the other great European powers, ratified 20 Nov. 1815, in which the boundaries of France were defined, and provision made for the temporary garrisoning of French fortresses; that between France and Portugal for the cession of Guiana to France, concluded 28 Aug. 1817; that for the conclusion of peace between Russia on the one hand, and France, Austria, Turkey, and Great Britain on the other, ratified 30 March 1856; the treaty of 26 May 1857, between the great powers of Europe with regard to Neuchâtel; the convention constituting the Danubian Principalities, 1858; and the treaty of peace with Germany, concluded 10 May 1871. See TREATY.

**Parish** (Low Latin, *parochia*), in ecclesiastical law, in England, a certain territory or "circuit of ground," committed to the spiritual



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charge of one ecclesiastic having care of souls therein. The whole of England is divided into 10,000 parishes. Camden says that this division was made in England about the year 630. Others refer it to a decree of the council of Lateran held in 1179. A law of King Edgar, about 970, seems to confine the payment of tithes to the parish to which a person belonged; and so it has remained ever since, and nowadays a man's parish in England is that in which the poor rate is collected from him. In the United States the word parish does not mean the same thing as in England, nor does it mean the same thing in all the States. The legal importance of parishes in England depends upon the fact that the rector of each parish is entitled to certain dues collected within it. From the first settlement of the United States there have been everywhere associations and bodies corporate or organized for ecclesiastical purposes, and these have been generally called parishes. In New England they were originally the same as towns; that is, the persons composing a town, and acting as a town in civil and political matters, also acted as one body in religious or ecclesiastical matters; and the parish had therefore the same territorial limits as the town. Afterward, as the towns grew more populous, they were divided for ecclesiastical purposes into different parishes, which were still territorial and were contained within local limits. There are many such parishes now in most of the States. At length, however, as a diversity of religious sentiment became developed, all religious opinions standing on the same footing in law, parishes began to be formed of persons associated by similarity of religious sentiment and not mere nearness of residence, and therefore with little or no reference to their place of abode. These were called poll parishes, in distinction from territorial parishes. They are numerous everywhere, and in the large cities may be considered as having taken the place of territorial parishes, which are almost unknown there. In Louisiana, the word parish is used to designate a district separated and defined by local limitations for merely civil and political purposes.

**Parish School.** See SCHOOL.

**Parish Schools, Roman Catholic.** A free school attached to a Roman Catholic parochial foundation in order to carry out the belief of the Roman Catholic Church that there should be a union of secular learning and religious training for a complete education. Experience having shown that the instruction received at home and at church is not adequate for the requisite religious training of the child, the parish school, wherein religious, moral, and secular training shall be imparted, was instituted. Such schools have been in existence from the earliest ages, although the special form in which we know them at the present day has been a development of the 19th century.

The parish school does not materially differ in method, organization, or scope from the public schools under the direction of the civil authorities, except that it is controlled by the Roman Catholic diocesan officials and supported by the voluntary contributions of the Roman Catholic people receiving no State aid.

**Organization.**—The schools are graded according to the customary primary and grammar divisions of modern educational ideas. In some

dioceses, notably Philadelphia, a high school course is added. The teachers are mainly members of the religious orders instituted for the work of education, supplemented by lay assistants. The rector of the parish is the official director of each school. There is a diocesan school board appointed by the bishop to look after the general welfare of the diocesan school system, and a special diocesan superintendent, a priest, who is charged with the immediate inspection of the schools and who is responsible for the progress and efficiency of the classes.

The course of studies is prescribed by the diocesan board, which also controls the teaching staff. In some dioceses these teachers hold State licenses to teach, or they must pass an examination equal to the requirements for such a license. In many schools in New York State the Regents' examinations are taken. Lay trustees have been appointed on some of the school boards, but this custom has not become general as yet. Normal schools for members of the teaching orders, training classes, and all the formal details for the study of pedagogy have been instituted. At present statistics show that less than one twelfth of the teachers in the parish schools are men, and nearly all of these belong to religious orders. Elementary education in these schools is now almost entirely in the hands of the religious orders of women. Of these there are in the United States 85 distinct communities, the combined membership of which is more than 40,000. The work of some is confined to a single diocese, but usually houses of each order have been founded in several States and some have schools in almost every section of the country.

With the growth of the general educational impulse and the development of the public school system there was an insistence by the Roman Catholic Church authorities on an equal impetus for the free parochial school. It must be remembered always that this opposition was not against the public school *per se*, but against the system that divorces religion from education or the "national endowment of agnosticism" as it has been termed. Official figures prepared by the authorities of each diocese give the following standing of the Roman Catholic parish schools, January 1904:

ARCHDIOCESES, DIOCESES, VICARIATES- APOSTOLIC	Parishes with schools	Children attending	Total children in Roman Cath- olic institutions	Roman Catholic population, about
Baltimore .....	95	21,711	28,349	250,000
Boston .....	76	45,786	47,943	700,000
Chicago .....	168	67,388	93,388	1,000,000
Cincinnati .....	103	26,281	30,147	200,000
Dubuque .....	82	16,424	15,000	100,000
Milwaukee .....	149	32,024	32,698	290,861
New Orleans .....	90	17,232	22,463	450,000
New York .....	198	52,895	75,712	1,200,000
Oregon City .....	25	3,100	3,600	40,000
Philadelphia .....	113	45,353	53,023	475,000
St. Louis .....	141	24,430	28,069	220,000
St. Paul .....	90	19,000	24,000	230,000
San Francisco .....	37	14,515	20,184	225,000
Santa Fe .....	8	1,887	2,660	133,000
Albany .....	42	15,370	18,000	145,000
Alton .....	65	7,814	8,300	75,000
Altoona .....	25	6,100	6,320	50,000
Baker City .....	5	1,000	1,075	2,350



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ARCHDIOCESES, DIOCESES, VICARIATES- APOSTOLIC	Parishes with schools	Children attending	Total children in Roman Cath- olic institutions	Roman Catholic population, about
Belleville .....	67	7,515	7,600	50,000
Boise .....	4	765	765	12,000
Brooklyn .....	68	35,651	40,040	500,000
Buffalo .....	73	23,500	27,646	194,797
Burlington .....	20	5,190	.....	70,000
Charleston .....	5	411	838	8,500
Cheyenne .....	4	430	482	4,500
Cleveland .....	166	36,442	36,442	300,000
Columbus .....	37	8,945	9,725	56,000
Concordia .....	18	1,884	2,091	22,445
Covington .....	36	7,137	8,534	48,225
Dallas .....	24	2,620	2,700	30,000
Davenport .....	42	5,855	6,904	70,000
Denver .....	19	5,243	5,910	70,000
Detroit .....	66	19,200	27,000	191,450
Duluth .....	9	1,500	1,840	50,000
Erie .....	42	8,378	9,394	70,000
Fargo .....	12	630	1,369	52,000
Ft. Wayne .....	77	13,317	14,838	80,000
Galveston .....	30	4,489	4,579	40,000
Grand Rapids .....	50	12,089	12,469	121,836
Green Bay .....	84	13,800	14,304	125,000
Harrisburg .....	32	6,934	6,934	50,759
Hartford .....	57	26,933	28,143	275,000
Helena .....	9	1,700	2,800	50,000
Indianapolis .....	102	14,682	15,517	106,573
Kansas City .....	40	5,343	5,573	52,000
La Crosse .....	77	11,023	11,496	112,000
Lead .....	4	800	800	10,000
Leavenworth .....	37	4,000	4,677	30,000
Lincoln .....	21	1,829	2,215	30,000
Little Rock .....	29	1,642	3,087	13,900
Louisville .....	58	9,351	11,501	100,000
Manchester .....	35	12,611	13,646	104,000
Marquette .....	23	6,529	6,529	80,000
Mobile .....	28	3,635	3,924	25,013
Monterey-Los Ang...	22	3,100	4,500	65,000
Nashville .....	18	2,773	3,923	29,500
Natchez .....	20	3,358	3,358	21,499
Natchitoches .....	12	1,970	2,107	32,000
Nesqually .....	20	4,000	5,000	65,000
Newark .....	100	39,244	42,000	310,000
Ogdensburg .....	16	3,502	3,248	83,000
Omaha .....	45	5,716	7,319	65,175
Peoria .....	68	11,000	13,200	123,500
Pittsburg .....	108	33,944	36,581	300,000
Portland .....	23	9,437	10,433	105,619
Providence .....	37	19,126	21,563	290,000
Richmond .....	16	3,430	5,000	30,000
Rochester .....	45	16,859	17,756	110,000
Sacramento .....	9	1,400	1,800	40,000
St. Augustine .....	11	2,245	2,162	16,500
St. Cloud .....	26	4,000	4,000	44,000
St. Joseph .....	13	1,663	2,153	20,000
Salt Lake .....	3	380	939	10,000
San Antonio .....	39	5,119	6,169	78,000
Savannah .....	11	2,260	2,495	21,000
Scranton .....	40	12,000	12,000	200,000
Sioux City .....	43	5,876	5,876	50,000
Sioux Falls .....	23	2,080	2,080	45,500
Springfield .....	46	21,300	22,500	260,000
Syracuse .....	16	4,943	6,779	115,000
Trenton .....	37	9,139	9,731	85,000
Tucson .....	6	1,000	2,000	40,000
Wheeling .....	10	1,820	3,013	25,000
Wichita .....	29	1,911	2,024	25,450
Wilmington .....	11	2,772	3,100	28,000
Winona .....	22	4,062	4,062	55,000
Brownsville .....	8	1,015	1,147	68,000
Indian Terr. ....	28	2,735	2,735	24,265
North Carolina ...	8	596	804	4,600
Alaska Terr. ....	....	.....	.....	9,500
Total .....	4001	986,088	1,136,890	11,887,317

*History.*—Roman Catholic schools have existed in the United States from the earliest days of missionary effort. As the church membership grew in numbers and influence after the Revolution the movement for the establishment of elementary schools took on new vigor. It can be traced best in the formal legislation of the church authorities on the subject. The first

Provincial Council of the bishops of the United States, held at Baltimore, Md., in October 1829, expressed the wish that schools should be organized where youth may imbibe principles of faith and morality along with human knowledge. In the three Plenary, or National, councils of the American hierarchy held also in Baltimore, the first in 1852; the second in 1866, and the third in 1884, the legislation is specific on the subject. What was an exhortation in the first and a prayer in the second became a command, emphatic and imperative in the third. In the First Plenary Council the bishops were exhorted, in view of the evils which arose from the defective education of the youth, to have a school attached to every church in each diocese, and to provide for the same and for suitable teachers from the revenues of the parish. In the Second Plenary Council the decrees laid down that the first, and in fact the only, remedy for the terrible evils of religious indifference and of moral corruption would seem to be that in every diocese, each church should have its school in which the Roman Catholic youth should be trained in religion and good morals as well as in literature and the arts. In the Third Plenary Council, it was decreed that:

- I. Wherever a parish school did not already exist, one must be built within two years from the promulgation of the decree, and maintained in perpetuity, unless the bishop, on account of insuperable obstacles, should consent to a delay.
- II. Any priest, who, by culpable negligence, will fail to erect and to maintain a school within that time, or who will not heed the repeated admonitions of the bishop, will be liable to removal from his church.
- III. Any mission or parish which will fail to assist the priest in erecting and maintaining a school to such an extent, that owing to this negligence the school cannot exist, must be censured by the bishop, who will employ efficient and prudent means of obtaining the necessary support.
- IV. All Roman Catholic parents are obliged to send their children to parish schools, unless they provide for their Christian education either at home or in other Roman Catholic schools, or else obtain permission for sufficient reason, approved by the bishop, and with due precaution and other remedies, to send their children to other schools. What constitutes a Roman Catholic school is left to the judgment of the bishop.

Other laws to give force to these decrees enact that candidates for the priesthood during their seminary course shall receive special training with a view to the proper management of schools. Bishops are required to appoint a commission for the examination of all persons who shall apply for positions as teachers in the parish schools and to see that the schools be brought to that "state of efficiency and perfection which the honor of the Church, the interests of the pupil, temporal as well as eternal, and the generous loyalty of the laity, unquestionably demand and deserve." The end to be kept in view is "that the parish schools may continue to grow stronger and more efficient and may prove to be a source of pride, of hope and of strength to the State no less than to the Church."

As a consequence of this legislation parish schools are to be found in every centre throughout the land where the Roman Catholic congregation is numerous enough to support one. Throughout the country as a whole the church authorities claim that one half the Roman Catholic population of school age attends Catholic schools of one kind or another. The cost of the round million of children in the parish schools averages about \$13 per capita of school



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attendance. This does not include the cost of buildings or property. This, on a rough estimate, the church officials claim (1903), would show a value of \$130,000,000. The same authority gives the total amount of money Roman Catholics have spent on the parish schools of the United States since 1880 at more than \$200,000,000. This amount is in addition to the taxes which Roman Catholics pay in support of the public schools. Pleas have been and are being made that the state shall recognize the work thus done in its free educational system and allow for its results out of the general tax levy for school purposes as is the system in England, Germany, and Canada.

The first schools in the United States were usually established under the auspices of some religious denomination. The first free parish school in New York was started by Saint Peter's parish, New York city, in 1800. By subsequent act of the legislature, passed in 1806, this school was empowered to receive its due proportion of the taxes collected by the State for educational purposes. In the United States Catholic Directory 1845-9 it is stated, "There are common schools for both male and female children in most of the cities and towns of this diocese (Boston) having Catholic teachers. In Lowell they are supported at the public expense, but in all other places at the expense of the parents of the children, aided by collections in the churches." Lowell was a centre that had attracted a large Irish Catholic population and at the annual town meeting in May 1830 a committee was named to consider the expediency of establishing a separate school for the benefit of this part of the population. This committee reported favorably on such a school in April 1831. Bishop Fenwick writing to Lowell from Boston 26 March 1831, said:

I see no impropriety in the Catholic school of your town receiving aid from the school fund, especially if the Catholics of Lowell have contributed their portion by the payment of taxes or otherwise toward the support of said fund. Common justice would entitle them to something out of it for the payment of their Master. But I really do not understand how, in this liberal country, it can be made a condition to their receiving anything that they, the Catholics, shall be in that case debarred from having a Catholic teacher, learning out of Catholic books and being taught the catechism of the Catholic Church. We can never accept such terms. . . . I would not give a straw for that species of education which is not accompanied with and based upon religion.

Under an arrangement then made with the Catholic pastor of Lowell, several schools were organized which were paid for out of the public taxes. They are spoken of in the State Board's report of 1851 as the outcome of a "wise and liberal policy," but they lapsed after 16 years of trial with the rise of the Native American movement and its consequent religious disturbances. The first Roman Catholic school in Boston was opened in 1820 and taught by Ursuline nuns. The Rev. John Thayer collected money in Ireland to have the project carried out.

In New York city in 1841 the school question played an important part in the State election. The school funds in the city were then administered by a body known as the Public School Society. The Roman Catholics complained of unjust treatment at its hands, and the agitation by them with Bishop Hughes at their head resulted in the formation of the present Public School system of the city and the entire

abolition of the old Public School Society. In his message to the legislature on 4 Jan. 1842, Governor Seward, presenting the subject of schools and the school fund to the legislature, favored the consideration of the denominational free schools in the distribution of the taxes for educational purposes. In this he followed the teachings of his old preceptor, the famous Rev. Dr. Eliphalet Nott, president of Union College, who was asked by the governor to give him his views in writing on the subject that he might embody them in a message to the legislature. This he did and Governor Seward, in his message to the legislature, 1 Jan. 1840, says:

The children of foreigners found in great numbers in our populous city and towns and in the vicinity of our public works are too often deprived of the advantages of our system of public education in consequence of prejudices arising from difference of language or religion. It ought never to be forgotten that the public welfare is as deeply concerned in their education as in that of our own children. I do not hesitate therefore to recommend the establishment of schools in which they may be instructed by teachers speaking the same language with themselves and professing the same faith. There would be no inequality in such a measure. Since it happens from the force of circumstances if not from choice that the responsibilities of education are in most instances confided by us to native citizens and occasions seldom offer a trial of our magnanimity by committing that trust to persons differing from ourselves in language or religion. Since we have opened our country and all its fullness to the oppressed of every nation we should evince wisdom equal to such generosity by qualifying their children for the high responsibilities of citizenship.

The establishment of the Department of Education practically as at present constituted in New York, did not materially alter the situation as far as the Roman Catholic view held it. Bishop Hughes put new energy into the establishment of free parish schools and the example of the Roman Catholic body in New York had an equally potent effect on other sections of the country. Attempts were subsequently made to bridge the difficulty of the heavy double school tax by compromise. One of the most important, known as "the Poughkeepsie Plan," was started by the pastor of Saint Peter's Church, Poughkeepsie, N. Y., who leased his school house to the local Board of Education at a nominal sum, the city authorities in return assuming all the expenses of running the school. No religious instruction was given during the regular school hours and the teachers were under the control of the local school board. Many Roman Catholics, lay and clerical, condemned this plan, but it was tolerated by the late Cardinal McCloskey, then archbishop of New York. This was in the early seventies of the last century.

In the agitation of the issue some of the bishops went so far as to interpret the parish school law of the church as giving the warrant to deny the sacraments to parents who refused to send their children to the parish in preference to the public schools. The controversy reached its climax in 1891, when the Roman Catholics of the United States were divided into two opposing parties, or what might be called the strict constructionists and the liberals, over the question. The late Archbishop Corrigan of New York was popularly regarded as the leader of the first and Archbishop Ireland of Saint Paul, Minn., of the other. The German Catholics of the West were specially in evidence against the position assumed by the last named prelate in regard to the most feasible method of



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securing state aid for the parish school without sacrificing Roman Catholic principle.

Some time before Archbishop Ireland had made an arrangement at two towns in his diocese, Faribault and Stillwater, by which the parish schools there received State money. This he described as follows:

The plan to which allusion here is made is most simple. It accords both with State laws and Church requirements and on this account commends itself to all fair minded, intelligent citizens. An existing Catholic school, which observation shows to be in all particulars fit to be put on a line with existing public schools, is adopted by the Public School Board and conducted during school hours under all the laws and regulations of the Board as to teachers and pupils. The Board is supreme in all that regards the imparting of the instruction required by its own programme and during all the time marked in this programme. In return the Board pays the current expenses. No State money is paid out for sectarian instruction; there is no division of the school fund; there is not the slightest setting aside of State rights.

There is on the other hand the serious advantage which all American citizens should appreciate—that Catholics have their children instructed under payments from the public fund to which they are contributors, together with their fellow citizens and the State has the satisfaction of bringing peaceably, and without violation of personal rights, under its direction, for the imparting of secular instruction, multitudes of Catholic children who otherwise must keep aloof from it.

The Catholic conscience is satisfied under the plan. For while secular instruction is imparted there is no danger from Protestant or agnostic bias of teachers' minds and the legal school hours over the buildings revert to Catholic control and religious instruction is given. Nothing more than this is marked in a formal letter from Rome, written in 1875, as needed in order that Catholic children may be authorized by bishops to attend State schools.

The opponents of this plan contended that the archbishop's advocacy of such a scheme unsettled the whole Roman Catholic position hitherto held on the education question. Complaint was made to Rome against him, and he drew up a memorial defending his position, which was printed in Italian in a pamphlet of 27 pages, and submitted to the cardinals of the Congregation of the Propaganda. It was a long time after that the decision on the plan—"tolerari potest" (it can be tolerated)—came and evoked further excitement. But the plan itself did not succeed owing to local secular opposition. The State superintendent of public instruction, Dr. D. L. Kiehle (November 1891), said of it in regard to a ruling that the contract could not bind in any such conditions as that of retaining religious teachers:

"A Board of Education cannot legally bind itself to follow any religious criterion in its choice of teachers, nor is it allowed to classify children according to their religion." And he adds that in case "the presence of the Sisters in the school displeases a certain class of persons, or the habit they wear had a significance which was not acceptable, the Board had the right of inviting them to dress like other teachers or else to withdraw."

The contract was therefore not renewed after the first year.

At the annual meeting of the archbishops of the United States held in St. Louis in 1891, Archbishop Ireland at the request of Cardinal Gibbons, made a formal explanation of the Faribault plan on the expediency of which his colleagues of the hierarchy divided. Previous to this a pamphlet had been written, as the author stated, at the request of his superiors, by the Rev. Dr. Thomas Bouquillon, professor of moral theology at the Catholic University, Washington, D. C., entitled 'Education: To

Whom Does It Belong?' In this it was alleged Dr. Bouquillon made a plea for State education and admitted that the State had a right to educate the children of its citizens; to determine a minimum of instruction and make it obligatory; and to exercise its authority in the matter of education not only over schools founded by the State but also over other educational institutions founded by individual families and associations.

His position was controverted at once by opponents here and abroad with the counter proposition that the duty and right of education belongs first to the parent, and that no one may suppress or diminish this right. This new controversy added a greater intensity to the differences on the question of education, as Dr. Bouquillon was held to represent the side of which Archbishop Ireland was the leader.

When the archbishops met in New York for their annual convocation on 16 Nov. 1892, Mgr. Satolli, the apostolic delegate, appeared before them and delivered a letter of instruction from the Pope which he had received from Rome, and which contained 13 propositions "For the settling of the school question and the giving of religious education." In these the denial of the sacraments to parents who sent their children to the public schools, or to the children themselves, was expressly forbidden.

"It is to be greatly desired," the instruction said, "and would be a most happy arrangement if the bishop agree with the civil authorities or with the members of the School Board to conduct the school with mutual attention and consideration for their respective rights."

"While there are teachers of any description for the secular branches who are legally inhibited from offending Catholic religion and morality—let the right and duty of the Church obtain of teaching the children catechism in order to remove danger to their faith and morals from any quarter whatsoever."

"We further desire you to strive earnestly that the various local authorities firmly convinced that it is more conducive to the welfare of the commonwealth than religion should by wise legislation provide that the system of education, which is maintained at the public expense and to which therefore Catholics also contribute their share, be in no way prejudicial to their conscience or their religion. For we are persuaded that even your fellow citizens who differ from us in belief with their characteristic intelligence and prudence will readily set aside all suspicions and all views unfavorable to the Catholic Church, and willingly acknowledge her merit as the one that dispelled the darkness of paganism by the light of the Gospel and created a new society distinguished by the lustre of Christian virtues and by the cultivation of all that refines. We do not think that anyone hereafter looking into these things clearly will let Catholic parents be forced to erect and support schools which they can not use for the instruction of their children."

The controversy was finally and conclusively settled by a letter of Pope Leo XIII. to the bishops of the United States, May 1893, instructing them to "steadfastly observe" the decrees of the Third Plenary Council of Baltimore in regard to parochial schools.

*Bibliography.*—Decrees of Plenary Councils; Shea, 'History of Catholic Church in United States'; 'Catholic Directory' (1904); 'American Catholic Quarterly Review' (October 1903); Report of Board of Examiners, Diocese of New York; Early Irish Catholic Schools of Lowell, Mass.; Report of Philadelphia Diocesan School Board (1903); Report Supervisor Catholic Parochial Schools, Archdiocese of Boston (1903); Report State Board of Schools, Massachusetts (1851); Bouquillon, 'Education: To Whom Does it Belong?'

THOMAS F. MEEHAN, A.M.



## PARJANA — PARKER

**Parjana**, in the mythology of the Vedas, the rain god, probably identical with the Lithuanian Verkunas.

**Park, Edwards Amasa**, American Congregational clergyman: b. Providence, R. I., 29 Dec. 1808; d. Andover, Mass., 4 June 1900. He was graduated at Brown University in 1826, from Andover Theological Seminary in 1831, and was ordained pastor of the Congregationalist Church in Braintree, Mass., in the last-named year. He accepted the chair of moral and intellectual philosophy at Amherst in 1835, and in 1836 was appointed professor of moral and intellectual philosophy at Andover; from 1847-81 he held the chair of sacred rhetoric in that institution, and thereafter until his death he was professor of theology there. He edited various translations from the German, several memoirs, etc., and wrote 'Discourses on Some Theological Doctrines as Related to the Religious Character' (1885).

**Park, Mungo**, Scottish African explorer: b. near Selkirk 10 Sept. 1771; d. Boussa, Africa, 1806. He studied at Edinburgh University and in 1792 sailed for the East Indies as assistant medical officer on board the East Indiaman Worcester. He made some botanical studies in Sumatra, found there eight new species of fish, returned in 1793, and in 1795 was sent by the African Association to explore the course of the Niger. With but two attendants he proceeded up the Gambia, and after extreme hardships reached Sego in 1796. He finally arrived at Falmouth in 1797, and in 1799 published his 'Travels in the Interior of Africa,' which went through three editions in that year and made the author famous. In 1803 he became leader of an expedition despatched by the government for African discovery, and in 1805 set out with instructions to follow the course of the Niger "to the utmost possible distance to which it can be traced." He passed Timbuctoo, but at Boussa, with all but one of the party, was killed by hostile natives. He possessed the qualities of a great explorer, and aroused British interest in African travels. Consult: Memoir by E. Wishaw in Park's 'Journal of a Mission to the Interior of Africa' (1815); Maclachan, 'Life of Mungo Park.'

**Park, Roswell**, American physician: b. Pomfret, Conn., 4 May 1852. He was educated at Racine College and Harvard, studied medicine at the Northwestern University, and was adjunct professor of anatomy there 1879-82. Since 1883 he has been professor of surgery at the University of Buffalo and surgeon to the Buffalo General Hospital. He was one of the attendants upon President McKinley after the latter was shot. He has published: 'Lectures on Surgical Pathology' (1891); 'History of Medicine' (1897); 'Text-Book of Surgery.'

**Park City**, Utah, city in Summit County; on the Union Pacific and Utah Central railroads; 30 miles southeast of Salt Lake City. It is a silver mining region, with valuable mines in the vicinity, and contains sampling works, quartz mills, etc. Pop. (1890) 2,850; (1900) 3,759.

**Parke, John Grubb**, American soldier: b. near Coatesville, Pa., 22 Sept. 1827; d. Washington, D. C., 16 Dec. 1900. He was graduated from West Point in 1849, assigned to the topo-

graphical engineering corps, and at the outbreak of the Civil War he was appointed brigadier-general of volunteers. He served under Burnside in North Carolina, was in command at the capture of Fort Macon, and in 1862 received promotion to the rank of major-general of volunteers. He was chief-of-staff of the Ninth corps at Antietam and South Mountain, and served in that capacity under Burnside in the Army of the Potomac. He accompanied Sherman on his march to Vicksburg in command of the Ninth corps; in 1866 was retired from the volunteer service. He was in charge of the construction of fortifications in Maryland in 1867-8, and then became senior assistant in the office of engineers at Washington. He was promoted colonel of the corps of engineers in 1884, and in 1887 was appointed superintendent at West Point. He was retired at his own request in 1889. He published: 'Compilations of Laws Relating to Public Works for the Improvement of Rivers and Harbors' (1877); 'Laws Relating to the Construction of Bridges over Navigable Waters' (1882); etc.

**Parker, Alton Brooks**, American jurist: b. Cortland, N. Y., 14 May 1852. He was educated at the Cortland Normal School, taught school for a time, and then began the study of law. He was graduated from the Albany Law School, was admitted to the bar, and entered upon the practice of his profession at Kingston. In 1877 he was elected surrogate of Ulster County, being the only one on the Democratic ticket to secure election, and in 1883 was re-elected. In 1884 he was a delegate to the Democratic National Convention, and in 1885 President Cleveland offered him the office of first assistant postmaster-general, which, however, he declined. In 1885 he was chairman of the Democratic State Committee, and in that same year was appointed a judge of the State supreme court to fill a vacancy left by the death of Theodore R. Westbrook; the next year he was elected to the supreme court. In 1889 he was appointed to the 2d division of the court of appeals, and when that court was dissolved, was appointed a member of the general term of the 1st department, and in 1896 a member of the appellate division. In 1897 he was elected chief justice of the court of appeals. He is an able lawyer, and has written many of the important decisions of the court of appeals, none of which have been attacked as unsound. Since becoming a judge he has abstained from taking an active part in practical politics, and has not been involved in any of the controversies in the Democratic party. He is, however, recognized as one of the leading men of that party, and in 1904 was its Presidential candidate and was defeated by Theodore Roosevelt.

**Parker, Edward**, English Chinese scholar: b. 3 July 1849. He was educated at the Royal Institution School, Liverpool, and became a barrister of the Middle Temple. He originally intended to engage in the tea trade, studied Chinese, and as an interpreter traveled in Mongolia 1869-71. He was then in the consular service in various parts of the world (1871-95), and since 1901 has been professor of Chinese in Owens College, Manchester. He is the author of 'Comparative Chinese Family Law' (1879); 'Up the Yangtze' (1892);



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'Burma' (1893); 'A Thousand Years of the Tartars' (1895); 'China' (1901); 'John Chinaman' (1901); etc.

**Parker, Foxhall Alexander**, American naval officer: b. New York 5 Aug. 1821; d. Annapolis, Md., 11 June 1879. He entered the navy as midshipman in 1839, was attached to the West Indian squadron, and later transferred to the Philadelphia naval school, where he was graduated in 1843. He served on the Great Lakes, the Mediterranean, the Pacific, and on various coast surveys until 1861, when he was appointed executive officer of the navy yard at Washington, D. C. His capable manipulation of the forces at his command after the battle of Bull Run in 1861 went far toward restoring order and confidence at Washington. He performed excellent service throughout the War, receiving the rank of captain in 1866. He subsequently served on various commands, was raised to the rank of commodore in 1872, and was one of the founders of the Naval Institute at Annapolis in 1873. In 1877-8 he was in charge of the Boston navy yard, and in 1878, until his death, was superintendent of the Naval Academy at Annapolis. He published: 'Fleet Tactics' (1865); 'The Naval Howitzer' (1866); 'The Fleets of the World: the Galley Period' (1876); etc.

**Parker, Sir (Horatio) Gilbert**, Canadian novelist: b. Camden East, Addington, Ontario, 23 Nov. 1862. He was educated at Trinity College, Toronto, in 1886 became associate editor of the Sydney (Australia) *Morning Herald*, and during his stay in Australia began to write plays. He traveled widely among the South Sea Islands and in northern Canada. His novels include: 'Pierre and His People: Tales of the Far North' (1892); 'Mrs. Falchion' (1893); 'The Trespasser' (1893); 'Translation of a Savage' (1894); 'The Trail of the Sword' (1895); 'When Valmond Came to Pontiac' (1895); 'An Adventurer of the North' (1895); 'The Seats of the Mighty' (1896), a romance of the taking of Quebec; 'The Stolen Bonds' (1897); 'The Pomp of the Lavillettes' (1897); 'The Battle of the Strong' (1898); 'The Lane that had no Turning' (1900); 'The Right of Way' (1901); and 'Donovan Pasha' (1902). He has also published a book of travel entitled 'Round the Compass in Australia' (1892). His works, despite their popularity, exhibit a finished method and much skill in characterization and description. In 1900 he was elected as member of parliament in the Conservative interest for Gravesend, and in 1902 was knighted.

**Parker, Horatio William**, American musician and composer: b. Auburndale, Mass., 15 Sept. 1863. His education was for the most part European, and in 1885 he graduated from the Munich Royal Conservatory. After that time he was professor of music in the Cathedral School of St. Paul, Garden City, L. I., and organist of Holy Trinity Church, New York, until 1893, when he became organist of Trinity Church, Boston. Since 1894 he has been professor of the theory of music at Yale University. His compositions rank high in American music; they include the oratorio 'Hora Novissima,' the first American music given at an English musical festival; 'A Wanderer's Psalm,' also given at one of the English festivals; the

oratorio of 'St. Christopher'; the cantatas 'King Trojan' and 'The Kobolds'; etc. In 1902 he received the degree of Mus. Doc. from Cambridge University.

**Parker, Sir Hyde**, English admiral: b. Devonshire, England, 1739; d. 16 March 1807. He entered the British navy, served in the war of the American Revolution, where in 1776 he commanded a small squadron, and for services in the North River was knighted in 1779. He was promoted rear-admiral in 1793, vice-admiral in 1794, and appointed commander-in-chief at Jamaica in 1796. He returned to England in 1800, was given command of the Baltic fleet and moved northward to check the measures of the armed neutrality formed by Russia, Sweden, and Denmark. In the battle of Copenhagen he had no share, it being an independent move of Nelson's, who was second in command and more daring than his commander. Parker compelled Sweden to remain inactive by his appearance before Carlskrona, and was preparing to move upon Cronstadt when the death of Emperor William ended hostilities. He was shortly afterward succeeded by Nelson, and thenceforward until his death lived in retirement.

**Parker, Joel**, American legislator: b. Monmouth County, N. J., 24 Nov. 1816; d. Philadelphia, Pa., 2 Jan. 1888. He was graduated from Princeton in 1839, admitted to the bar in 1842, and established a law practice in Freehold, N. J. He engaged in politics with much zest, and in 1847 was elected to the legislature; in 1852-7 he was prosecuting attorney of Monmouth County, and in 1861, at the outbreak of the Civil War, was appointed major-general of volunteers. In 1862-6 he was governor of New Jersey, giving loyal support to the policy of the national administration. He was again elected governor in 1870, and in 1880 was appointed associate justice of the supreme court of New Jersey, and reappointed in 1887.

**Parker, John Henry**, English archæologist: b. London 1 March 1806; d. Oxford 31 Jan. 1884. He began his career as a bookseller in Oxford in 1832. Later he superintended many excavations in Rome, and was the author of 'The Archæology of Rome' (1874-84), a work of importance on the walls, aqueducts, tombs, etc., of the Eternal City. His other publications are: a 'Glossary of Architecture' (1836), an important aid to the revival of Gothic art; 'Introduction to the Study of Gothic Architecture' (1849); 'The A B C of Gothic Architecture.'

**Parker, Joseph**, English Congregational clergyman: b. Hexham-on-Tyne, Northumberland, 9 April 1830; d. London 28 Nov. 1902. He studied at University College, London, in 1853 became pastor of the Congregational Church at Banbury, and in 1858-69 was pastor of the Cavendish Street Church at Manchester. In 1869 he began his larger ministry at the old Poultry Chapel of London, the congregation of which was transferred in 1874 to the City Temple, Holburn Viaduct. At the City Temple he conducted three services weekly, two on Sunday, and one at noon on Thursday. He became one of the best-known preachers in England. His views were liberal, and he spoke with a ready command of vigorous English. In 1887 he visited the United States. He was twice



## PARKER

chairman of the Congregational Union of England and Wales, and published several works, including: 'Ecce Deus' (1868); 'The Paraclete' (1874); 'The People's Bible,' "discourses upon Holy Scripture, forming a pastoral commentary" (25 vols. 1885 *et seq.*); 'Christian Profiles in a Pagan Mirror' (1898); and 'A Preacher's Life,' an autobiography (1899). Consult the 'Life' by Adamson (1903).

**Parker, Louis Napoleon**, English dramatist and composer: b. Calrados, France, 21 Oct. 1852. He was educated at Freiburg and the Royal Academy of Music, and was director of music in Sherborne School, Dorsetshire, 1877-96. In the latter year he removed to London and in 1898 was made a fellow of the Royal Academy of Music. He is the author of many cantatas, such as 'Silvia' and the 'Twenty-third Psalm' as well as many other musical compositions, and of a large number of plays. Among the latter may be cited 'Change Alley,' and 'The Man in the Street.' He has also translated 'Magda'; 'L'Aiglon'; 'Cyrano de Bergerac,' and other dramas.

**Parker, Matthew**, second Protestant archbishop of Canterbury: b. Norwich 6 Aug. 1504; d. Canterbury 17 May 1578. He entered Corpus Christi College, Cambridge, in 1522, and was graduated in 1525. Two years afterward he was ordained priest, and elected fellow of his college. His favorite studies were the Scriptures, the church fathers, and other ecclesiastical writers. In 1535 he was made chaplain to Queen Anne Boleyn, who shortly before her death commended to his care her daughter Elizabeth. This appointment carried with it the deanery of the College of St. John the Baptist at Stoke-by-Clare, in Suffolk. He early imbibed reformation principles, and in 1537, after the death of Anne Boleyn, Henry VIII. made him one of his chaplains, and about five years afterward appointed him canon of Ely. In 1544 he was appointed to the mastership of Corpus Christi College, Cambridge, for which he compiled a new body of statutes; and in the following year was elected vice-chancellor of the university, and presented with the rectory of Land Beach. In 1547 he married Margaret Harlstone, the daughter of a Norfolkshire gentleman. In 1552 he was elected prebendary and afterward dean of Lincoln; but on the accession of Mary to the throne was stripped of these as well as his other preferments. A portion of his time he now spent in translating the Psalms into English verse. He also wrote a treatise, 'De Conjugio Sacerdotum,' defending the marriage of priests. When Elizabeth succeeded to the throne he was raised to the archbishopric of Canterbury, his consecration taking place 17 Dec. 1559. During his 15 years' primacy he labored to make clear the belief and discipline of the Church, and published his 'Advertisements' for the regulation of divine service.

In 1568 was published under his direction and his expense, the Bishops' Bible, which was a revision of the text founded on Cranmer's translation; he was likewise prominently associated with those who drew up the Book of Common Prayer. He edited the histories of Matthew of Westminster, Matthew Paris, and others; and had a considerable share in the work 'De Antiquitate Britannicæ Ecclesiæ.'

Archbishop Parker was the founder of the Society of Antiquaries. His valuable collection of MSS. relating to the civil and ecclesiastical history of England he presented to his own college at Cambridge, and founded a number of valuable fellowships there.

Consult: 'Life and Letters of Matthew Parker' (Parker Society, 1853); Strype, 'Life and Acts of Matthew Parker' (1824); Hook, 'Lives of the Archbishops of Canterbury' (1872).

**Parker, Theodore**, American clergyman: b. Lexington, Mass., 24 Aug. 1810; d. Florence, Italy, 10 May 1860. He took the arts course at Harvard, studying at home and visiting Cambridge for the examinations; and though he was unable thus to obtain a degree in course, that of M.A. was conferred upon him *honoris causa* in 1840. In 1834-6 he studied at the Cambridge Divinity School, and after preaching as a candidate was ordained 21 June 1837 and installed as pastor of the West Roxbury Unitarian Church. It was soon noised about that he was not in agreement with the Unitarian position of the time. His outspokenness had already won for him the reproach of "infidel," and many of the clergy had found exchanges of pulpit with him inconvenient, before his discourse on 'The Transient and Permanent in Christianity' at the ordination of C. C. Shackford at South Boston 19 May 1841. In this sermon Parker denied the special authority of the Bible, the supernatural origin of Christianity, and the supernatural character and divine mission of Christ. It is perhaps not surprising that most pulpits were now closed against him, and that his name was associated with those of leaders of irreligion. His own congregation gave him steadfast support. He did not withdraw from the Unitarian Church, believing, apparently, that that church was liberal enough to suffer a freedom of thought even so great as his; while the church never formally expelled him from its ministry, being, it would seem, reluctant to afford him the prestige which might result from such action. But he was thenceforth actually an independent preacher. In 1846 he became pastor at Boston of what he always called the "Twenty-eighth Congregational Society." Services were held until 1852 in the Melodeon, and in 1852-9 in the Music Hall, whose 3,000 seats were generally fully occupied. The regular membership was never large, but all shades of religious dissatisfaction there assembled, and many others were drawn by Parker's championship of humanitarian endeavors, especially of anti-slavery reform. In this cause "probably no one—not Garrison, not Phillips himself," says Frothingham, "did more to awaken and enlighten the conscience of the North." He was a leader in the committee of vigilance, received runaway slaves, fought the rendition of such, and aided their escapes. For several years he was a popular lecturer, and to this activity gave much time. Both in the pulpit and on the platform he had none of the arts of the practised orator, but carried weight rather by his massive knowledge, deep conviction, frankness, and vigorous and often picturesque English. Ill-health compelled the foreign sojourn during which he died. He was editor of the 'Massachusetts Quarterly Review' in 1849-51, and wrote, besides sermons, several works, including 'Historic Americans'



## PARKER — PARKERSBURG

(1870) and 'Views of Religion' (1885), which have been collected by F. P. Cobbe (1870). For his peculiarly individual religious beliefs consult Clarke, 'Parker and his Theology' (1859); and the 'Lives' by Frothingham (1874) and Chadwick (1901).

**Parker, Willard**, American surgeon: b. Hillsborough, N. H., 2 Sept. 1800; d. New York 25 April 1884. He was graduated from Harvard in 1826, studied medicine and took his degree there in 1830, when he accepted a professorship in the Berkshire Medical College, Pittsfield, Mass. In 1836 he accepted the chair of surgery in the Cincinnati Medical College, but removed in 1839 to New York, where he had been appointed professor of surgery in the College of Physicians and Surgeons, which position he held for 30 years. He established a large practice in New York and as a surgeon he took high rank, making many advances in methods as well as important discoveries. He established the first college clinic in the United States at the College of Physicians and Surgeons in 1840; organized the New York Pathological Society in 1843; the New York Academy of Medicine in 1847, of which he was president for many years after 1856. From 1865 he was president of the State Inebriate Asylum at Binghamton, where his conduct of the management was very successful. He was consulting physician at the leading New York hospitals and connected with many medical organizations.

**Parker, Sir William**, English naval officer: b. Alington, Staffordshire, England, 1 Dec. 1781; d. Shenstone Lodge, England, 13 Nov. 1866. He entered the navy in 1793, where he was steadily promoted; in 1806 he captured the *Belle-Poule*, a French frigate, and in 1809 further distinguished himself by the capture of the citadel of Ferrol. He was promoted rear-admiral in 1830 and in 1841 was placed in command of the squadron at Hong Kong, where he succeeded in forcing the entrance of the Yangtse-kiang and concluded a treaty of peace. He was made admiral of the fleet in 1863.

**Parker, William Gordon**, American author and artist: b. Clifton, N. J., 1875. He was educated at the Brooklyn Polytechnic Institute and besides contributing illustrations to periodicals has illustrated his own books for boys, which are: 'Grant Burton the Runaway' (1899); 'Six Young Hunters' (1898); 'Rival Boy Sportsmen'; 'Two Boys in the Blue Ridge' (1901).

**Parker, William Kitchen**, English anatomist: b. Dogsthorpe, near Peterborough, Northamptonshire, England, 23 June 1823; d. Cardiff, Glamorganshire, Wales, 3 July 1890. He was educated at King's Hospital College and in 1873-83 was professor of comparative anatomy at the Royal College of Surgeons, London, though he continued his practice. He was deeply interested in biology, but devoted his attention chiefly to the study of comparative osteology. He wrote nearly a hundred scientific papers concerning his investigations, principal among them being: 'On the Osteology and Systematic Position of *Balaniceps*' (1860); 'The Skull of *Batrachia*' (1878); 'Insectivora' (1886); etc.

**Parker's Cross Roads (Tenn.), Engagement at.** On the morning of 11 Dec. 1862 Gen. N. B. Forrest, with about 2,500 cavalry, left Columbia, Tenn., to operate in the western part of the State and fall upon Gen. Grant's communications with Columbus. On the 13th he reached the Tennessee River at Clifton, about 50 miles east of Jackson, crossed on a flatboat, and on the 16th reached Lexington, where he met 700 of the 11th Illinois cavalry and two guns, under command of Col. R. G. Ingersoll, and routed Ingersoll, capturing him and nearly one fourth of his command. Two detachments were now sent to cut the Mobile and Ohio railroad at points north and south of Jackson, and on the 19th Forrest, with the remainder of his command, not over 600 men, moved on the town, and was met by a force of infantry and cavalry, which disputed his advance, but which was gradually driven back until within reach of the defenses of the place, when Forrest withdrew and, uniting his command, turned north on the line of the railroad. He captured Humboldt and Trenton, at the latter place taking and paroling its garrison of 700 men. Several small posts were captured and the railroad destroyed as far as the Kentucky line. On the 25th he retraced his steps toward the southeast, closely followed by Gen. Sullivan with 4,000 men. On 31 December, at Parker's Cross Roads, a few miles north of Lexington, Sullivan's leading brigade of 1,500 men, under Col. C. L. Dunham, intercepted Forrest's march, but Forrest attacked it and drove it eastward and southward from the crossroads. The fighting lasted several hours, during which time Sullivan came up with Col. J. W. Fuller's brigade, and at 3 P.M. struck Forrest's rear and soon defeated him, taking 400 prisoners, six guns, and several caissons and ammunition-wagons. The Union loss was 27 killed, 140 wounded, and 70 missing. The Confederate loss in killed and wounded is not known. Forrest continued his retreat, brushed away the 6th Tennessee cavalry that had been sent to intercept him at Clifton, and 1 and 2 Jan. 1863 recrossed the Tennessee River, having destroyed the railroad at many points between Jackson and Columbus, also a large quantity of stores, and claiming that with a loss of less than 400 men he had killed, wounded, and captured nearly 2,500. Consult: 'Official Records,' Vol. XVII.; Greene, 'The Mississippi'; The Century Company's, 'Battles and Leaders of the Civil War,' Vol. III.

E. A. CARMAN.

**Parkersburg**, pär'kèrz-bèrg, W. Va., city, county-seat of Wood County; on the Ohio River at the mouth of the Little Kanawha, and on the Baltimore & O. S. W., the Ohio R., and the Baltimore & O. R.R.'s; about 65 miles north of Charleston, the State capital, and 75 miles in direct line southwest of Wheeling. The city is connected by steamers with the river ports on the Ohio. It was settled in 1773; in 1820 was incorporated, and chartered as a city in 1863. Near by is the island where once lived Harman Blennerhassett (q.v.). It is in an agricultural region; in the vicinity are valuable clay and coal deposits, gas and petroleum wells, and several mineral springs noted for their medicinal qualities. The chief industrial establishments are oil refineries, oil-well supply works, foun-



## PARKES — PARKINSONIA

dries, machine shops, flour and lumber mills, breweries, veneer works, and furniture factories. It has an extensive trade in manufactured goods, farm products, and coal. The prominent buildings are the government building, city-hall, court-house, some of the school buildings, and Saint Joseph's Hospital. The educational institutions are the Academy of the Visitation (R. C.), the Washington High School, public and parish elementary schools, and a public library. A railroad bridge, one and one third miles long, crosses the Ohio. It was opened in 1871 and constructed at a cost of \$1,000,000. Another fine bridge spans the Little Kanawha. The location near the raw material, and the facilities for transportation combine to make Parkersburg an important manufacturing city. The city owns and operates the waterworks. Pop. (1890) 8,408; (1900) 11,703; (1903) 16,193.

**Parkes, parks, Elizabeth Robins** ("C. E. RAIMOND," "ELIZABETH ROBINS"), American author and actress: b. Louisville, Ky. She was married to G. R. Parkes, an actor (now dead), and has spent much of her life in London, where as an actress she has appeared in several Ibsen roles, and as a novelist, using the pen names "C. E. RAIMOND" and "ELIZABETH ROBINS," has published 'The Fatal Gift of Beauty and Other Stories'; 'George Mandeville's Husband'; 'The New Moon'; 'An Open Question.'

**Parkes, SIR Harry Smith**, English diplomat: b. Bloxwich, Staffordshire, 24 Feb. 1828; d. Peking 22 March 1885. He went to China in 1841, became a proficient Chinese scholar, and at 17 was appointed interpreter at Foo-Chow. In 1854 he had become consul at Amoy, effecting the first treaty with Siam signed by a European power, and in 1856 was acting consul at Canton when the city was stormed by the British troops. He was appointed a member of the European commission in charge of Canton in 1858, and had pretty thoroughly reorganized the government of the city when the third war with China (1859-60) came on; during its course, while he was returning from negotiations under a flag of truce Parkes was seized by the Chinese. He was imprisoned, tortured, and threatened with execution, and saw most of his escort, who had been taken prisoners with him, die of hard treatment, before he was released upon the capture of the Summer Palace. In 1864 he became consul at Shanghai, where there was constant friction with Li Hung Chang (q.v.), and in 1865 was sent to Japan as British minister. He secured the ratification of the treaty of 1858, was formally thanked by the Mikado in 1871 for his assistance to the reorganized kingdom, and remained in Japan until 1883, when he became minister to China. The treaty with Korea, which he drafted, negotiated and concluded in 1883, opened three ports and two cities, and with his successful treaties with Siam and Japan goes to rank him one of the foremost of British diplomats in the Far East. His position in China was extremely difficult, owing to the government's resentment toward his actions in Canton and to the anti-foreign excitement aroused by French occupation of Tongking. In 1884 he demanded and secured the repeal of the governmental order to poison all Frenchmen. Consult the biography by Lane-Poole and Dickins (1894).

**Parkes, SIR Henry**, Australian statesman: b. Stoneleigh, Warwickshire, 27 May 1815; d. 27 April 1896. His father was a farmer; the son became an ivory turner and in 1839 emigrated to Sydney. For several years his life was a hard struggle with poverty. He entered politics as a leader of the "anti-transportationists"; founded in 1849 'The Empire,' a liberal organ which he edited until 1857; in 1854 was elected to the Legislative Council, in which he led the fight for responsible government; was a member of Parliament for East Sydney 1858-61, colonial secretary 1866-8, and again a member of the colonial parliament 1871, becoming prime minister of New South Wales in 1872. His cabinet remained in office until 1875, and he was again prime minister 1878-82 and 1887-9. He was a prominent adherent of the cause of Australian federation, insisted on democracy as the basis of any such scheme, and successfully opposed Wentworth's plan of a bicameral Legislature, with colonial peers in the upper House. He was a personal friend of Tennyson, and himself wrote several volumes of verse. Consult his political autobiography, 'Fifty Years in the Making of Australian History' (1892); the 'Life' by Lynes (1897); and an article by Marin La Meslée in 'Revue des Deux Mondes' (1892, Tome III.).

**Parkhurst, pärk'hèrst, Charles Henry**, American Presbyterian clergyman: b. Framingham, Mass., 17 April 1842. He was graduated at Amherst in 1866, studied theology at Halle 1869-70 and at Leipsic 1872-3, taught in Williston Seminary 1870-1, was pastor of the Congregational Church of Lenox, Mass., 1874-80, and since the last named date has been pastor of the Madison Square Presbyterian Church, New York. His work as president of the Society for Prevention of Crime, notably his personal study at first hand of the problem of crime in New York, led to the famous Lexow Investigation of the charge that the police were in league with metropolitan criminals. He wrote, besides some philological studies and various contributions to periodicals, 'The Blind Man's Creed' (1883); 'The Pattern on the Mount' (1885); 'Three Gates on a Side' (1891); 'What Would the World be Without Religion?'; 'The Swiss Guide'; 'Our Fight with Tammany' (1895); 'The Sunny Side of Christianity'; 'Talks to Young Men' and to Young Women' (1897); and 'Guarding the Cross with Krupp Guns' (1900).

**Parkhurst, Howard Elmore**, American musician and author: b. Ashland, Mass., 13 Sept. 1848. Beside various musical compositions he is the author of 'The Birds' Calendar' (1894); 'Songbirds and Waterfowl' (1897); 'How to Name the Birds' (1898); 'Trees, Shrubs and Vines of Northwestern United States' (1903).

**Parkinsonia**, a genus of tropical trees and shrubs of the order *Leguminosæ*. The species, of which there are less than ten, have short spines, bipinnate leaves, yellow or whitish flowers arranged in loose terminal or axillary racemes, and more or less twisted compressed pods. The best known and most widely popular species is the Jerusalem thorn (*P. aculeata*). It is probably a native of America, but is cultivated throughout the tropics, in many parts of which it is naturalized. From its frequent employment for hedges, and from its gorgeousness when in blossom it is often called the Barbados flower-



## PARKMAN — PARKS AND PARK-MAKING

fence. Its bark yields a white fibre which might be valuable for paper-making, but is rather weak and short for most purposes. It is fairly hardy in the Southern States and will thrive in the driest situations. As a greenhouse plant it is difficult to grow. *Parkinsonia torreyana* is a native of the Southwestern States where, like *P. microphylla*, it is known as "palo verde" from its green branches. It is rarely leafy. Three species are natives of South America and one of South Africa.

**Parkman, pärk'man, Francis**, American historian: b. Boston 16 Sept. 1823; d. there 8 Nov. 1893. He prepared for college at Chauncey Hall School, in Boston, entered Harvard in 1840, and was graduated in 1844. During his college course he determined to write the history of the struggle between France and England for the possession of the New World, but kept his purpose a secret. In college he gave particular attention to history and literature, and attained considerable distinction as a historical student. On his vacation trips also he visited many of the localities of which he was afterward to write, and studied the life of the Indians of Maine. He kept diaries of all these excursions in which he recorded in detail his observations and impressions. After leaving Harvard he spent two years at the Law School, but never entered upon the practice of law. Feeling the need for a fuller understanding of Indian character and life, he spent five months in the West, living among the Dakotas and other tribes. This gave him just the kind of first-hand knowledge he desired, but the hardships to which he was exposed undermined his constitution and brought upon him the weakness of the eyes and general ill health from which he suffered for the rest of his life. From that time he devoted himself in so far as his health allowed to the completion of the work he had planned. He several times visited Canada and Europe, making a careful examination of the numerous manuscripts of the period concerning which he wrote, and also studied closely life in several monasteries for the better comprehension of the spirit of monasticism and of Roman Catholic ecclesiasticism. From 1853 to 1863 his health prevented him from doing any historical work, and at this time he gave his attention to horticulture, in which he was particularly successful; he wrote several valuable horticultural papers and 'The Book of Roses,' still a recognized authority. In 1868 he was overseer of Harvard, resigned this position in 1869 and became professor of horticulture; and in 1875-88 was a fellow of Harvard. The courage and persistency with which he overcame the obstacles of ill health and ruined eyesight were truly heroic. Often he could work only a few minutes at a time; he had all documents and manuscripts read to him, taking as few notes as possible, and dictated from his notes; yet he brought to full completion the great work he had planned. His first book, 'The Oregon Trail,' an account of his travels in the West, appeared in 1849; his one work of fiction, 'Vassall Morton,' in 1856. In 1851 he issued the 'Conspiracy of Pontiac,' and in 1865 'The Pioneers of France in the New World,' the first of the series 'France and England in North America.' The rest of the series appeared as follows: 'The Jesuits in North America' (1867);

'La Salle and the Discovery of the Great West' (1869); 'The Old Régime in Canada' (1874); 'Count Frontenac and New France under Louis XIV.' (1877); 'Montcalm and Wolfe' (1884). This last concluded the series, but left an important period untreated; the gap was filled by the publication of 'A Half Century of Conflict' (1892). Parkman chose for his subject a theme entirely untouched by other writers, and dealt with it so successfully as to obtain preeminent rank among historians. His histories are not philosophical, yet are written with a breadth of view and a sense of proportion that mark the philosophic spirit. Nowhere does he show his power more clearly than in his sympathetic and vivid portrayal of many widely different characters. He combined to an unusual degree the merits of both the scientific and literary historian. None of the most scientific of modern historical students have surpassed him in thorough and exhaustive research, while his literary style is marked by a clearness, beauty and dramatic power that give to his histories the fascination of the best of romance. Consult Farnham, 'Life of Parkman' (1901).

**Parks and Park-making.** In Europe the word park has been variously applied to any garden or space used for out-of-door rest and recreation, but in the United States the term park is used to denote a large tract of wooded land for public use and enjoyment. Such data as pertain to gardens and the planting of trees, shrubs, flowers, etc., will be found under HORTICULTURE. The parks of the ancients were more architectural than horticultural, while forestry was neglected entirely. The Egyptians ornamented their parks with colonnades and sculpture. Those of Greece were small, and in the Middle Ages there was none worth recording. The Renaissance, however, developed the park idea and many beautiful public gardens resulted. Nearly all the larger cities of Europe were early adorned with public parks of more or less magnitude. The parks of Potsdam (q.v.) are remarkably beautiful.

*Paris.*—The French capital is noted for its public parks and gardens. The Bois de Boulogne, an ancient forest, containing 2,200 acres, was given to the public in 1852. Newer parks are the Butes Chaumont, the Parc Monceaux, Saint Cloud, Versailles, and Fontainebleau. The old gardens of Luxembourg and the Tuileries are also extensively used as public parks. (See PARIS.)

*London.*—There are seven great parks in London: Hyde Park (q.v.), 400 acres; Regent's Park, 450 acres; Victoria Park, 290 acres; Battersea Park, 320 acres; Kensington Park (q.v.), 20 acres; Green Park and Kensington Gardens. There is also at Kew the famous Botanical Gardens, also used as a public park. These London parks are scarcely broken by carriage roads, being given over almost to the exclusive use of pedestrians. See LONDON.

*United States.*—The public park system adopted by the older cities like Boston, New York and Philadelphia has extended during recent years to every city and town of any considerable size in the Union, and this work is constantly expanding. The younger cities are profiting by the experience of the older, many





*Francis Parkman*







PARKS.



1. The Fountain, Central Park, New York.
2. Lake Alvord, Golden Gate Park, San Francisco.







## PARLATORE — PARMA

of which, by failing to recognize at the beginning of their growth that open spaces would become necessary, have had to invest enormous sums in park land. New York has about 295 square miles, of which more than 10 square miles (6,766 acres) are in parks. A large proportion of the area of the city consists of open spaces on the outskirts which have not yet been built up, and as the city extends farther out, provision will probably be made for a greater park acreage. Chicago has three park systems: the South Park system with five large parks, of 1,181 acres; the Lincoln Park system with Lincoln Park (308 acres) and two smaller parks of nearly 10 acres; and the West Chicago system of three large parks, of 575 acres, and six small parks, of 37 acres. Philadelphia has one large park, of 3,300 acres, and 22 small ones of 318 acres. The three large parks of San Francisco cover 1,090 acres, and the 14 small parks, 224 acres. In Baltimore there are nine large parks, with an area of 1,100 acres, and 20 small parks, covering 37 acres. Detroit has an island park,—Belle Isle, about two miles long. Part of the island has been improved, but at the upper end the natural conditions have been faithfully preserved. Detroit has one other large park, the combined area of the two being 723 acres. There are also 17 small parks, with a total area of 30 acres. Among other cities with notable park areas are Buffalo, Cincinnati, Cleveland, Kansas City, St. Louis, St. Paul, Minneapolis, Newark, and Hartford. St. Louis has 11 large and 10 small parks, with a total area of 2,223 acres. The area of the three Kansas City parks is 1,328 acres. Minneapolis has given 1,500 acres to 11 large parks and 40 acres to 25 small parks. The Newark parks include 3,113 acres, the Hartford parks 1,207 acres, the Cleveland parks 1,326 acres, the St. Paul parks 889 acres, the Buffalo parks 813 acres.

In size and extent Boston has the great park system of the country, embracing 2,337 acres, and \$8,000,000 has been expended on improvements. The amount spent by a few of the leading cities on their park systems aggregate several millions. Some of these expenditures were as follows: Chicago, South Park system, \$405,000; Lincoln Park system, \$315,000; West Chicago system, \$883,000; Cincinnati, \$45,800; Detroit, \$160,320; Brooklyn and Queens Boroughs of Greater New York, about \$547,000; Bronx Borough of Greater New York, about \$245,000. These figures represent in some instances merely the cost of maintenance of existing parks. The appropriations of different cities vary in different years according to the amount of work to be done.

The government parks such as the Yellowstone (q.v.), Yosemite (q.v.), and others are no small part of park improvement and development in the United States. The government has laid out other great tracts of forest and stretches of land of unusual natural beauty. Every year excursions to these great parks increase.

Detailed descriptions of the leading parks in the United States will be found under their names, CENTRAL PARK; FAIRMOUNT PARK; GOLDEN GATE PARK, etc., and descriptions of the smaller parks in the articles on the various cities and towns. See also FOUNTAIN; NATIONAL PARKS AND RESERVATIONS.

**Parlatore**, pār-lä-tō'rä, **Filippo**, Italian botanist: b. Palermo, Italy, 8 Aug. 1816. He was educated at the University of Palermo as a physician, but soon turned his attention to botany. He traveled in Italy and Switzerland in the prosecution of his studies and succeeded in founding a herbarium at Florence, of which he was made curator. A professorship of botany was revived for him in Florence and he afterward traveled in northern Europe in the interests of his favorite science. He published: 'Observations on some new Planets in Italy'; 'Journey to the Great St. Bernard' (1849); 'Journey to the North of Europe' (1854); etc.

**Par'lement**, in French history, before the Revolution, a name applied to certain superior and final courts of judicature, in which also the edicts of the king were registered before they became laws. Of these the chief was that of Paris, but there were no fewer than 12 provincial parlements, at Toulouse, Grenoble, Bordeaux, Dijon, Pau, Metz, Besançon, Douai, Rouen, Aix, Rennes, and Nancy. These, though not actually connected with that of Paris, invariably made common cause with it in its struggles with the royal power. The parlement of Paris dated from the 14th century, and consisted of three chambers, the Grand Chambre, the Chambre des Enquêtes, and the Chambre des Requêtes. By 1344 it had grown in numbers and power, and consisted of three presidents and 78 counselors, of whom 44 were ecclesiastics and 34 laymen. In 1467 Louis XI. made the counsellors irremovable. Its influence grew during the 16th century. Louis XV. exiled the members from Paris in 1753 for their interference in the struggle between the Jansenists and the Jesuits, and in 1770, on the advice of Maupeou, abolished the old parlement altogether. See FRANCE.

**Par'liament, British.** See GREAT BRITAIN; LONDON.

**Parliament, Houses of.** See LONDON.

**Parliamentary Law.** See LAW.

**Parliamentary Reform.** See GREAT BRITAIN.

**Parloa**, pār-lō-ä, **Maria**, American author and domestic scientist: b. Massachusetts, 1843. She is an authority on the proper preparation of food and on household management upon which subjects she has lectured and written extensively. Among her works are: 'First Principles of Household Management and Cookery' (1879); 'The Kitchen Companion' (1887); 'Home Economics' (1898); etc.

**Parma**, pār'mä, **Alessandro Farnese**, 3d DUKE OF. See FARNESE, ALESSANDRO.

**Parma**, Italy, (1) the capital of the province of the same name, on the Parma, dividing the city into unequal parts, 55 miles by rail northwest of Bologna. The town is encircled by the Rampari, a promenade laid out on the site of the former fortifications. The old Roman Via Æmilia traverses the town centrally east to west, forming the principal street, at its widest section named Corso Vittorio Emanuele; and the Strada Garibaldi, another important street, intersects it north and south. Both are laid with tramways. Of the four principal squares the chief is the large and handsome Piazza Grande, near the centre of the town. Among the principal buildings are the Duomo or cathedral, begun in 1058, partly Romanesque



and partly Gothic, with a fine octagon tower and a dome in the centre, the interior painted in fresco by Correggio; the baptistery, in the Lombard-Romanesque style (1196-1270), and covered externally with curious bas-reliefs; the church of La Steccata; the church of San Giovanni, which, with other churches and buildings, contains paintings by Correggio and by Parmigiano, who was born here. Other buildings and places of interest are the ducal palace (now the prefecture); the Palazzo della Pilotta, comprising a museum of antiquities, a gallery of valuable paintings, and library of nearly 300,000 volumes; and the university founded in 1512, with faculties of law, medicine, and science, 42 professors and over 600 students. The manufactures are of silk, cottons, woollens, felt hats, etc. Traces of a prehistoric pile-village of the Bronze Era and of an Etruscan town, precede the authentic history of Parma as a Roman colony. Pop. (1901) 49,370. (2) The province of Parma has an area of 1,250 square miles, and a population (1901) 294,159. It is watered chiefly by the Taro, the Parma, and the Enza, all of which fall into the Po. It is covered by branches of the Apennines on the south. (3) The duchy of Parma, formerly an independent state of northern Italy, but since 1860 incorporated in the kingdom of Italy, and divided into the provinces of Parma and Piacenza. As an independent state it comprehended the three duchies of Parma proper, Piacenza, and Guastalla, and had an area of 2,766 square miles. The government was an absolute monarchy. During the decline of the Roman empire this territory became part of the kingdom of Lombardy. Charlemagne, having conquered that kingdom, made a present of Parma to the pope, who long possessed it. In the subsequent quarrels between the popes and the emperors both Parma and Piacenza became independent republics. In 1512 Pope Julius II. regained possession; and in 1543 Paul III. erected them into a duchy in favor of his son Luigi Farnese, whose line became extinct in 1731. Don Carlos, son of Philip V. of Spain and Elizabeth Farnese, obtained possession in the face of a protest by the pope, and kept it till 1736, when he became king of the Two Sicilies. A claim was now put in by Austria; but the Treaty of Aix-la-Chapelle in 1748 gave possession to Philip, another son of Philip V. and Elizabeth Farnese. The victories of the French in Italy in the beginning of last century enabled Napoleon to seize the duchy and attach it to his kingdom of Italy. After Napoleon's downfall it fell to the Archduchess Maria Louisa for life, and thereafter to the Duke of Lucca and his descendants, until 1860 witnessed its annexation to Sardinia and its incorporation with the kingdom of Italy (q.v.).

**Parmenides**, pār-mě'nĩ-dēz, Greek philosopher, head of the Eleatic school: b. Elea in southern Italy, and flourished about the middle of the 5th century B.C. In 460 he went to Athens, with his pupil Zeno, and made the acquaintance of Socrates, then a young man. He was held in high esteem by both Plato and Aristotle for the depth of his intellect, and the loftiness of his character. His only writings consist of a didactic poem in epic verse composed in the Ionian dialect. In the first part of the poem he treats of that which *is*, of absolute being which reason alone is able to conceive and dem-

onstrate; and in the second part of that which *appears*, of the phenomena of the senses. Pure being he opposes to all that is multiplex and mutable, as well as to non-being, and excludes from the notion of it the elements of time and space, origination and termination, identifying it finally with thought. Being cannot be predicated of the phenomenal world, which is illusion. The second part of his poem begins with the remark that truth's discourse and thought are now ended, and mortal opinion only remains to be considered. Consult: Karsten, 'Philosophorum Græcorum Reliquiæ' (1835); Stein, 'Symbola Philologorum Bonnensium in Honorem Ritschlii' (1864-7); Vatke, 'Parmenidis Veliensis Doctrina' (1864).

**Parmenio**, pār-mě'nĩ-ō, or **Parmenion**, Macedonian general under Philip and Alexander the Great: b. about 400 B.C.; d. Ecbatana 329. A trusted counsellor and able lieutenant of Philip, he carried to a successful issue many campaigns during his master's life, and upon his death used his influence in behalf of Alexander, whose accession was thus assured. Alexander also had great confidence in him, although deprecating the conservative prudence of the older man. Parmenio's son was found guilty of plotting against Alexander, and soon after his execution the father, too, was put to death; either because Alexander feared that he would attempt to take vengeance for the death of his son, or because the son implicated him in the plot. He was almost certainly innocent.

**Parmesan** (pār-me-zăn') **Cheese**, a cheese originally made in Parma, of skimmed milk flavored with saffron, and celebrated for its keeping qualities. It had to be grated when used.

**Parmigiano**, Il, ēl pār-mě-jä'nō. See MAZZOLA, FRANCESCO.

**Parnahyba**, pār-nä-ē'bä. See PARANAHYBA.

**Parnassus**, pār-näs'ūs, in ancient geography, a mountain in Phocis, near the Gulf of Corinth and the frontier of Bœotia and Attica. To the northeast lies the plain of Cephissus, to the west the plain of Amphissa, to the south two narrow valleys, and the northwest and southeast passes between it and Giona and Helicon, respectively. Parnassus has two snow-capped peaks, each over 8,000 feet high, Lycorea, now Lykeri (the name is also given to the entire mountain), is at the southeast and is only 80 feet higher than Tithorea, now called Gerantorachos or Hierondovrachos. The site of Castalia, a fountain of inspiration and of the temple of the Delphic Apollo (on the southern slope), Parnassus has become a symbol of poetry and belles-lettres.

**Parnell**, pār'něl, **Charles Stewart**, Irish political leader: b. Avondale, County Wicklow, 27 June 1846; d. Brighton, Sussex, 6 Oct. 1891. He was educated at Magdalene College, Cambridge, which he left without a degree. In 1872-3 he visited the United States, and in 1875 was elected to Parliament as member for County Meath. He allied himself with Joseph Biggar and began the policy of obstructing parliamentary proceedings, in order to bring pressure to bear on the government, and obtain concessions for Ireland. In 1879 he was chosen first president of the recently started Land League; he



## PARNELL — PAROS

now visited the United States a second time to raise funds for the League, and was well received by even the most extreme of the Irish party. At the general election of 1880 he was elected for three Irish constituencies, but chose to sit for Cork, which he represented to the last. He now became the chairman of the Irish parliamentary party. The methods of the Land League, especially the system of "boycotting," warmly advocated by Mr. Parnell, and the general state of Ireland, led the Gladstone government to bring in a Crimes Bill and an Arms Bill in 1881, both of which were passed, but not till after violent opposition from the Parnellites in Parliament. A Land Act was passed in the same session, and as the government saw that an attempt would be made to thwart its operation, Parnell was arrested and lodged in Kilmainham Jail with several of his supporters. In reply to this a "No Rent" manifesto was issued, which caused the suppression of the Land League, but boycotting and crime continued. In the spring of 1882, by what has been called the "Kilmainham Treaty," Parnell was set at liberty, having promised to lend some assistance in checking crime. In 1886 Gladstone definitely declared in favor of Home Rule, and gained the support of Parnell and his party; in that same year the Home Rule Bill was introduced, and after its rejection Parnell and Gladstone were in close alliance. In 1887 Parnell and others of his party were accused by the London *Times* of complicity with the crimes and outrages committed by the extreme section of the Irish Nationalist party. To investigate these charges a commission of three judges was appointed by the government in 1888, with the result that, after a great deal of evidence received from both sides, a report was laid before Parliament in February 1890, acquitting him of the graver charges against him; and he obtained £5,000 (\$25,000) damages in a suit for libel against the *Times*. In 1890 he was proved the guilty co-respondent in the divorce case of Capt. O'Shea, and afterward married Mrs. O'Shea. The affair, however, ruined his political career. The Irish party at first reappointed him their chairman, but shortly afterward a letter from Gladstone to John Morley was published stating that if Parnell continued to be leader it would be "disastrous in the highest degree to the cause of Ireland," which, of course, implied that the support of Gladstone and his party would be withdrawn from Parnell. He was then deserted by the great majority of his parliamentary followers, and the Irish priesthood made a determined stand against him. He by no means tamely acquiesced in this position of affairs, but fought vigorously to the last to maintain his position as leader of the Irish people, thus overtasking his strength and breaking down his health. Parnell as a speaker was reserved and dignified; he had an unusual knowledge of parliamentary law, which he used most effectively, and for a time he completely dominated his party, making them a force both respected and feared in English political life.

Consult: Hansard, 'Parliamentary Debates' for 1875-91; Bryce, 'Studies in Contemporary Biography' (1903); Mahoney, 'Life of Parnell' (1886); Moore, 'Parnell and His Island' (1887); O'Brien, 'Life of Charles Stewart Parnell' (1888); O'Connor, 'The Parnell Move-

ment' (1890); Sherlocke, 'Life of Parnell' (1887); 'Memorial Volume to Charles Stewart Parnell,' with a biography by Walsh (1892).

**Parnell, Thomas**, Irish poet: b. Dublin, Ireland, 1679; d. Chester, England, July 1717. He was educated at Trinity College, Dublin, took orders in the Church of England in 1700, and in 1706 was made archdeacon of Clogher. He was intimate with Pope, whom he assisted in his translation of Homer and wrote the essay prefixed to it. In 1713 he was appointed prebend of the Cathedral of Dublin through the influence of Swift, and in 1716 was made vicar of Finglas. His poems were published by Pope in 1721.

**Parochial Schools.** See PARISH SCHOOLS.

**Par'ody**, a literary composition in which the style, form, or expression of dignified writings are closely imitated, usually in a humorous or satirical manner. Among English parodies the best are the famous Rejected Addresses of James and Horace Smith. The term is also applied to burlesque musical works.

**Parole'**, a term used in law and in military affairs. (1) In law, something done verbally or by word of mouth, in contradistinction to what is written; thus an agreement may be by parole. Evidence also may be divided into parole evidence and written evidence. (See EVIDENCE.) (2) In military affairs, when a prisoner of war receives full liberty within certain limits on promising not to attempt to escape he is said to be on his parole; or he may get leave to depart from custody on promising that he will return at the time appointed; or he may give his parole not to fight again during the continuance of the war. Breach of parole is reckoned infamous in all civilized nations. The word parole is also used as a password; a word given out each day in orders by the commanding officer in camp or garrison, by which friends and foes may be distinguished. It differs from a countersign in being given only to officers, or those who inspect and give orders to the guard.

**Paropamisus**, pār-ō-pām'ī-sūs or pār''ō-pāmī'sūs, an ancient name for a small hill or ridge, less than 1,000 feet above the adjacent country, which forms part of the great plateau of Persia and Afghanistan.

**Paroquet.** See PARROT.

**Paros**, pār'rōs, an island of the Cyclades in the Greek archipelago, four miles west of Naxos, nowhere more than 15 miles long or 9 miles wide, with a perimeter of 36 miles and an area of 82 square miles. In the centre of the island rises Mount Hagios (Helias, or St. Elias), about 2,400 feet, the summit of the mountain which occupies the entire island and which is largely composed of fine marble, the best variety, called "lychnites," having been used in Greek statuary. The marble quarries are no longer worked, but the old roads to them are plainly to be seen. The fertile soil grows vines and grain. The capital city of the island was Paros (now Parikia), settled first by Cretans and then by Peloponnesians; its people joined the invading Persian armies in 490 and 480 B.C. After Marathon, Miltiades (q.v.) attempted to reduce the city, but was unsuccessful; a year later, defeated by Themistocles, it entered the



## PAROTID GLAND — PARRHASIUS

**Athenian league.** After the downfall of Macedonia the city came into the hands of the Ptolemies; in 197 was restored to Athens by the intervention of the Romans; and half a century later became subject to Rome. The island was the birthplace of Archilochus. Pop. (1896) 7,740.

**Parot'id Gland.** See SALIVARY GLANDS.

**Par'quetry,** ornamental inlaid wood-work, generally used for floors. The designs are geometric patterns executed in differently tinted woods. See MARQUETRY.

**Parr, Catherine,** English queen, sixth wife of Henry VIII.: b. 1512; d. Sudeley Castle 5 Sept. 1548. The daughter of Sir Thomas Parr, master of wards and controller to Henry VIII.'s household, she was well educated, and thanks to her wealth was married when a mere girl to Edward Borough, who cannot be identified with certainty; then to John Neville, Baron Latimer, who died in 1542; and, though apparently engaged to Sir Thomas Seymour, brother to Lady Jane, 12 July 1543, became the wife of Henry VIII. To her step-children, and not only to the young Edward VI., the heir apparent, to whom she may have been tutor, but to Mary and Elizabeth, who had been declared illegitimate and who, because of her influence, were restored to their rank as princesses, she showed tender love and great kindness. She also did much to mitigate the severity of the Six Articles and to restrain Henry VIII. from excessive cruelty against the recusants. The story that her life was endangered by a plot accusing her of heresy and that she assured the king that in matters of religion she had never argued with him nor objected to his remarks save to profit by his wisdom, thus saving herself and bringing discredit on the lord chancellor and her other enemies, may not be wholly free from additions and changes at the hands of Foxe, who tells it, but it is none the less characteristic. A few months after the king's death Catherine married Sir Thomas Seymour, probably in April 1547. She died in September of the next year, a month after bearing him a daughter. Her purity, grace, and learning make her a very attractive figure. She wrote several devotional works.

**Parr, Louisa Taylor,** English novelist: b. London; d. November 1903. Her earlier years were spent in Cornwall, and in 1869 she was married to a physician and made her home in London. Her best novels are: 'Dorothy Fox' (1870); 'Adam and Eve'; and 'Robin,' which have been widely read. Other works by her are: 'How it all Happened' (1868); 'The Prescotts' (1874); 'Gosau Smithy' (1875); 'Loyalty George' (1888); 'Dumps' (1891); 'The Squire' (1892); 'Can This Be Love?' (1896); 'The Follies of Fashion.'

**Parr, Samuel,** English classical scholar and clergyman: b. Harrow, Middlesex, 26 Jan. 1747; d. Hatton, Warwickshire, 6 March 1825. After two years at Cambridge University he became an assistant master at Harrow School, and in 1776 head master of Colchester School. Taking orders in the Established Church he became perpetual curate of Hatton, and in 1820 was appointed to a prebend's stall in St. Paul's Cathedral. He possessed a wonderful memory,

was a brilliant talker and esteemed a weighty scholar, but his reputation does not seem justified by his writings, which with a memoir by John Stone appeared in eight volumes in 1828. Consult also Field, 'Memoirs of Dr. Parr' (1828).

**Parr, Thomas, or Old Parr,** English centenarian, supposed to have lived to be 152 years old: b., according to tradition, 1483; d. London 14 Nov. 1635. His home was Winnington, near Shrewsbury; there he entered service in 1500, was married in 1563, and in 1588 (at 105) did penance in the church of Alberbury for incontinence. He married again in 1605, and in 1635 was sent as a "piece of antiquity" to court by the Earl of Arundel. The change of air killed the old man. It is more than dubious that the tradition as to Parr's age is correct. The story in its popular form is given in John Taylor's 'The Olde, Olde, Very Olde Man' (1635).

**Parral, pār-räl', Hidalgo del Parral, or San Jose de Parral,** Mexico, city of the state of Chihuahua, a little more than 120 miles south-east of Chihuahua. Its wealth is in its silver mines, which have been worked for years and are now run by American capital; the old mines, Jesus Maria, Mina, Prieta, and Tajo, are in the very centre of the city; seven miles north-east of the city are the Minas Nuevas. There are ore-crushing machines in the city. Parral is also famous for its aguardiente and other vinous products. Pop. about 6,000.

**Parramatta, pār-a-măt'a, or Paramatta,** New South Wales, Australia, a city of Cumberland County, on the Parramatta River, 14 miles (by rail) northwest of Sydney. It lies west of Port Jackson; has broad streets, detached houses, street railways, a beautiful park, and a large orphan asylum; is the site of Sydney reservoir; is itself a railroad centre; and is connected with Sydney by rail and by steamer. Only the Sydney settlement is older than that at Rosehill, as Parramatta was first called. The city was the first shipping port for Australian grain, and the surrounding country is now full of orange groves and orchards. There are woolen manufactures, salt works, and copper-smelting furnaces near the city. Pop. (1891) 11,677; (1901) 12,568.

**Parras de la Fuente, pār'räs dā lä fwān'tā,** Mexico, city of the state of Coahuila, 83 miles west of Saltillo and 34 miles east of the salt lagoon of Parras. It is about 1,800 feet above sea-level in a fertile district growing orchard fruits, grapes, and cotton, and with silver mines near. The principal industries are the manufacture of wines and brandies, some cotton-spinning and silver refining. Pop. (1895) 8,326.

**Parrhasius, pa-rā'shī-ūs,** Greek painter: b. Ephesus 4th century B.C.; d. about 388. According to the account of Seneca he purchased an old man as a slave and employed him as a model for his Prometheus, torturing him in such a way as to obtain a vivid representation of the bound and agonizing Titan. With Zeuxis he was one of the leaders of the Ionian school of painting. He painted 'Ajax Wrestling With Ulysses for the Arms of Achilles.' His artistic contest with Zeuxis is famous. The picture of the latter attracted the birds to peck at the painted fruit; while Zeuxis himself was deceived



## PARRIS — PARROT

by the representation of a curtain which Parrhasius depicted upon the wall with such exact truthfulness as to give the impression that it concealed a picture. He was remarkable for purity of tone in painting and exquisite modeling of forms.

**Parris, pār'is, Samuel**, American clergyman: b. London, England, 1653; d. Sudbury, Mass., 27 Feb. 1720. He studied at Harvard, was in commerce at Boston, but subsequently was ordained, and in 1689-96 was first minister of Danvers, then part of Salem. He started the Salem witchcraft delusion in 1692 by beating Tituba, a South American slave of his, until she confessed herself a witch. The notion spread, and during the 16 months of its prevalence, 17 persons were put to death. In these cases Parris was active for the prosecution. Charges were brought against him by his parish in 1693, and, though he admitted his error, he was dismissed in 1696. He afterward preached in Stow and Concord, and for six months in 1711 at Dunstable. Consult Fowler, 'Life and Character of Rev. Samuel Parris' (1857).

**Parrish, pār'ish, Maxfield**, American artist: b. Philadelphia 25 July 1870. He studied at the Pennsylvania Academy of Fine Arts and was later a pupil of Howard Pyle. As an illustrator, he is well known for his posters and magazine covers. He designs in flat tints, strong and delicate outline, and elaborately detailed ground, or background, although he does not aim at perspective. He has illustrated 'Mother Goose in Prose' and other humorous works with signal success. The 'Bulletin Board' is among the best known of his paintings. He is a member of the Society of American Artists.

**Parrish, Stephen**, American artist: b. Philadelphia 9 July 1846. He first exhibited in the Pennsylvania Academy (1878), and in 1879 one of his pictures was hung in the New York National Academy. Since then he has produced a series of landscapes, usually large canvases, showing much power of expression and poetic feeling. Among these may be mentioned 'The Road to Perry's Peak'; 'Low Tide'; and 'Evening.' He has been successful also as an etcher, especially in his treatment of American coast scenery, as in the series 'Cape Ann to Marble Head.'

**Parrot**, the name applied generally to birds of the very strongly marked order *Psittaci*, the members of which are distinguished by the large size and arched form of the upper mandible, which terminates in an acute point overhanging the shorter lower mandible. The sides of the movable upper mandible, which is freely hinged to the skull, are frequently serrated or cut into teeth-like processes. The nostrils are situated in the *cere*, at the base of the mandible. By the reversion of the fourth or outer one the toes are paired,— a disposition fitting the feet admirably for climbing. The two front toes are united at their bases by membrane, the hinder toes being free; and the adaptation of the feet is completed by the short stout tarsi, covered with rough granulated scales. The bill also aids these birds greatly in their peculiar mode of locomotion. The wings are of moderate size; but the tail may be short or elongated, and in some instances assists in climbing. Unlike that of most other birds the tongue is soft and

fleshy throughout and serves with the upper mandible as a prehensile organ. Parrots abound in the warm and tropical regions of the world, but rarely extend into the Temperate zone except in the Australian region. Their distribution presents many remarkable features: thus, while none occur in the Philippine Islands, species are extremely numerous in the Celebes, Solomons and intervening groups. The food ordinarily consists of seeds, fruits, buds and flowers, but rarely of tubers or even insects. These birds break open the hard husks of nuts, etc., by aid of their beaks, with great ease and dexterity. Parrots are monogamous in habits, the nests being generally constructed in the holes of rocks or trees. At other than the breeding season they are gregarious and, with rare exceptions, arboreal, reminding one in their actions of feathered monkeys. The classification of the parrots is by no means settled; but most recent schemes do not depart widely from that proposed by Count Salvadori, who divides them into six families, of which the *Psittacidae* is subdivided into six subfamilies and comprises, in its 56 genera and about 400 species, the bulk of the order, among them the true parrots, macaws (q.v.) and parrakeets. The other families are the *Cacatuidæ* or cockatoos (q.v.), the *Loriidæ* or lorries, with 14 genera and 75 species, found chiefly in Australian regions and the Moluccan groups, the *Cyclopsittacidæ*, with 2 genera and 18 species, of the same region, the *Stringopidæ*, containing only the remarkable nocturnal and terrestrial owl-parrot or kakapos of New Zealand, and the *Nestoridæ*, with another equally remarkable New Zealand parrot which has acquired the unique habit of destroying sheep for the purpose of feeding upon their kidney fat.

Of all this great assemblage of about 500 species of parrots the vast majority inhabit the Australian and Malayan region and South America; Europe has none and the United States only one, and that is probably doomed to early extinction. The Carolina paroquet or parrakeet (*Conurus carolinensis*) formerly ranged throughout most of the country east of the Rocky Mountains as far north as New York and the Great Lakes, but is now restricted to local colonies in Florida, Arkansas and Indian Territory. It was gregarious and roamed irregularly in large flocks which subsisted on fruits, nuts and grains. During the breeding season it was likewise colonial and laid its roughish, white elliptical eggs in hollow trees. This species is not a true parrakeet, but stands between the macaws and true parrots and, like the latter, is a clever talker.

Many exotic species of parrots are exhibited in zoological gardens or by bird fanciers, some of the best known of which may be mentioned. The gray parrot (*Psittacus erythacus*) of western Africa is the form which acquires the power of talking in greatest degree. The extent to which these birds can imitate the various tones of the human voice is astonishing and is one of the most remarkable instances of readiness to acquire an accomplishment of no utility to themselves known among the lower animals. These parrots grow exceedingly docile, and may live to a great age, instances being on record of birds attaining an age of 70 or more years. The green parrots are American in their distribution, a familiar form being the Amazonian



## PARROT-FISHES — PARROTT

parrot (*Chrysotis amazonicus*). This bird is colored a bright green, and possesses a blue strip across the forehead; while the cheeks, tips of the wings, and throat may be colored red or yellow. It chiefly inhabits the Orinoco territory, but extends southward on the continent. The lorries (*Loriidæ*) possess a bill of more slender form than the preceding species, with a wavy or sinuous margin. The plumage is brilliantly colored, mostly crimson and green; and in some cases it has been proved that the females are red and the males of the same species green, although the red and green lorries were formerly considered to be generically distinct. Some of the species are remarkable among parrots because of the elongation of the papillæ of the tongue into brushes of filaments, on which account they are styled brush-tongued parrots. The lorries are extremely characteristic of the Moluccas and New Guinea, where many of them are the most richly colored of all birds.

The parrakeets constitute the largest subfamily (*Palæornithinæ*) of the *Psittacidæ*; and are characterized by the generally small size of the body, and of the beak, the upper mandible being also less convex or arched than in the true parrots. The tail-feathers are very long and the form graceful and trim. The islands of the Eastern Archipelago form the chief habitat of these birds, but species also occur in India and Australia. Among the most familiar forms included in this subfamily are the Rose-ringed and Alexandrine parrakeets. The former (*Palæornis torquatus*) is found in India and also on the eastern coasts of Africa. It averages 15 inches in length, the tail making up nearly two thirds of this. The body-color is a bright green, the specific name being derived from the presence of a pink circle around the neck. The Alexandrine parrakeet (*P. alexandri*) of India is a nearly-allied species. These birds may be taught to speak with distinctness. From three to four eggs are produced, the nest being situated in holes of trees and similar places.

The ground parrakeets of Australia are so named from their terrestrial habits, these forms never perching on trees, but inhabiting flat grounds, and living in plains or among the reeds and grass swamps. They generally live in solitary pairs. The nest is of simple construction, and situated on the ground. The common ground parrakeet of Australia (*Pezoporus formosus*) possesses a green and black plumage, the tail being similarly colored, and the body-feathers having each a band of dark-brown hue. It measures about 12 inches in length, inclusive of the tail. The grass parrakeets of Australia, of which the common cage-bird, the small warbling parrakeet (*Melopsittacus undulatus*) is a good example, are also to a great extent terrestrial in habits. They inhabit the central flat lands of Australia, and feed on the seeds of the grasses covering the plains. They perch on the eucalypti or other trees during the day, and the eggs are deposited in the hollows of trees. The English name of the species above mentioned is derived from the warbling notes they emit—a sort of song differing widely from the general coarse screech of the parrot tribe. The genus *Nephema* also includes several representative forms of Australian grass parrakeets. The lorikeets (*Loricu-*

*lus*) of Australia, and the love-birds (*Agapornis*) may also be mentioned.

Parrots take very naturally to domestication, and in their native countries many species frequent human habitations or have even become more or less completely domesticated. During the luxury-loving period of the Roman empire the African species were first brought to Europe as pets or food, and since then fully three fourths of the known species have been exhibited in Europe and America. The favorite cage birds are the talking gray and green parrots of Africa and South America, respectively. They are readily taken by means of snares or bird lime and decoys, or the young are taken from the nest and raised by hand. Some of the smaller species readily breed in confinement. The chief requisites to success in keeping them are plenty of good fresh food, both dry and succulent, cleanliness, and opportunity for exercise.

Consult: Salvadori, 'Catalogue of Parrots in the British Museum' (London 1891); Seth-Smith, 'Handbook of Parrakeets' (London 1902-3); Wilson, 'American Ornithology' (1828); Baird, Brewer and Ridgway, 'North American Land Birds' (1874); Wallace, 'Geographical Distribution of Animals' (1876); Greene, 'Parrots in Captivity'; and for habits, the narratives of most naturalist-travelers in the tropics.

**Parrot-fishes**, fishes of the large marine family *Scaridæ*, allied to the urasses. The body in this family is oblong, with the back arched, dorsal fin long and low, tail short, square, and powerful, scales large and round and head terminating in a parrot-like beak, containing numerous small teeth. These fishes are mainly tropical, herbivorous, usually of brilliant coloration, and of little value, in the estimation of North Americans for either food or game. The smaller ones usually lurk about weedy shores, hiding and feeding among the algæ; larger species are to be found about coral reefs. In Hawaii, several species are regarded as excellent to be eaten raw, and are caught regularly by native fishermen; and others are daily trapped and brought to market in the West Indies, especially about Porto Rico, where they go under the general name of loros. The best known, probably, is the turquoise blue parrot-fish or "tumble rose" (*Scarus cæruleus*), which sometimes weighs 15 or 20 pounds, and is caught from Virginia to Brazil. Another common and important one on the Florida coast and throughout the West Indies is the guacamaia (*Pseudo-scarus guacamaia*), which is usually about two feet in length. Consult: Jordan and Evermann, 'American Food and Game Fishes' (1902); Goode, 'American Fishes' (1888).

**Parrott**, pār'ôt, **Robert Parker**, American inventor and ordnance expert: b. Lee, N. H., 5 Oct. 1804; d. Cold Spring, N. Y., 24 Dec. 1877. He was graduated at the United States Military Academy in 1824, for the next five years taught natural and experimental science there, saw active service against the Creeks in 1836, and in the same year became captain of ordnance and a member of the Ordnance Bureau in Washington. He resigned his commission immediately after to become superintendent of a cannon foundry at Cold Spring, N. Y. Utilizing



PARROTS, PARRAKEETS AND MACAWS



1. Purple Capped Lory. 2. Leadbetter's Cockatoo. 3. Red and Blue Macaw. 4. Ring Necked Parrakeet. 5. Kakapo. 6. Blue-Crowned Hanging Parrot. 7. Rosy-Faced Love-bird. 8. Common Gray Talking Parrot. 9. Rosella Parrakeet. 10. Grass Parrakeet, or Budgerigar.







## PARROTT RIFLE — PARSEES

the process of hollow casting and cooling patented by Gen. Rodman and using shrunk hoops of wrought iron he perfected the cannon called by his name, which showed such wonderful durability in the Civil War, during which his dealings with the Federal government were marked by rare lack of greed and an evident unwillingness to take personal advantage of the needs of the army. He severed his connection with the Cold Spring foundry in 1867.

**Parrott Rifle.** See **ORDNANCE**.

**Parry, pār'ī, Sir Charles Hubert Hastings,** English composer: b. Bournemouth, Hampshire, 27 Feb. 1848. He studied at Exeter College, Oxford, took advanced studies in music under Bennett, MacFarren, and Dannreuther, and after three years in business, devoted his entire attention to the musical profession. In 1894 he became director of the Royal College of Music, and in 1899 professor of music at Oxford. Among his compositions are music to the 'Birds' and 'Frogs' of Aristophanes; 'Judith,' an oratorio (1888); 'Ode for St. Cecilia's Day' (1889); 'The Lotos Eaters' (1892); 'Job' (1892); 'King Saul' (1894); 'Magnificat' (1896); 'Song of Darkness and Light' (1898).

**Parry, Sir William Edward,** English navigator: b. Bath, England, 19 Dec. 1790; d. Ems, Germany, 8 July 1855. He entered the navy in 1803 and in 1818 joined the Arctic expedition of Sir John Ross, second in command. The venture proving unsuccessful, Parry was given command of an expedition in 1819, and with the *Hecla* and *Griper* succeeded in reaching lon. 110° W., earning thereby the £5,000 reward offered by Parliament to the ship which should first reach that point. He made two other expeditions in search of the Northwest Passage, both unsuccessful, and in 1827 made an effort to reach the North Pole with the *Hecla*, and gained a point farther north than any then reached (82° 45'). He was knighted in 1829, made admiral of the white in 1852, and in 1853 was appointed lieutenant at the Greenwich Hospital. He wrote: 'Arctic Voyages' (1821-7); etc. See **POLAR RESEARCH**.

**Parry Islands,** Canada, an Arctic archipelago of Franklin territory, north of Melville Sound, Barrow Strait, and Lancaster Sound. The principal islands are Bathurst, Cornwall, Grinnell Land, North Devon, Melville, and Prince Patrick. Parry (q.v.) in 1819 wintered on Melville Island and the islands and surrounding region were thoroughly explored during the Franklin Research Expeditions. They are bleak, inhospitable, and uninhabited, the coasts precipitous and rocky, while glaciers cover the interior.

**Parsees, pār'sēz** (*Parsis*, people of ancient Persia), the small remnant of the followers of the ancient Persian religion of Zoroaster (Zarathustra or Zerdusht). The relation in which Zoroaster stood to the Iranian faith has been much discussed; his existence has even been denied; and it is difficult to state clearly the original principles of the Zoroastrian faith. (See **ZOROASTER** and **ZEND-AVESTA**.) At first the doctrine was Monotheism; and Zoroaster taught the existence of but one deity; the Ahura-Mazdâo (Ormuzd), the creator to whom all good things, spiritual and material, belong. But his speculative philosophy was a dualism. The two sides

of Ahura-Mazdâo's being were taken to be two distinct spirits, Ahura-Mazdâo and Angrô-Mainyush (Ahriman), who represented Good and Evil God and the Devil, and Parseeism became a characteristic dualism.

The Zoroastrian creed flourished up to the time of Alexander the Great, but rapidly declined under his successors. Ardashir (Artaxerxes) (212 A.D.), a native Persian, attempted the restoration of the partly lost, partly forgotten books of Zoroaster, which he effected through the inspiration of a Magian sage, chosen out of 40,000 Magi. The sacred volumes were translated into the vernacular and distributed, and fire-temples were built throughout the length and breadth of the land. The Magi or priests were all-powerful, and hated Greek civilization. "Far too long," wrote the king, "for more than 500 years, has the poison of Aristotle spread." The Jews have left us some account of the oppression to which they as unbelievers were exposed in Persia. In return the Magi were hated by the Jews. From the period of its re-establishment the Zoroastrian religion flourished till, in 651 A.D., the Persian army under Yezdegird was routed by the caliph Omar. The Zoroastrian population was converted to the Mohammedan faith; the remnant that would not apostatize were subjected to severe oppression and persecution. Some nine thousand "Guebres" are still found in Persia, mainly in Yezd, Kerman, and at Teheran. Others found a home on the west coast of India, chiefly at Bombay, Surat, Ahmedabad, where they now live under English rule, and form one of the most respectable and thriving sections of the community. Parsee traders have also settled at Calcutta, Madras, Aden, Zanzibar, in Burma, and in China, where they bear equally with their poorer brethren in Persia the highest character. Their general appearance is prepossessing, and many of their women are beautiful. They conform to the laws of the country they inhabit; and its language is also theirs, except in the ritual of their religion, when Zend is used by the priests as laity. They value highly an English education, and not a few have studied law in England. Conspicuous among Parsee merchant-princes was Sir Jamsetjee Jejeebhoy. In 1891 there were 89,904 Parsees in India, 60 per cent of them in Bombay.

We have spoken of the leading fundamental doctrines as laid down by their prophet. Parsees eat nothing cooked by a person of another religion; and touch neither beef nor pork. Marriages can only be contracted with persons of their own caste and creed. Polygamy, except after divorce, is forbidden. Persons convicted of unchastity are put to death. Their dead are not buried, but exposed on an iron grating in the Dakhma, or Tower of Silence.

Ahura-Mazdâo being the origin of light, his symbol is the sun, the moon, the planets, and fire. Temples and altars must be fed with the holy fire, brought down from heaven, and the contamination of whose flame is punishable with death. The priests themselves approach it only with veiled face, and only touch it with sacred instruments. Parsees never consider fire and light as anything but emblems of divinity. Their ethical code may be summed up in the three words—purity of thought, of word, and of deed. Various superstitions have in the course



## PARSIFAL—PARSON

of ages defiled the original purity of this creed, and its forms now vary much. There are two main sects as well as Conservatives and Liberals in usage, the latter allowing many innovations resisted by the others.

Consult: Haug, 'Essays on the Sacred Language, Writings, and Religion of the Parsees' (2d ed. by West, 1878); Hovelacque, 'L'Avesta, Zoroastre, et le Mazdeisme' (1880); and Dosabhai Framji Karaka, C. S. I., 'History of the Parsis' (2 vols. 1884).

**Parsifal**, pär'sē-fäl, name of an opera by Richard Wagner. The fable of the drama is founded on an episode in the Arthurian cycle, which Wolfram von Eschenbach put into metrical form in his *Perceval*, and the pursuit of the Holy Grail, and this appears to have been the source of Wagner's inspiration. The composer took three years to complete his work, finishing the outline of his music scheme in 1879, and the orchestration in 1882, the year in which the opera was first performed at Bayreuth. He places the scene at Monsalvat, Spain, in the Castle of the Holy Grail. Klingsor, the malignant magician, has thrown his spell over Amfortas, formerly a Knight of the Holy Grail, who has been wounded by the Holy Spear, which he has been dispossessed of by the sorcerer. Klingsor hopes to gain control of the knights through the lovely Kundry, who will seduce them to break their vow of chastity. Parsifal is cast out from the castle by the knights because of his indifference to the Holy Grail, which they adore. But he is impenetrable to the spells of Klingsor and the charms of Kundry, and finally recovers the Holy Spear from the magician. He has been brought to a sense of the Holy Grail's significance and importance and starts out in search of it. He is eventually crowned king by the Knights of the Holy Grail, Kundry repents, and dies after baptism in hope and peace; while the wound of Amfortas, which no salve has been able to close, is healed by contact with the Holy Spear. See WAGNER, RICHARD.

**Parsis.** See PARSEES.

**Parsley**, a biennial herb (*Carum petroselinum*) of the order *Umbelliferae*. During its early stages the leaves are arranged in a rosette, and rarely rise more than six inches above the ground, but when in flower the plant may be three feet tall. It bears pinnate leaves divided and subdivided in threes, and in cultivated varieties greatly divided. It is a native of southern Europe, where it has been cultivated for centuries as a "sweet herb" and whence it has been carried to civilized countries throughout the world. In some regions it has become naturalized. Formerly it was employed in medicine, but now is used principally as a garnish or as a flavoring ingredient in soups, stews, dressings, etc., for which purpose the "moss-curled" varieties are most popular. The "fern-leaved" sorts are more dainty, and the "plain" rather coarse. Hamburg parsley is a variety with large carrot-like roots, which are boiled and served like other roots or used for flavoring soups, stews, etc. The plant succeeds best in rich, light loam well supplied with nitrogenous plant-food. Since the seed is very slow to germinate, it should be soaked before planting and some radish seed planted with it to mark its position and thus

permit of early cultivation. The plants are thinned to stand about six inches asunder in rows 18 inches apart and given clean cultivation throughout the season. In the autumn the roots may be transplanted to the greenhouse or a window-box for a winter supply of leaves, or they may be left in the ground until spring, when they will furnish a supply. The frequent removal of the leaves, and the cutting out of the flower-stalk when it first appears, will extend the season of production until new plants are in bearing.

**Parsley, Giant.** See COW-PARSNIP.

**Parsnip**, a biennial herb (*Pastinica sativa* or *Peucedanum sativum*) of the order *Umbelliferae*. Its stout, grooved, hollow stem which rises from a rosette of radical odd-pinnate leaves, often grows more than four feet tall. The small whitish flowers are followed by disk-shaped fruits ("seeds"), which retain their vitality only one year. The plant is a native of western Asia and adjacent Europe, where it was cultivated before the Christian era, and whence it has been taken by man to all civilized countries in temperate climates. In many places it has become a troublesome weed in neglected fields, and as such it loses its thick root and may even become an annual. Its roots, which often attain a length of 18 inches and a diameter of three or four inches at the crown, are used as a vegetable and as food for live stock. The plants succeed best in deep, fairly rich, well drained but moist loam, free from stones and other obstructions. The seed, being slow to germinate, should be sown very early in the spring and some radish seeds sown with it. The radish plants which appear quickly will show the positions of the rows and thus permit early cultivation. They must be removed promptly when the parsnip plants appear. The rows should be about 18 inches apart and the plants six inches asunder in the rows. Clean cultivation must be given until the plants shade the ground. Since the roots are improved by frost if left in the ground they need not be stored; but if stored they must be kept moist to prevent their shriveling and thus becoming tough. In the spring the roots should be used before growth starts, because they quickly become acrid. There are a few short-rooted varieties which are adapted to shallow and stony soils. The cut-leaved parsnip or sekakul (*P. sekakul*, or *Malabaila pumila*) is a native of western Asia and northern Africa, where it is cultivated and used like the first named species.

**Parson**, in English law, the rector of a parish; also, in a general sense, one that has a cure of souls, a clergyman, or minister of the gospel. He is called parson (Latin, *persona*), because the Church is represented in his person. A parson in England has for life the freehold of the parsonage house, glebe, tithes, and other ecclesiastical dues. The modes of becoming parson involve four requisites, namely, the taking of holy orders, presentation, institution, and induction. The duties of a parson are principally ecclesiastical, such as carrying on divine service in the parish church, administering the sacraments, preaching, etc. A parson during his lifetime may lose his parochial preferment either by cession, in taking another living, by consecration; on promotion to a bishopric, when



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all other preferments become void; by resignation, but only when accepted by the bishop; and lastly, by legal deprivation, for heresy, infidelity, gross immorality, or other causes.

**Parson-bird, or Poë-bird**, a small bird (*Prothemadera novæ-zealandiæ*), one of the honey-eaters, familiar all over the country. Its plumage is jet-black, except two little lappets of white feathers on each side of the throat, which look like the white lawn "bands" of a Church of England clergyman. It has a fine song, great powers of mimicry, and many interesting habits.

**Parsons, pär'sonz, Albert Ross**, American musician and archæologist: b. Sandusky, Ohio, 16 Sept. 1847. He was educated in Buffalo, New York, and Germany; he is especially prominent as a specialist in musical pedagogy and technics, and has also devoted much study to archæology. As a pianist and a composer of pianoforte music he gained considerable attention and he has also acted as a critic of music. He translated Wagner's 'Beethoven,' Lessman's 'Liszt,' etc., designed the symbolic pyramid mausoleum at Greenwood cemetery, and has written: 'Science of Pianoforte Practice'; 'The Secret of Wagner's Genius'; 'New Light from the Great Pyramid' (1893); etc.

**Parsons, Alfred William**, English painter: b. Beckington, Somersetshire, 2 Dec. 1847. He has made his specialty water-color landscapes of English scenery, executed with great dash yet lightness of touch, accuracy of drawing and dazzling color. His pictures have been awarded medals at Paris (1889); Chicago (1893); and Munich (1893). He also designs in black and white, and in collaboration with E. A. Abbey (q.v.) has furnished illustrations for 'Old Songs'; 'A Quiet Life'; 'The Danube from the Black Sea to the Black Forest.' Among the most characteristic of his paintings are 'When Nature Painted All Things Gay' (1887), bought by the Chantrey bequest; and 'A Mid-May Morning.'

**Parsons, Charles**, American artist: b. Hampshire, England, 8 May 1821. He was educated in New York; studied art at the National Academy; was elected an A. N. A. in 1860; worked as a lithographer 1838-61; and became director of the art department of Harper & Bros., for whose publications he furnished many illustrations, and from whose employ he retired in 1889. He won some repute as a landscape painter and exhibited at the National Academy and the exhibitions of the Water Color Society. His best known paintings are: 'Salem' (1876); 'November' (1877); 'Gravesend Bay' (1878); and 'Old Orchard' (1884).

**Parsons, Frances Theodora Smith Dana**, American nature writer: b. New York 5 Dec. 1861. She was married to William Starr Dana (d. 1890) in 1884, and as "Mrs. William Starr Dana" published 'How to Know the Wild Flowers' (1893); 'According to Season' (1894); 'Plants and Their Children' (1895). In 1896 she was married to J. R. Parsons of Albany, N. Y., and under her present name has published 'How to Know the Ferns' (1899).

**Parsons, Frank**, American lawyer and political economist: b. Mount Holly, N. J., 14 Nov. 1854. He was graduated from Cornell in 1873; he studied law, was admitted to the bar in Bos-

ton, and opened an office there. He rewrote several law treatises, including Morse 'On Banks and Banking,' Perry 'On Trusts,' and May 'On Insurance,' and in 1892 was appointed lecturer on law at Boston University. He also became known through his books and lectures as a student of political economy, and from 1897 to 1900 was professor of history and political science at the Kansas Agricultural College, and in 1900 became professor of political science at Ruskin College, Trenton, Mo. He has also been dean of the university extension department there, and has lectured for the University Extension Association of Chicago. In 1901-2 he was an expert witness before the United States Industrial Commission on the public ownership of railroads, telephones, and telegraphs. His publications include: 'The World's Best Books' (1892); 'Our Country's Need' (1894); 'The Drift of Our Time' (1898); 'Rational Money' (1899); 'The New Political Economy' (1899); 'The Power of the Ideal' (1899); 'The City for the People' (1900); 'Direct Legislation' (1900); 'The Heart of the Railway Problem' (1906). He is among the leaders of the progressive economists and an earnest advocate of the public ownership of monopolies.

**Parsons, Lewis Baldwin**, American soldier and lawyer: b. Genesee County, N. Y., 5 April 1818; d. Flora, Ill., 16 March 1907. He was graduated from Yale in 1840, from the Harvard Law School in 1844, and established a law practice in Alton, Ill., where he was city attorney in 1846-9. At the outbreak of the Civil War he entered the Union army as captain of volunteers, served through the war, with promotion, was chief of river and railroad transportation of the national armies and was retired in 1866 with the rank of brevet brigadier-general of volunteers. He afterward devoted himself to law practice, and in 1895-8 was president of the Illinois Soldiers' and Sailors' Home.

**Parsons, or Persons, Robert**, English Jesuit and controversialist: b. Nether Stowey, Somerset, 24 June 1546; d. Rome 15 April 1610. He was educated at Oxford, was elected fellow of Balliol in 1568, and in 1574 became its dean. In 1574 Parsons went to the continent, and on his way to Italy stopped at Louvain, where he was probably received into the Roman Catholic Church, and at Rome entered upon his novitiate in the Society of Jesus (1575). In 1578 he was ordained priest and made English penitentiary at the Vatican. With Edmund Campion (q.v.) and several secular priests he arrived in England in 1573 under instructions from Aquaviva, general of the order, to aid the secular clergy and on no account to discuss political questions. At that time the Jesuits were forbidden to set foot in England on pain of death; and Parsons landed at Dover in a military disguise. He encouraged the secular priests, then closely in hiding, converted many of the nobility, and set up a secret press, which was transferred from place to place at his order, and printed controversial tracts, among them Parsons' 'Brief Discourse' (1581) and Campion's well-known 'Decem Rationes' (1581). Campion was at last seized, but Parsons escaped to Normandy (1581). He continued, however, to devote his energies to the restoration of the Roman Catholic Church in England, and did everything pos-



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sible to promote the attempted invasion of England in 1588 by Philip II. of Spain, which ended so disastrously in the defeat of the Armada. For a short time in 1588 he was rector of the English College at Rome, and in 1582-92 established various schools and seminaries in France and Spain for English Catholics. From 1597 until his death he was rector of the English College, and later was made prefect of the Jesuit mission. By virtue of this office, confirmed to him in 1606, he had direct control of all foreign seminaries governed by the order. He was an indefatigable worker, an unrivaled controversialist, and a writer the clearness and simplicity of whose English has been highly praised. His 'Book of Resolution, or the Christian Directory' (1582, and subsequently enlarged) was often reprinted, and Dean Stanhope prepared a Protestant edition of it (1700). Consult: More, 'Historia Provinciæ Anglicanæ Societatis Jesu' (1660); Gee, 'The Jesuits' Memorial' (1690).

**Parsons, Samuel Holden**, American soldier: b. Lyme, Conn., 14 May 1737; d. Big Beaver River, Ohio, 17 Nov. 1789. He was graduated from Harvard in 1756, admitted to the bar in 1859, and engaged in law practice at Lyme. For 18 years he was a member of the State assembly and is accredited with originating the idea of a general colonial congress. At the outbreak of the American Revolution he was appointed colonel and stationed in Massachusetts. He planned the capture of Ticonderoga executed by Ethan Allen, and after the evacuation of Boston by the British was transferred to New York, where he participated in the battles of Long Island, Harlem Heights, and White Plains, and later served under Washington in New Jersey. He was a member of the board which tried General André, and in that year was promoted major-general and succeeded to the command of Gen. Putnam, which he held until the close of the war. After the war he resumed his law practice, was appointed by Washington in 1789 the first judge of the Northwest Territory and took up his residence near Marietta, Ohio, where he was drowned in the Beaver River in the same year. Parsons has been accused of giving information to Sir Henry Clinton concerning the state of the Federal armies, and letters are said to be in existence written by him to that general. A refutation of this charge was written by George B. Loring, 'A Vindication of General Parsons' (1888).

**Parsons, Theophilus**, American jurist: b. Byfield, Mass., 24 Feb. 1750; d. Boston, Mass., 30 Oct. 1813. He was graduated from Harvard in 1769, studied law, was admitted to the bar in 1774, and began practice in Falmouth, Maine, but his flattering prospects were interrupted by the almost total destruction of that place by the British in 1775. He then returned to Byfield, where he studied law for several years, and laid the foundation of the vast legal knowledge for which he was afterward distinguished. Settling in Newburyport he there established a large practice, and taking an active interest in politics allied himself with the conservatives, who later became the Federalist party. He was a member of the "Essex Junto" in 1778, which opposed the adoption of the State constitution approved by the Legislature; the pamphlet entitled 'The Essex Result,' undoubtedly written

by him and circulated widely throughout the State, did much toward the rejection of the constitution. He was a member of the convention which in 1779 framed the constitution ultimately adopted by Massachusetts, and also served as a member of the convention which ratified the Federal constitution in 1788. His attitude toward the latter was extremely favorable, and the "Proposition" presented by John Hancock and usually credited to him was written by Parsons. After the adoption of the constitution he took no further active part in politics, but devoted himself to his profession, and under his instruction John Quincy Adams (q.v.) gained a large share of the legal skill which afterward made him a national figure. In 1800 Parsons removed to Boston, and in 1806 was appointed chief justice of the State supreme court, which office he occupied until his death. As a lawyer and a justice he enjoyed an enviable reputation, standing at the head of his profession in his State. His decisions upon the laws governing real property, marine insurance, and pleading were regarded as of highest value and he earnestly strove to lessen the delays of the law in bringing cases to trial. A collection of his decisions was published in 1836 under the title 'Commentaries on the Laws of the United States, by Theophilus Parsons, late Chief Justice of Massachusetts.' See memoir by his son, Theophilus Parsons (1859).

**Parsons, Theophilus**, American author, son of the preceding: b. Newburyport, Mass., 17 May 1797; d. Cambridge, Mass., 26 Jan. 1882. He was graduated in 1815 at Harvard, where he became in 1847 Dane professor of law. He founded the 'United States Literary Gazette' and wrote much in support of Swedenborgian doctrines. He wrote a 'Treatise on the Law of Contracts' (1853); 'Memoir of Chief Justice Parsons' (1859); 'Treatise on Marine Insurance' (1868); 'The Infinite and the Finite' (1872); and 'The Rights of a Citizen of the United States' (1875); etc.

**Parsons, Thomas William**, American poet: b. Boston 18 Aug. 1819; d. Scituate, Mass., 3 Sept. 1892. He studied at the Boston Latin School, went to Europe at 17 and spent several years in Italy, where he devoted himself to the study of Dante. He returned to Boston in 1843, studied at the Harvard Medical School, practised dentistry in Boston and London, and devoted the last 20 years of his life to literature. He wrote: 'Ghetto di Roma' (1854); 'The Magnolia' (1867); 'The Old House at Sudbury' (1870); 'The Shadow of the Obelisk' (1872); and 'Circum Præcordia' (1892), all poems of much lyric beauty, but too elevated in tone and thought to be popular, his 'Lines on a Bust of Dante' first printed in 1841 being the exception. Parsons is better known as the "poet" of Longfellow's 'Tales of a Wayside Inn,' and best as the author of a matchless version of parts of Dante's 'Divina Commedia,' namely the 'Inferno' entire (1867), and much of the 'Purgatorio,' with scanty fragments of the 'Paradiso.'

**Parsons, William Barclay**, American civil engineer: b. New York 13 April 1859. He was graduated from Columbia in 1879, and from the Columbia School of Mines in 1882. He at once entered the service of the Erie railroad,



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resigning after a few years to take up general practice as consulting engineer. Since 1894 he has been chief engineer of the Rapid Transit Commission of New York, and designed and carried out the underground railway there. He has been connected professionally with railroad construction in various parts of the world, especially in China, and besides contributing to various periodicals and to the 'Encyclopedia Americana' has published 'Track' (1885); 'Turnouts' (1885); 'An American Engineer in China' (1900).

**Parsons, Kan.**, city in Labette County, on the Saint Louis & S. F. and the Missouri, K. & T. R.R.'s; about 125 miles in direct line south by east of Topeka. It was settled in the early "settlement days" of Kansas, but was laid out and incorporated in 1871, and in 1873 was made a city of the second class. It is in a productive agricultural region, and the commercial centre of quite an extent of territory. The chief industrial establishments are grain elevators, creameries, flour and feed mills, foundry, agricultural implements works, and railroad shops. The Missouri, Kansas & Texas railroad has its general offices in this city. There are two parks, well kept streets, and good roads leading into Parsons. The prominent buildings are the State Hospital for the Insane, the Masonic Temple, the Y. M. C. A. building, the churches and schools, and the Missouri, Kansas & Texas station and office building. The educational institutions are the high school, public and parish elementary schools, and a public library. Natural gas is in general use for lighting and for fuel. Pop. (1890) 6,736; (1900) 7,682; (1904) 10,789.

**Parson's Case**, in American legal history, a celebrated law suit won by Patrick Henry (q.v.) as attorney for Rev. James Maury, in 1763, at the Hanover County court in Virginia. The action involved the constitutionality of the "option law" or "twopenny act," passed by the Virginia legislature in 1758. The act affected each parish minister, compelling him to receive the value of the 16,000 pounds of tobacco, due for his year's services, in paper money of the colony, amounting to £133 instead of £400 sterling, the selling value of the tobacco. The clergy appealed to the crown. The crown vetoed the law. Rev. James Maury having sued for damages, the court squarely "adjudged the act to be no law," and decided for the plaintiff. A new trial was allowed on a demurrer, and Henry was retained as counsel for the defendant. His eloquence induced the jury to return one penny damages for the plaintiff.

**Parsons College**, located at Fairfield, Iowa, established in 1875 under the control of the Presbyterian Church. The work of the college is arranged in three courses, classical, scientific, and philosophical, which lead respectively to the three degrees of A. B., B. S., and Ph. B.; there is also a normal training course, a business course, and a preparatory department. In 1903 the grounds and buildings were valued at over \$80,000; the productive funds amounted to \$160,000, and the annual income to \$20,000. The students (1903) number 259, and the faculty 20.

**Parterre**, pār-tār', in old French gardens, the open part in front of the house or dwelling, in which flower beds and closely cut lawn were intermingled according to a regular plan. Also

a name for the pit or orchestra space in French theatres.

**Parthenius**, pār-thē'nī-ūs, Greek elegiac poet of the 1st century B.C. He was a native of Nicæa in Bithynia, was taken to Rome as a prisoner in the war with Mithridates, was soon freed, and became the friend, possibly the Greek teacher, of Virgil, and the intimate of Cornelius Gallus. Virgil borrowed from him a line in the first Georgic (437); and for Gallus he composed in prose a resumé of love myths suited for elegiac poetry, which still exists under the title *Περὶ ἐρωτικῶν παθημάτων*, 'On Love's Sufferings,' and is edited in Sakolowski and Martin's 'Mythographi Græci' (1896-1902). Only a few fragments of the many poems, elegies, epicedia, etc., remain.

**Par''thenogen'esis**, a method of reproduction in which eggs develop without impregnation by spermatozoa. Formerly this was regarded as an asexual reproduction (Agamogenesis), but now, with increased knowledge of sexuality, it is regarded as a sexual reproduction in which a degeneration of fertilization has occurred. Instances are most abundant in insects, rotifers, and the lower crustaceans, especially in fresh-water forms, which are exposed to drought or freezing. Thus in *Apus* parthenogenesis is the rule, and males only occur at intervals of years, while in many ostracods, and in *Cladocera*, parthenogenesis occurs during the spring and summer, normal production taking place in the fall. In the plant-lice (aphids) the conditions are similar. During the warmer season only wingless females occur, and these bring forth living young from parthenogenetic eggs. With the approach of cold weather males and winged females appear, from which are produced fertilized eggs that carry the species through the winter. Among the *Lepidoptera* a few instances of parthenogenesis are known, while the conditions among bees deserve mention. The spermatozoa are stored in a seminal receptacle in the female (queen), and as she lays her eggs she allows them to be fertilized or not, at will. From the fertilized eggs females (workers and queens) only are produced, while unfertilized eggs invariably develop into males (drones).

Within a few years a new aspect has been given to the subject of parthenogenesis by the discovery by Loeb and others that the eggs of many marine animals which are not normally parthenogenetic might be made to develop by placing them in solutions of certain alkaline salts. At first this was ascribed to the action of the ions set free by the dissociation caused by solution, but this view is shown to be untenable by the fact that other substances (ether, etc.) incapable of ionization will produce the same result, and that, in some instances, "artificial parthenogenesis was induced by strongly agitating the eggs." The conclusion is that the egg is in a condition of unstable equilibrium, and that normally the entrance of the spermatozoon affords the stimulus which results in development, but also that other stimuli may produce the same effect.

In normal eggs there is an interesting process of maturation in which two polar globules are formed. These are small bodies which are cast out of the egg (see EMBRYOLOGY). The first polar globule is formed by normal cell division,



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while the second is formed by a so-called "reduction division," in which half of the chromosomes are cast out from the egg. These lost chromosomes are then replaced by those derived from the spermatozoon in impregnation. In parthenogenetic eggs the second polar globule is not formed, and hence those parts which are lost in normal eggs are retained, and so the spermatozoon is not necessary. This is the most plausible explanation, and yet it is not perfectly satisfactory. See Weismann, 'Essays on Heredity' (1889); Taschenberg, 'Historische Entwicklungen der Lehre von der Parthenogenesis' (1893), in which will be found a full bibliography of the subject. Compare METAGENESIS; PÆDOGENESIS.

**Par'thenon, The.** See ATHENS.

**Parthenope**, in Greek mythology, a siren cast up by the sea on the shore of Naples, who was said to have drowned herself for love of Ulysses. Parthenope, the ancient name of Naples, was connected with this myth. The name Parthenope was also borne by the daughter of Stymphalus, with whom Hercules was in love.

**Parthenopean** (par'thě-nō-pē'an) **Republic**, a name given to the state into which the kingdom of Naples was transformed by the French republicans in 1799. This name was chosen because in the earliest times the city of Naples was called Parthenope. Ferdinand I., king of the Two Sicilies, having joined in 1798 the coalition formed against France, the French general, Championnet, entered Italy at the head of an army, and after having defeated the Austrians in Rome, he invaded the Neapolitan territory and took Naples, 23 Jan. 1799. The republic was then proclaimed, and though at first the change of government was far from being relished by the Neapolitans, they very soon became reconciled to it. It was, however, very short-lived, for on 20 June Cardinal Ruffo, at the head of a mixed body of troops, took possession of the city, and the republic, which had existed only five months, then terminated.

**Par'thia**, in classical geography, either all the region between the Euphrates and Oxus rivers and the Caspian Sea and the Indian Ocean, or, in a narrower usage, the district bounded by Media, Hyrcania, Ariana, Margiana, and the Caramanian desert. The latter use of the term applies to the original home and the former to the empire of the Parthians, who seem to have been of Turanian stock migrating from central Asia into Iran, where they learned an Aryan tongue, practically equivalent to Persian. The capital city of the Parthians was Hecatompylus; the main product of the country, its splendid horses; and the chief characteristic of the nomad and simply living Parthians their skill in cavalry battle, notably their ruse of pretended flight, in the midst of which they shot backward from their unerring bows—the origin of the phrase "a Parthian shot," of which "parting shot" seems a corruption. They were subdued in succession by the Assyrian, Median, and Persian monarchies, then fell to Macedon and to the Seleucidæ, but in 250 B.C. established their independence of the Syrian kingdom of the Seleucidæ after a successful revolt led by Arsaces, who claimed to be of the Persian royal line

and, backed by the Magi, became the first king of the new realm and conquered to the Indus in the east and to the Caspian in the west. This spread of the old Persian national religion and of the new Parthian empire was most successfully carried out by Mithridates I., king 174–136 B.C. The inevitable clash with Rome came in 53 B.C., when Crassus' army was annihilated at Carrhæ. Ventidius gained a slight victory over the Parthians in 38, but Antonius was severely defeated in 35, and no Roman army won a decisive victory over them until 115 A.D. in the reign of Trajan. Even then Rome gained no permanent footing in the Parthian empire. In 217 at Nisibis a battle was fought which gave neither side the victory and assured peace. In 226 the Arsacid dynasty came to an end with the defeat of Artabanus IV., and the Persian Sassanidæ became rulers of the country. Consult Rawlinson, 'The Sixth Great Oriental Monarchy' (1873), and 'The Story of Parthia' (in 'Story of the Nations' series, 1893).

**Particular Baptist.** See BAPTISTS.

**Par'tington, Mrs.** See SHILLABER, P. B.

**Partition**, in law, is the division which is made between several persons who own land, goods, chattels, or other property which belong to them as co-heirs or co-proprietors. Technically it applies to the division of real estate between co-parceners, tenants in common, or joint tenants, and the object is to establish that to which each of the co-proprietors is severally entitled. Voluntary partition is made by the owners of an estate, by the conveyance of such part to each other which is to be owned by him. Compulsory partition is effected through special laws providing that remedy. Any kind of property or thing of value, whether real or personal, which is the subject of joint ownership can be the subject of partition; the right of partition being an incident of joint ownership. In law it has been held that a husband and wife being one, cannot partition an estate held by them; this has been largely remedied by the married woman's acts; in any event this could be accomplished by conveying it to a third, who could reconvey to each in equal shares. Occasionally the question of division is left to arbitration. (See LAW OF HUSBAND AND WIFE.) A partition is often effected by a single deed executed by all the parties in interest, whereby to each is assigned a share, or else by mutual conveyances between the parties. Generally the same effect is given to an agreement for partition, as to an act of partition. Partition by judicial proceedings is frequently effected by an ordinary action at law. In the United States the practice in these cases is usually regulated by statute. The title of an applicant for partition to possession must be clear or the action cannot be maintained. The fact that property sought to be partitioned is subject to liens, easements, or a lease, will not generally prevent partition. Mines, mill privileges, water power, and oil and gas under the surface of the earth, have all been the subject of partition proceedings. The courts have refused to partition property which would impair its usefulness to the public. The court in granting relief through partition proceedings does not act ministerially and its object is to adjust equitably the rights of all the parties in interest.



## PARTITION TREATIES — PARTNERSHIP

**Partition Treaties**, the name given two treaties made between France, England and the Netherlands in 1698 and 1700, for the settlement of the Spanish Succession. See TREATY AND TREATIES.

**Partnership**, has been variously defined, in once instance as "a voluntary contract between two or more competent persons, to place their money, effects, labor, skill, or some or either of them, in lawful commerce or business, with the understanding that there shall be a communion of the profits thereof between them." However, it would hardly be possible to form a definition that would meet every case. Contract between partners is essential; it may be verbal or in writing, and the partners must have assented to its terms. An agreement to share profits is an element essential to partnership, and if such does not exist there is no such relation; the manner of sharing the profits controls the test of partnership. One cannot against his will, or by the conduct of others, be made a partner, but in many jurisdictions under certain circumstances one may be held liable to third parties, as a partner who receives a share of the profits in place of salary or some other consideration. The general present theory is that persons sharing the profits of a business are not liable as partners to third persons, unless they are in fact partners or have so conducted themselves as to hold out to the public that they are partners. Considerable conflict of authorities exists in various States on the many important questions involved in this subject, and some are the subject of statutes; they cannot be treated fully except in a work devoted to that purpose, of which there are a number, therefore this treatment of the subject will be restricted to general principles.

It must be borne in mind that the existence of a partnership is one that contains questions of both law and fact, and that the proper determination of these questions is frequently the subject of conflicting opinions of upper courts. A rule that is very generally established is that in all cases the question of the existence of a partnership depends on the agreement between the parties and their intention as same may appear from all the surrounding facts. Persons receiving a debt, the payments on account of which are measured by the profits of a business, are not partners; neither is one a partner who is employed as an agent or servant, and receives a part of the profits as his remuneration, but the investment of capital in the business, in addition to rendering services, tends to show the relation of a partner, rather than that of employee. Participation in losses tends to show a partnership, but the absence of it tends to show merely a loan; sharing expenses or losses only does not constitute a partnership. One lending money to another engaged in conducting a business, under a contract to receive a part of the profits in the place of interest, or in addition to the interest, is not a partner, unless he has the usual rights and powers accorded to a partner; one receiving a fixed amount, having no relation to the profits, in consideration for services or property, is not a partner. An important distinction exists between sharing gross receipts and net profits; sharing the former is not evidence of partnership, neither

is the division of the results of a joint venture, such as raising a crop. Proof as to the conduct or relation of the parties may be such as to show the existence of a partnership, such as the fact that the alleged partner assumed charge and direction of the business; the conducting of the business under a firm name and the keeping of partnership books may all tend to prove the existence of partnership. Clubs, associations, societies, etc., formed for the purpose of social or political objects and not for profit, are not partnerships. Parties together owning property from which they obtain a profit from its use, is not necessarily a partnership, but may become such through an agreement to carry out a joint venture in which the owners share in the profits and losses. A secret partner is one whose relation to a firm is unknown to the public, and a silent partner is one who takes no active interest in the management of the business affairs of the firm, but receives a share of the profits. A dormant partner is one who takes no part in the business of the firm and whose relation to it is unknown by the public. A nominal partner is one who though apparently a partner, does not share in the profits. A liquidating partner is a member of a partnership which has dissolved, who has charge of winding up the affairs of the company. A special partner is one who is a member of a firm under a statutory limitation.

In entering into a contract of partnership all the general rules of law governing contracts are applicable; generally such contracts are not required to be in writing, except in the case of some statutory provision. In many jurisdictions it is held that a partnership, the object of which is to own or deal in realty, must be set forth in writing. A partnership that is to begin after the expiration of one year must be in writing, and it is advisable that a contract for a partnership which is to last for a longer term than one year be in writing. Persons who can make a valid contract are capable of entering into partnership. One not of age may become a partner, but would have the right to rescind his contract, as same would be voidable. A partnership with an insane person is valid, if the parties to the contract were ignorant of the condition of the insane person. A married woman may become a partner, and in some jurisdictions, the partner of her husband. No corporation can become the partner of a person, or any other corporation, unless its charter so permits. Any number of persons may form a partnership. A partnership is void which is created for any object or purpose which is prohibited by law, or which is contrary to public policy. In the absence of a statute authorizing a firm as such to sue, an action must be brought in the individual names of the partners; the same is true of actions brought against partnerships. A firm name is not necessary, although it is generally adopted as a matter of convenience; such name cannot rightfully be used for any purpose other than that connected with the partnership transactions. One partner has the right to bind the other partners.

The capital of a firm is the sum contributed by the members for the purpose of conducting the partnership business, and is distinguished from the partnership property, which includes everything that the firm may own; the capital



## PARTON — PARTRIDGE

may consist of money or property, or the use of property, and may be contributed in different amounts. Upon the dissolution of a partnership the capital is returned, and the proportionate profits, as agreed, divided. In the event of the death of a partner the assets of the firm vest in the surviving partners, and it becomes the duty of the surviving partner, or partners, to settle up the business, and to account to the representative of the deceased partner for his interest.

A partnership may be dissolved, changed or modified at any time by the members, provided that such is not contrary to law. The failure of a partner to fulfil the terms of the agreement of partnership does not necessarily nullify the agreement. Each partner has the same right to share in the management of the business, unless otherwise stipulated in the agreement. The law imposes a very strict duty on the part of partners, their relations with each other, and absolute good faith is demanded; one partner is liable to the others for a strict account of all matters conducted by him that are within the general scope of the business of the partnership. A partner will not be allowed to buy for his personal benefit a claim against his firm but will be held to have bought it for the benefit of his firm, nor will a partner be allowed to obtain a renewal of a lease of the premises occupied by his firm, or to deal in the property of the firm for his own benefit, and if he uses the firm's funds for speculating, he must account to the firm for the money and for the profits. A partner must account for any benefits obtained by him for the information obtained in the course of the business of the partnership. Except that the agreement prohibits it, a partner may engage in a business which does not compete with the business of the partnership and is not inconsistent with his duties as a partner. A member of the firm is not entitled to any compensation for extra services under any circumstances, except in the case of an agreement, unless it is necessitated by the wilful negligence of his partner. The partners have a right to insist that accurate accounts be kept of all the transactions of the firm and they have access to the books at all times.

As a general rule unless there is some agreement to the contrary, the acts of the majority control. The rights of the minority, however, must be afforded every protection and they must have an opportunity of presenting their objections. Members of a firm cannot expel a partner unless that right is given by their agreement. A partnership is liable for any loss or injury caused to one who is not a member of the firm by one of the partners acting in the ordinary course of the firm's business or with its authority; the partnership is also liable for money misapplied by one member of the firm who is apparently acting for it. A judgment creditor can proceed against the individual property of partners without first obtaining execution against the firm property, except that this be contrary to the provision of the statute governing the partnership.

A partnership may be dissolved at any time by mutual consent, and the partnership does not terminate until the partners cease to carry on the business. On the dissolution of a partnership it is usually in some cases necessary to give

public notice, this prevents a partner becoming liable to third persons for the acts of his partners. Partners cannot sue each other in law but courts of equity have jurisdiction to demand accountings and to make a settlement of partnership affairs. Any change in the membership of a partnership effects a dissolution, and if the business continues it is as a new firm. See also AGREEMENT; CONTRACT.

HENRY M. EARLE.

**Par'ton, Arthur**, American artist: b. Hudson, N. Y., 1842. He began landscape painting as a pupil of W. T. Richards in Philadelphia, and has developed a particular talent in the portrayal of scenery in clouded sunlight, or the semi-darkness of declining day. He has been charged with subduing his landscapes with too prevailing a gray tone, but his handling is vigorous as well as imaginative. All his pictures are pleasing and suggestive. This is seen in his 'Nightfall' (1881); and his 'Palisades in Winter.'

**Parton, James**, American biographer: b. Canterbury, England, 9 Feb. 1822; d. Newburyport, Mass., 17 Oct. 1891. He was brought to the United States in early boyhood and received his education here. His first literary employment was on the staff of the 'Home Journal' of New York. In 1855 appeared his 'Life of Horace Greeley,' of which over 30,000 copies were sold, and which was followed in 1857 by his 'Life of Aaron Burr.' Of this work nearly 20,000 copies were sold during a period of great commercial distress. It was followed by 'Life of Andrew Jackson' (1859-60), a collection of 'Humorous Poetry of the English Language, from Chaucer to Saxe' (1856); 'General Butler in New Orleans' (1863); 'Life and Times of Benjamin Franklin' (1864); 'Famous Americans of Recent Times' (1870); 'Life of Thomas Jefferson' (1874); 'Life of Voltaire' (1881); 'Noted Women of Europe and America' (1883); 'Captains of Industry' (1884); 'Triumphs of Enterprise, Ingenuity, and Public Spirit' (1871); 'Topics of the Time' (1871); 'Caricature in all Times and Lands' (1875). He was an extremely entertaining writer and a literary force in his day.

**Parton, Sara Payson Willis** ("FANNY FERN"), American writer, sister of N. P. Willis (q.v.), and wife of James Parton (q.v.): b. Portland, Maine, 9 July 1811; d. Brooklyn, N. Y., 10 Oct. 1872. Married early to C. Eldridge of Boston, and left at his death dependent upon her own resources, she turned to literature, and by her pseudonym, "Fanny Fern," soon became widely known. 'Fern Leaves,' the first of her collection of sketches, was published in 1853 and 70,000 copies were sold in a short time. This was followed by 'Little Ferns' (1853); 'Fern Leaves, 2d Series' (1854); 'Ruth Hall,' a semi-autobiographical novel (1854); 'Rose Clark' (1857); 'Fresh Leaves' (1857); and 'The Play Day Book' (1857), all of which once enjoyed a considerable popularity, some of them being translated into French and German. For 16 years she contributed a weekly article to the New York 'Ledger.' She was married to James Parton in 1856.

**Partridge, pär'trij. Alden**, American soldier: b. Norwich, Vt., about 1785; d. there 16 Jan. 1854. He was graduated at West Point in



## PARTRIDGE

1806, and acted as assistant professor and afterward professor of mathematics there from that time until 1813. He was professor of engineering 1813-16, and superintendent from January 1815 to November 1816, and from January to July 1817. He resigned in 1818 and became the principal of an exploring survey sent out in 1819 to determine the northwest boundary of the United States. In 1820 he founded in his native town a military academy, afterward incorporated as Norwich University, with Partridge as its president. He subsequently founded similar institutions in Pennsylvania, Virginia, and Mississippi, was surveyor-general of his native State in 1832, and was a member of the Vermont legislature 1833-4 and 1839.

**Partridge, John**, English astrologer: b. East Sheen, Surrey, 18 Jan. 1644; d. Mortlake, Surrey, 24 June 1715. He was bound to a shoemaker in early youth but contrived to teach himself Latin, Greek, and Hebrew, by means of which he gained a knowledge of astrology. In 1680 he issued the first of his almanacs, 'Merlinus Liberatus,' which with its rarely perfect equivocation soon gained popular favor and quack imitators. Swift, in 1708, prompted in part by a spirit of jest, and wishing also to check the flood of quack almanacs, published his 'Predictions . . . by Isaac Bickerstaff,' in which he prophesied the death of Partridge at 11 o'clock at night on the 29th of March. On the 30th he published the announcement of the fulfilment of the prophecy; so thoroughly convincing the public of its truth that Partridge was unable to establish the fact that he was living and he made no further issues of his almanac until 1714, probably deterred by Swift's continuance of the jest in 'Elegy on the Death of Mr. Partridge' (1708) and 'Vindication of Isaac Bickerstaff' (1709).

**Partridge, William Ordway**, American sculptor: b. Paris 11 April 1861. He studied at Columbia University, but after a year his health broke down and he was ordered abroad. In Naples and in Florence, under Galli, he studied modeling and sculpture, but did not devote himself entirely to art for several years, making his living instead by public readings and for a time as an actor. He married in 1887 and went to Rome where he studied under Welonski. Upon his return to America he was for a time professor of fine arts at the Columbian University in Washington. Among his best known works are: 'Nearing Home,' the bust of an old woman, now in the Corcoran Gallery, Washington; a seated Shakespeare in Lincoln Park, Chicago, which may be reckoned to present the refinement and nobility, but to lack the simplicity and power of the poet; a statue of Alexander Hamilton, in front of the Hamilton Club, Brooklyn, showing the passionate vehemence and the complete self-control of Hamilton in the Poughkeepsie Convention; a very remarkable equestrian statue of General Grant for the Union League Club of Brooklyn; busts of Lincoln, Whittier, Edward Everett Hale, Wm. S. Tyler, and Walt Whitman; two ideal busts of the Madonna, and the Kaufmann Memorial in Washington. Partridge wrote art critiques and poetry — 'Art for America' (1894); 'Song Life of a Sculptor' (1894); 'The Technique of Sculpture' (1895); a novel, 'The Angel of Clay'

(1900); and a historical study, 'Nathan Hale' (1902).

**Partridge**, a name properly designating a common European game-bird (*Perdix cinerea*) but applied with little discrimination to a variety of gallinaceous fowls. In the United States the name is given to the ruffed grouse and spruce grouse, and with greater appropriateness to a number of birds more or less closely resembling the European partridges and quails. Taken in the wide sense the family *Tetraonidæ* includes all of these birds, the American partridges being the subfamily *Odontophorinæ*, which is sometimes united with the Old World partridges under the name *Perdicinæ* or *Perdicidæ*. The *Odontophorinæ* have the bill very short and thick, more so than in the European partridges. Like them, the nostril is covered by a scale, but is not filled with short feathers. The lower mandible is more or less distinctly toothed near the end. Both toes and tarsi are naked and the latter scaly, which characters, with the completely feathered head, offer a ready distinction from the grouse. This group is strictly American, but most of the 40 or 50 described species are confined to Central and South America. Many of the species have the head ornamented with graceful crests of very characteristic forms in the different genera; and remarkably rich and varied color-patterns occur, especially in the males of those species in which the sexes differ. Seven species representing four genera, and divided into a number of sub-species and local races, are found within the boundaries of the United States. With a single exception all are western and southwestern, and most of them may be considered as an overlapping of the Mexican fauna.

The exception just noted is that of the most prominent and familiar of these birds—the bob-white, which is popularly, if unfortunately, known both as partridge and quail, and is described under QUAIL.

Of the western species the mountain partridge or plumed quail (*Oreortyx pictus*), of the Pacific coast region, especially the mountainous parts of California, Oregon and Washington, is distinguished by the pair of slender black plumes which ornament the head. Those of the male are nearly four inches long and curve gracefully over the back; in the female they are much smaller. The extremely handsome colors are similar in the two sexes. These birds are not well known to gunners, are extremely wild, and the coveys are easily scattered. The call of the male is a pleasant crowing note. The eggs are buff-colored. The California partridge or helmet-quail (*Callipepla californica*) has a crest of several club-shaped feathers, which are erect and curve forward. The male is very richly adorned with soft grays, warm browns and slaty blues, variously marked with black and white. The female is much plainer and has a smaller crest. This is the common or valley quail of California, and it has been introduced into the Pacific States northward. When flushed, this species is said almost invariably to fly into a tree. Its notes are harsh and very peculiar. The eggs are spotted and laid in a very carelessly made nest or on the bare ground. Gambel's partridge (*C. gambelii*) is similar to the last, from which the male is distinguished by the greater amount of black in the plumage,



## PARTRIDGE-BERRY — PARVISE

particularly on the face and belly. It is exceedingly abundant in Arizona and New Mexico, from which it spreads through the surrounding States. It is equally at home in the mountains and lowlands. The Massena partridge (*Cyrtonyx montezumæ*) is a bird of Mexico rather than of the United States, within which it is found only in portions of Texas, Arizona and New Mexico. The sexes are very unlike, the male having the sides of the head white fantastically striped with black, and the under-parts dark thickly spotted with white. The crest is depressed, brush-like and on the occiput. Many of these partridges are extremely variable, and numerous sub-species and races of some of them have been described. They are also said to readily hybridize, at least under domestication. The several crested and plumed partridges described give a fair picture of those occurring in South America, most of which belong to the same or similar genera.

The partridges of the Old World are not clearly distinguished as a group from ours. They are found in most temperate and tropical countries from England and China to Australia.

The common or gray partridge (*Perdix cinerea*) chiefly inhabits the cultivated fields of Britain and the Continent. Mating takes place in February, the males frequently engaging in combats for the possession of the females. The eggs, numbering from 10 to 15, are deposited at the end of May or beginning of June, the female taking upon herself the entire duties of incubation, although the male, after the young birds are hatched, shares the duties of his mate. The partridges are exceedingly solicitous regarding the welfare of the young. The parent birds will run before the sportsman, and by fluttering in an opposite direction will strive to distract his attention from the neighborhood of the nest. Selby mentions that he has seen two partridges successfully engage a carrion-crow in battle in defense of their young. These birds in autumn and winter collect in flocks of small size, known as "coveys," but they separate in spring to pair and incubate. The food consists chiefly of grass, young seeds, and also of insects; and the birds feed in the early morning and late in the evening. The roosting place of the covey is generally in the middle of a flat field.

The red-legged partridge (*Caccabis rufa*) is common in certain parts of England, having been introduced from the Continent, where it is common. It is found in France, southern Europe generally, and in Guernsey and Jersey. The flesh is of a less succulent and tender character than that of the common partridge. It inhabits healthy places chiefly, but otherwise closely resembles its more familiar neighbor in habits.

The true quails belong to the genus *Coturnix*, which has the nostrils feathered beneath the covering scale, the bill more slender than in the partridges, the wings somewhat pointed and the tail very short. The common or Messina quail (*C. communis*) is colored much like our bob-white but is smaller, more slender and far inferior from a sportsman's point-of-view. Rather extensive attempts have been made to introduce the quail into the United States but, in part owing to its migratory habits, in part to the changed conditions, they have failed. Naturally this species inhabits a large part of Europe, Asia and Africa. Except for the fact that

it is migratory and does not form coveys, its habits are closely similar to those of the bob-white (see QUAIL).

The partridges are readily domesticated, and even in the wild state will frequently associate with fowls in the barn yard when food is scarce in the winter. The eggs may be secured and incubated under a bantam hen which naturally cares for the young. Besides the bob-white many of the crested partridges have been thus bred and are familiar sights in the aviaries of zoological gardens and bird fanciers.

Consult: Baird, Brewer and Ridgway, 'North American Land Birds' (1874); Gould, 'Monograph of the Odontophorinæ' (1850); Sandys and Van Dyke, 'Upland Game Birds' (1902); Huntington, 'Our Feathered Game' (1902).

**Partridge-berry, Checker-berry, or Squawberry,** a perennial evergreen trailing vine (*Mitchella repens*) of the order *Rubiaceæ*. It is a native of North America and is found from Nova Scotia to Florida and westward to Minnesota, Texas and Mexico. The leaves are round, small and glossy; the flowers white or pinkish tubular, in pairs and very fragrant; the fruits bright scarlet, often two united in one, persistent during winter, almost flavorless. In shady places, on dry soil, the plants seem to thrive best; they are, however, found in moist situations. They are favorites in rockeries and wild gardens, and are easily propagated by root-division. The genus, which comprises very few species, one Japanese, another South American, is named in honor of Dr. John Mitchell, one of America's early botanists, a Virginian correspondent of Linnæus. The names partridge-berry and checker-berry are also sometimes given to *Gaultheria procumbens*, which is better known popularly as wintergreen and boxberry.

**Partridge Dove, or Pigeon.** See BRONZE-WING.

**Partridge-woodpecker,** one of the brownish mottled woodpeckers of the genus *Colaptes*, especially the eastern golden-winged, or flicker (*C. Auratus*). See WOODPECKER.

**Parts of Speech.** See GRAMMAR.

**Parturition.** See OBSTETRICS.

**Party-wall,** in law, is the wall that separates two houses. Such a wall, together with the land upon which it stands, belongs equally to the landlords of the two tenements, half belonging to the one and half to the other; and unless the wall has stood for 20 or more years, each can legally do what he likes with his own half, even to cutting it away. It is common practice for the party who builds a house adjoining another to pay a just proportion of the expense of the party-wall to the party who built the same.

**Pârvatî,** pār'va-tē, in Hindu mythology, a divinity; a daughter of the mountain, also called Durga (q.v.).

**Par'vise,** the open or enclosed space in front of a church or cathedral, especially in France. When the bishop held court he summoned delinquents to appear before him in the parvise, and at Saint Rhadegunda's church at Poitiers the episcopal court at the west end of



## PAS-DE-CALAIS — PASCAL

the church is well defined with five entrances, coped wall, kneeling angels, and lions. At Amiens and Liseux the raised platform of the court still remains and traces of the same construction are apparent at Lichfield.

The term is also applied to a room over the porch of a church which formerly was a watch house or lookout, but in modern times has been applied to various uses.

**Pas-de-Calais**, pā-dē-kā-lā, France, a northeastern department bordering on Dover Strait and the English Channel; area 2,606 square miles, five sixths of which are cultivable. Its coast, extending about 80 miles, presents a long tract of low sand-hills, but near Boulogne forms a lofty crumbling cliff, the interior is generally flat, and intersected by canals; the streams, too, though short, are generally navigable. The principal harbors are Boulogne and Calais; the capital is Arras. The soil, though marshy in several places, is fertile, and produces, besides cereal and leguminous, large oleaginous crops. The chief minerals are indifferent coal, good pipe and potter's clay, and excellent sandstone. There are numerous iron-foundries, glass-works, potteries, tanneries, bleach-works, mills, and factories of all kinds. Pop. (1901) 955,391.

**Pasadena**, pās-a-dē'nā, Cal., city in Los Angeles County; on the Atchison, T. & S. F., the Los Angeles & S. L., and the Southern Pacific R.R.'s; at the head of the San Gabriel Valley, 25 miles from the Pacific Ocean and 9 miles northeast of Los Angeles. There are trolley connections with Los Angeles. It was settled by Spaniards in 1771; some of the old Spanish houses are still in existence in the vicinity. In 1873 a colony from Indianapolis, Ind., located here and began raising fruit. In 1886 it was chartered as a city. Pasadena is a famous health and winter resort, on account of its equable climate and beautiful scenery. It is at the foot of the Sierra Madre range, which protects the city on the north and east, and on the west and south are broken ranges of high hills. It is surrounded with large fruit farms. Pasadena is a residential city, but its manufacturing establishments are substantial. The packing houses, part of the year, employ 500 persons, the planing mill 100, the building trades from 600 to 800. Large quantities of fruit are exported annually. A unique feature of Pasadena is the "Municipal Farm." Early in its history, the people recognized that the question of sewerage would have to be solved in some unusual way. Far from the ocean and surrounded by hills and mountains, only the wash of Arroyo Seco to depend on for drainage, it seemed as if the beautiful healthy city would soon become the home of disease. The city purchased a raw ranch of about 300 acres, six miles out, and by means of a large outfall pipe, the flow from the sewers was spread upon this land. About 60 acres were planted with walnut trees, and quite a large acreage was devoted to alfalfa. Enough alfalfa is raised to supply food for the horses of the fire and street departments, and leave a large overplus for sale. In 1903 the walnuts harvested brought in market nearly \$5,000. Corn, pumpkins, and other crops are raised which are fed to swine. The prominent public buildings are the churches, schools, hotels, and municipal buildings, and Pasadena Hospital. The educational institutions are the

Throop Polytechnic Institute, the Pasadena Academy of Science, Saint Andrew's Academy, high school, public and parish schools, and a public library which contains nearly 25,000 volumes. The five banks have a combined capital of \$500,000. The government is vested in a mayor and a council of five members, chosen by popular vote. Over 90 per cent of the population are native-born Americans. Pop. (1890) 4,882; (1900) 9,117.

**Pasargadæ**, pā-sār'gā-dē, ancient Persian city, capital of the kingdom, before Darius I. founded Persepolis, and even afterward the scene of the coronation of the Persian kings. Here was the sacred tomb of Cyrus. The site of the city has been identified as Murghab, two days' journey northeast of Persepolis. The origin of the name may have been from a noble Persian family of the same name. Consult: Stolze, 'Persepolis' (1882); Curzon, 'Persia and the Persian Question' (1892).

**Pasay**, pā'sī, Philippines, formerly Pineda, pueblo, province of Rizal, Luzon; six miles southwest of Pasig, the provincial capital. It is on the coast road. Upon application of the municipal council, the name of the town was changed from Pineda to Pasay by the Philippine Commission, in 1901. Pop. 9,850.

**Pascagoula**, pās-kā-goo'lā, a river of the State of Mississippi, formed in the southern part of Greene County by the junction of the Leaf and the Chickasawhay rivers, flows south into Pascagoula Bay, Gulf of Mexico, through an estuary of two mouths. It is navigable for small steamboats, and is used as the outlet for the pine timber cut in the surrounding region for the New Orleans market.

**Pascal**, pās'kal (Fr. pās-kāl), **Blaise**, French mathematician, philosopher and author: b. Clermont-Ferrand (Auvergne), 19 June 1623; d. Paris 19 Aug. 1662. He displayed an unusual mathematical genius, in 1639 wrote a treatise on conic sections which amazed Descartes and forms the basis of modern study of the subject (for a résumé of it consult his 'Essai pour les Coniques' 1640), and in 1642 invented an ingenious calculating machine. In 1648 on the mountain called Puy de Dôme, he made the famous experiments concerning atmospheric pressure which confirmed the work of Torricelli (q.v.). Though he later turned from these scientific pursuits, and though his remarkable contributions to mathematics and physics have been obscured by the fame of his yet greater contributions to literature, mention should still be made of his researches in the infinitesimal calculus, the theory of probability, the equilibrium of fluids, and the properties of the cycloid, the last of which he set forth so late as 1659 in his 'Traité Général de la Roulette.' From 1646 he read the works of Jansen and Arnauld, and his religious interest grew stronger. In 1654 his escape from a carriage accident and a vision which he experienced co-operated to a re-awakening which led him to reside for some time at Port-Royal (q.v.) and to identify himself with the defense of that community which found in his 'Letters' an imperishable renown. His austerities were severe, but not gloomy, and there is a mystic tinge to his spiritual elevation. He was well fitted to champion the Jansenist against the Jesuit cause in the quarrel which followed the



condemnation by papal bull in 1653 of five propositions declared to have been extracted from Jansen's 'Augustinus.' Arnauld, irritated at the frank triumph of the Jesuits, was drawn again into controversy. In 1656 he was condemned by the Sorbonne for doubting that the five propositions were to be found in Jansen, declaring the arguments against the 'Augustinus' erroneous and false, and proclaiming the identity of the teachings of Augustine and Jansen as to divine grace. "You, who are clever and inquiring, ought to do something," he said to Pascal. Pascal did something. This was the preparation of his series of 'Provincial Letters' ('Lettres à un Provincial'), which he published at intervals under the pen-name "Louis de Montalte." The professed Montalte directs an eloquently ironic attack against the enemies of Arnauld. The 'Lettres' evidently well accomplished their immediate object. But that they long outlived. Their interest became literary. They helped to form and perfect the French of Bossuet and Racine. "Molière's best comedies," said Voltaire, "do not excel these Letters in wit, nor the compositions of Bossuet excel them in sublimity." Even better known than the 'Lettres' are the 'Thoughts' ('Pensées'), being the fragments of an 'Apology for the Christian Religion' that he did not finish. Their logical order, if, indeed, they ever had one, is now hopelessly lost. But the main outlines of the thought are apparent; and it is not too much to say that mingled with much that might be thought somewhat sophistical are some of the profoundest and most striking utterances ever penned on matters of the loftiest speculation. For the satisfaction of his reason Pascal endeavors to penetrate to the absolute truth; but the source of that truth is above reason, and reason is compelled to acknowledge the divine superiority of the Christian revelation. Skeptical passages occur, but Saint Beuve believes them to be mere notes of suggested difficulties, later to have been cleared away. "They burn," says Hallam of the 'Pensées,' "with an intense light"; while Dowden declares them "the work of an eminent intelligence." Pascal's powers were very notable. Much in modern exact science is decisively his, much also he originated by his influence. To French prose and to literature in general he added two distinguished possessions. The best collected edition is by Faugère (1886). There are English versions of the 'Lettres' by M'Crie (1846), and Pearce (1849), of the 'Thoughts' by Pearce (1850), and Kegan Paul (1885). Consult the works by Reuchlin (1840), Weingarten (1863), Dreydorff (1870), Tulloch (1878), Bertrand (1891), Nasmith (1892), and Clark, 'Pascal and the Port Royalists' (1902).

**Paschal I.**, päs'kal (Latin, PASCHALIS, päs-kä'lis), **Saint**, pope: b. Rome; d. 10 Feb. 824. He was abbot of St. Stephanus and succeeded Stephen V. in 817. He crowned Lothaire, son of Louis le Debonnaire, emperor in 823.

**Paschal II.** (RANIERO, rä-nē-ä'rō), pope: b. Bieda, Tuscany, about 1050; d. 21 Jan. 1118. A Cluniac monk, he came to Rome and was there made a cardinal. He succeeded Urban II. in 1099, but was opposed for a time by the anti-pope, Clement III. He had a long contest with the Emperor Henry IV., and also with Henry I., king of England, respecting the right of investi-

tures. When the former visited Rome, to be crowned by the Pope, the latter refused to perform the ceremony unless Henry yielded the matter in dispute. Thereupon Henry caused Paschal to be seized by his troops, but the Romans rose in behalf of their pontiff, and Henry retired from Rome, but carrying the Pope with him. After a captivity of two months, Paschal under pressure of durance, conceded in part the emperor's claim to the right of the investiture; but this concession was afterward canceled in two councils.

**Paschal I.**, anti-pope: d. 694. He was a Roman archdeacon elected by a portion of the Roman populace and supported by the exarch of Ravenna in 687. Still another portion adhered to Theodorus II., but Sergius I. was finally declared successor of Conon in the pontifical chair. Paschal was then pronounced a magician and died in prison.

**Paschal III.** (GUIDO DI CREMA, gwē'dō dē krä'mä), anti-pope: b. Lombardy; d. Rome 20 Sept. 1168. He was nominated in opposition to Alexander III. in 1164, through the influence of the Emperor Frederick I., and assumed the name of Paschal III. He continued in power while Alexander was absent at Benevento. He canonized Charlemagne.

**Pas'co, Samuel**, American legislator: b. London, England, 28 June 1834. He came to the United States and in 1858 was graduated from Harvard. He went to Jefferson County, Florida, in 1859 and acted as principal of the Waukeenah Academy until the outbreak of the rebellion, when he entered the Confederate army and served as a private through the war. He was admitted to the bar in 1868, took an active interest in political affairs and in 1886 was elected to the Florida legislature, of which he became speaker. He was United States senator in 1887-99.

**Pasco**, päs'kō, or **Cerro de Pasco**, Peru. See CERRO DE PASCO.

**Paseng'**, a Persian name of the male of the wild goat, whence have sprung the domestic races; the female is called "boz." See GOAT.

**Pasha**, päsh'â, a title of rank in Turkey; formerly an honorary title of a prince of the blood; latterly a title of the higher military and civil officials. The badge of the pasha was originally a horsetail waving from the end of a lance, which was crowned with a gold or silver ball.

**Pashkoff**, päsh'köf, **Vasili Alexandrovitch**, Russian religious reformer: d. Paris 8 Feb. 1902. He was a member of the Russian aristocracy, a colonel of the Imperial Guard, and a personal acquaintance of Alexander II. In 1874 he became interested in the preaching of Lord Radstock, and finally accepted that nobleman's views of Christianity. From that time he devoted his life to evangelical work, opened his palace to all classes for religious meetings at which he preached, and founded several organizations for religious study. He required none of those who accepted his views to leave the national church, but merely to live the simple life of early Christianity according to the principles of the Gospels. He devoted almost all his fortune to helping the poor and unfortunate. After the death of Alexander II., who had



avored him, his preaching was condemned as "prejudicial to the state"; his public meetings were prohibited and he was finally exiled. He continued his work in England, Austria, Rome and Paris till the time of his death, and the "Pashkovski Sect," which he had founded in Russia, still continued its work to a certain extent.

**Pasht.** See BUBASTIS.

**Pasig**, pā'sīg, Philippines, pueblo, capital of the province of Rizal, Luzon; on the northwest shore of the Bay Lagoon (Laguna de Bay) at the mouth of the Mariquina River eight miles east of Manila. It suffered considerable damage by fire and otherwise during the Filipino insurrection of 1897, and only a few of the stone houses remained standing. It is an important road centre and has a large trade. Pop. 22,000.

**Pasig**, a river of the Philippines, the outlet of the Bay Lagoon (q.v.) into the Bay of Manila, at the city of Manila, length 10 miles. It has several important tributaries, is navigable for native boats and light craft, and is the chief means of communication between Manila and the Bay Lagoon and the provinces on its shores.

**Pasini, Alberto**, Italian painter: b. Busseto, near Parma, 1820; d. Turin 1899. He began his career as a lithographer, but subsequently became the pupil of Theodore Rousseau and other artists at Paris, and formed his style as a painter of Oriental genre in the course of travels through Turkey and Persia. He has been eminently successful in his chosen department of art, and rivals the best French artists of the Oriental school in the brilliance and truthfulness of his pictures, a good specimen of which, 'Entrance to a Mosque,' hangs in the New York Metropolitan Museum.

**Pasiphae**, pa-sīf'ā-ē, in Greek mythology, the daughter of Helios and the wife of Minos. She failed to perform certain duties and Poseidon caused her to become enamored of a bull. She was the mother of the Minotaur.

**Paskevitch**, pās-kyě'vīch, **Ivan Fedorovitch**, PRINCE OF WARSAW, Russian field-marshal: b. Pultova, Russia, 19 May 1782; d. Warsaw, Russia, 1 Feb. 1856. He was a page at the court of Emperor Paul, and in 1800 entered the army, where he rapidly won distinction and under Yermoloff in 1826 he waged such successful war against the Persians that he succeeded to the command in the following year; he conquered the fortified Armenian towns of Etchmiadzin, Nakhitchewan and Erivan, and in 1828 concluded the peace of Turkmantchai. He was made a field-marshal in 1830 and in that year crushed an uprising in Poland, where he was in command. In 1831 he succeeded to the chief command of the armies in Poland and though his rule was severe there was no uprising even in the troubles of 1848-9, when Paskevitch stopped the intervention of Hungary in behalf of the Poles by marching with 200,000 men into Hungary itself. He succeeded to the command of the Russian army in 1854, but resigned after meeting reverses at Silistria.

**Pas'palum**, a genus of grasses; the carpet-grasses. See GRASSES OF THE UNITED STATES.

**Pasque Flower**, a hardy perennial herb (*Anemone pulsatilla*) of the order *Ranunculaceæ*. It is a native of Europe in stony places

and well drained soils, and has been introduced into gardens in cool climates as an ornamental plant. It is very hairy, bears tripinnately divided leaves upon slender stalks, and blue or reddish-purple blossoms which are often more than two inches in diameter. Its name, "pasque," is the old French for Easter, about which time it blossoms, a habit which has made the plant a favorite in old-fashioned gardens. Its petals are often used to color Easter eggs. Several other species of the genus have been called by this name, notably the American pasque flower (*A. patens*, variety, *nuttalliana*), common in low ground in the northern central United States.

**Pasquin**, pās'kwīn, or **Pasquinade**, a lampoon or short satirical publication, deriving its name from Pasquino, a tailor who lived in Rome in the 15th century. He was celebrated for his wit and satire. After his death a mutilated or broken statue was resurrected and placed near his shop, and on this were posted all satires, rhymes, libels, etc., hence the name pasquin or pasquinade.

**Pass Christian**, Miss., town in Harrison County; on Mississippi Sound, and on the Louisville & Nashville railroad, 75 miles southwest of Mobile, Ala. It is one of the largest and most popular winter resorts on the Gulf of Mexico, the winter temperature averaging 60° F. It has a water front of over six miles, along which extends a shell-paved avenue, lined with magnolias and live oaks. There are also numerous promenading and fishing piers, and facilities for boating and bathing. It is in an agricultural and live-stock raising region, and has a packing establishment and a large oyster business. Pop. (1890) 1,705; (1900) 2,028.

**Passaglia**, pās-sāl'yā, **Carlo**, Italian theologian: b. Lucca 2 May 1812; d. Turin 12 March 1887. He was educated at Rome, becoming a Jesuit at 15; in 1844 became professor at the Collegium Romanum. Four years afterward he was exiled from Italy by the expulsion of the Jesuits, but returned to Rome in 1849 and founded the 'Civiltà Cattolica.' In 1853 he published a three-volume defense of the dogma of the Immaculate Conception, in which he was a firm believer. But in spite of his orthodoxy his allegiance to the Pope faltered on the question of temporal power; in 1858 he left the Jesuit Order, aroused by the ideal of Italian nationalism, and attacked the position of the Pope in his famous letter 'Pro Causa Italica ad Episcopos Catholicos,' which was put on the 'Index.' Passaglia left Rome and in 1861 became professor of moral philosophy in the University of Turin. His organ 1862-6, 'Il Mediatore,' renewed the attack on the temporal power of the pope. He was a member of the first Italian Parliament, in which he attempted to form a liberal Catholic party. Prior to his death in 1887 he retracted all that he had written and spoken against the papacy, and died in union with the Church.

**Passaic**, pa-sā'īk, N. J., city, in Passaic County; on the Passaic River, and on the New York, S. & W., the Erie, and the Delaware, L. & W. R.R.'s; about 10 miles northwest of New York city. It was settled in 1692, and until 1852 was called Aquackonk Landing. It was incorporated as a village in 1869, and in 1873 was chartered as a city. It is near the scene of



## PASSAIC — PASSENGER PIGEON

several of the engagements of the Revolutionary War; Washington crossed the Passaic River at Aquackonk Landing, in 1776, when he was retreating through New Jersey. Passaic is a manufacturing city, the good water-power is utilized in developing several industries. The chief industrial establishments are large rubber works, silk mills, enameline factories, woolen mills, handkerchief factories, chemical works, and wineries. The prominent public buildings are the churches, schools, libraries, and municipal buildings. The park surrounding the city-hall, the water system, the beauty of its residential section, flagged sidewalks, good roads, all indicate healthy progress. The educational institutions are the Collegiate School, the public and parish schools, the city library, and the Jane Watson Reid Memorial Library. The government is administered under a revised charter of 1874 and is vested in a mayor, who holds office two years, and a council. The school board is chosen by popular vote. Pop. (1890) 13,028; (1900) 27,777.

**Passaic**, a river of New Jersey, which has its source near Morristown, in Morris County, flows first south, then east on the line between Morris and Somerset counties, then northeast between Morris and Essex counties, crosses a corner of Passaic County, and flows south into Newark Bay. It is about 100 miles long and navigable for small vessels as far as Passaic. At Paterson there is a fall of 72 feet, about 50 feet of perpendicular descent. The extensive water-power has been utilized for manufacturing, and by means of dams and canals has been distributed to many manufactories.

**Passamaquoddy** (päs-a-ma-kwöd'ī) Bay, an inlet of the Bay of Fundy, forming a part of the boundary between Maine and New Brunswick, 12 miles long and 8 miles wide at the entrance. It receives the waters of the Saint Croix River. It is deep, sheltered by several islands lying at the entrance, and affords excellent harbors; the fisheries also are important. The rise of the tide averages 25 feet. Eastport, Maine, is on one of the islands at the mouth.

**Passamaquoddy Indians**, an American tribe of the Algonquin family, formerly residing in the vicinity of Passamaquoddy Bay and the Saint Croix River in Maine and in New Brunswick. During the period of the colonial wars the tribe fought with the French. About 200 of them now remain, residing on Lewis Island.

**Passarowitz**, pä-s-sä'rō-vīts, or **Poscharewatz**, pö-shä'rē-väts, Servia, a town, near the Morava, 10 miles south of the junction of the Morava and the Danube, at the foot of Sopot Mountain, and about 35 miles southeast of Belgrade. Pop. (1901) 12,957. It is capital of an administrative department of the same name, with an area of more than 1,600 square miles and a population of 231,029. The city was the scene of negotiations for a peace between Turkey on one side and Austria and Venice on the other 21 July 1718, by which Austria got Temesvar, Belgrade and part of Servia, Venice's rights in Herzegovina, Albania and Dalmatia were recognized, and the Morea was restored to Turkey.

**Passau**, pä-s'sow, Germany, a town of Lower Bavaria, in a mountain defile at the confluence of the Ilz, Inn, and Danube, 91 miles by

rail east-northeast of Munich. It stands on the southeast frontier of the kingdom, and consists of four parts — Passau proper, on the tongue of land between the right bank of the Danube and the left bank of the Inn; Innstadt, on the right bank of the Inn; Anger, a suburb on the left bank of the Danube, adjoining it Oberhaus, a fort strongly situated on a height 417 feet above the river; and Ilzstadt, also on the left bank of the Danube, but likewise traversed by the Ilz. Intercommunication is provided by numerous bridges. The principal buildings are the cathedral, a handsome modern structure in the Italian style, with a bell-shaped cupola; the bishop's palace; church of St. Michael; the Jesuit College, now converted into a lyceum; the townhouse, gymnasium, library, etc. The manufactures consist of iron, copper, and earthenware, porcelain, crucibles, etc. There are also several extensive breweries. Passau is an old town, and is famous for the treaty signed in 1552, when Charles V., intimidated by the victories of Maurice of Saxony, was compelled to recognize the Protestants, and to grant them religious toleration. Pop. (1900) 17,988.

**Passavant**, pä-sä-vän, **William Alfred**, American Lutheran clergyman: b. Zelienople, Pa., 9 Oct. 1821; d. 3 June 1894. He was graduated from Jefferson College in 1840, from the Lutheran Theological Seminary, Gettysburg, in 1842, was ordained in the same year and accepted a pastorate in Baltimore, Md. He was in charge of a parish in Pittsburg 1844-55, after which he devoted himself entirely to editorial and philanthropic work. He founded numerous hospitals and orphanages in different cities and, co-operating with A. Louis Thiel, founded in 1870 Thiel College at Greenville, Pa. He labored assiduously to secure funds for these institutions, collecting, it is estimated, over \$1,000,000 for them. The Order of Deaconesses was introduced by him into the United States. He edited the 'Missionary' at Pittsburg (1845-61) till it was merged with the 'Lutheran,' of which he was co-editor, and in 1880 he founded the 'Workman' at Pittsburg, of which he was editor until his death.

**Passé** (pä-sä') **Indians**, a South American tribe of the Arawakan family, formerly very numerous in northwestern Brazil, but now nearly extinct. The race is noted for handsome figures, fine features and bright complexions, nearly approaching the Caucasian type. They have a priesthood and bury their dead in circular graves. They have always been friendly to the whites and are a peaceful, industrious race, many of whom lived in the mission villages in the 18th century.

**Passenger Pigeon**, the American wild pigeon (*Ectopistes migratorius*), so named from its former conspicuous habit of passing from one part of the country to another in immense flocks. These movements were not migratory in the proper sense of the term, however, except in the northern parts of the birds' range, but were movements *en masse* in search of food. These birds were resident throughout the year south of Canada and the most northern States, which they were compelled to leave in midwinter when the ground was covered with snow. Early travelers and observers astonish us by their accounts of the immense numbers of these pigeons which used to move about the forested interior of the



## PASSENGERS — PASSINI

country previous to its general settlement — statements confirmed by records and recollections of men still living. Audubon once computed that the continuous stream of pigeons he saw on one of many occasions included more than 1,100,000,000 birds, and would consume more than 8½ million bushels of grain daily.

These enormous numbers do not appear to be at all exaggerated from the actual details of the case. Wilson similarly calculated that a flock observed by him was 240 miles long, and numbered 2,230,272,000 pigeons, while the food-supply was estimated at 17,424,000 bushels of grain a day.

In fact, however, grain became the food of pigeons only after fields of rice, wheat, oats, etc., began to be planted, and never formed an extensive part of the feed, since the birds did not settle upon and attack the growing or ripening fields, but only gleaned among the stubble. Their food consisted mainly of the smaller acorns and thin-shelled nuts, especially beech-nuts, and upon a variety of berries and small fruits; and where such material was plentiful they gathered in vast congregations, which thronged upon the trees, until branches would break with their weight, and covered the ground so thickly, turning over the leaves in search of something to eat, that the moment one rose upon the wing another was ready to take its place. The pigeons would remain at such "roosts" as long as the food-supply held out, and in May or early June would make their nests in company, sometimes so loading the trees that they would break down. The nests were rude platforms of twigs, holding two roseate white eggs, or sometimes only one.

Such congregations were more often seen in the Great Lakes region than elsewhere, and there, in the first third of the 19th century, settlers would gather and kill or catch the birds in great quantities, while the wild carnivorous animals from far and near would assemble to the feast. At first the killing was done only for home needs, each family perhaps salting a few barrels of the bodies; but later, when transportation facilities improved, large numbers were taken and packed for sale elsewhere; and other large numbers were captured alive especially of the young, by being tolled into pens by spreading food, and then transferred to other enclosures, where they were kept and fattened for market. Men made a business of this, going from place to place wherever pigeons abounded, and sometimes capturing 200 dozen or more in a day. Audubon records that in 1805 he saw schooners at the wharves in New York city loaded in bulk with pigeons caught up the Hudson River and sold for one cent each. In addition to this market use, a very large demand arose among so-called sportsmen for pigeons to be shot at when released alive from spring-traps merely as an amusement and test of marksmanship, as many as 20,000 being used on a single occasion in some "tournaments" before this reprehensible form of recreation could be prohibited by enlightened public sentiment crystallized into law. This incessant slaughter and persecution, together with the clearing away of large acres of forest, rapidly destroyed the pigeons, the disappearance of which was greatly hastened by a series of very cold winters and late, stormy springs between 1860 and 1870. Since that time the wild pigeon

has been known only in scattered examples here and there; but under the protection of the game laws the bird seems gradually becoming more numerous in its old haunts, and may revive in considerable numbers, since food remains abundant for it, and natural enemies are diminished.

The passenger pigeon has a total length in the male of 17 inches, one half of which belongs to the narrow, gracefully pointed tail. The female is much smaller. The upper parts generally are a variable blue, the neck richly glossed with metallic golden violet, and the lower purplish or brownish red, fading behind into a violet tint, nearly white beneath the tail. The wing-quills are blackish, with a bluish border, and the wing-coverts obscurely spotted. The middle ones of the 12 tail-feathers are brown, the others pale blue on the outer web and white on the inner web. The wings are long (8½ inches) and pointed, and the flight of the bird remarkably swift and powerful, rivaling that of the homing pigeon, which in general this bird resembles as a type of the *Columbidæ*.

This species was never known west of the eastern border of the plains, but originally occurred through all eastern North America as far north in summer as Hudson Bay.

Consult: Wilson, Audubon, Godman, Nuttall, DeKay, Richardson and early American writers generally; and Baird, Brewer & Ridgway, 'Birds of North America' (1874) and authorities there referred to. See PIGEON.

**Passengers.** See COMMON CARRIER.

**Pas'seres, or Passeriformes,** a group of birds, containing a large number of the small, familiar and predominantly migratory birds, more or less related to the sparrows. See ORNITHOLOGY.

**Passi, päs'sē, or Passy,** Philippines, pueblo, province of Iloilo, island of Panay; at the junction of the Malinao and Jalaur rivers; 25 miles north of Iloilo, the provincial capital. Pop. 13,800.

**Passing-bell,** the bell sometimes rung to call for the people's prayers for the dying in their hour of agony. The usage of tolling a bell while the soul is said to be "passing" from earth is at least as old in England as the days of the Venerable Bede (673-735), who tells us that at the death of St. Hilda, one of the nuns of a distant convent, as she was sleeping, thought she heard the sound of the passing-bell calling her and her companions to prayers.

**Passini, pä-sē'nē, Ludwig,** Austrian painter: b. Vienna 9 July 1832. He was the son of the copper-plate engraver, Johann Passini, and under his father's direction pursued his art studies at the Vienna Academy, and in 1850 went with his parents to Trieste and Venice, where he devoted himself to painting in water-colors. In 1855 he took up his residence in Rome and began his series of architectural pictures, and interiors with figures. Since 1873 he has lived at Venice, and the brilliant aquarelles which he has there executed reveal a remarkable talent for delineating racial types and a profound sympathy with the life and spirit of the common people. His masterly technique has commanded the admiration of critics and been the model and inspiration of younger artists. Among his principal works are 'The Choir of Saint Peter's Church' (Berlin National Gallery); 'The Catechism'; 'The



## PASSION — PASSION-PLAY

Girls' School'; 'Vespers in Saint Paul's at Rome.' He has also painted some clever portraits in water-color, notably that of the Empress of Austria. He is undoubtedly the first water-color painter of his country.

**Passion**, suffering, applied especially to the sufferings of Jesus, which are solemnly commemorated by Christian churches every year. Good Friday is the anniversary of the crucifixion, as Easter Day is of Christ's resurrection, these days being led up to by the whole season of Lent (q.v.), the seven and a half weeks preceding Easter (q.v.).

**Passion Flower**, a plant of the genus *Passiflora*, of the order *Passifloraceæ*. The species, of which about 50 have been described, are mostly natives of tropical and subtropical America, a few extending as far north as Pennsylvania, and a few natives of the Australasian Archipelago. The great majority are vines, but some are herbs, shrubs and trees. They are characterized by variously lobed, simple, alternate leaves with axillary tendrils; and perfect flowers of remarkable shape and often of high coloring, though green and yellow are the prevailing tints. The early Spanish settlers in America are responsible for the popular name of these plants. They fancied the flower to typify the passion of Jesus; the ten colored parts of the floral envelope being supposed to represent the apostles, with the exception of Peter and Judas Iscariot; the showy corona of filaments suggesting the crown of thorns, or, to some, the halo; the five stamens typifying the wounds in Jesus' hands, feet and side; the three styles representing the nails, and the column from which the stamens and pistil arise, the pillar used in the scourging. Other parts of the plant were similarly treated, for example, the pointed leaves symbolized the spear-head, and the tendrils, the cords. (Consult Folkard, 'Plant Lore, Legends and Lyrics.')

A large number of the species are cultivated in greenhouses. They are graceful in foliage, and their large, often showy flowers, borne singly in the axils of the leaves or in axillary racemes, are valued as curiosities. They vary in their ease of propagation and cultivation, some being easy to raise from seed, some from cuttings, etc. Several are hardy out of doors as far north as Washington, D. C., others tender even in the Gulf States.

Among the best known are *P. incarnata*, popularly called Maypop, and *P. lutea*. The former is a well-known weed from Pennsylvania southward and westward; the latter from Pennsylvania southward. Both are cultivated for ornament in gardens and greenhouses. The fruit of maypops is edible. *P. quadrangularis* is a tropical American species commonly called granadilla. Its fruits are highly prized in the West Indies and southern Florida. Several other species bear edible fruits; for example, *P. edulis*, sometimes erroneously called granadilla; *P. laurifolia*, the water lemon or Jamaica honeysuckle; and *P. alata*; all South American species.

**Passion Music**, the musical rendering of certain portions of the Catholic Church's liturgy in the week preceding Easter, now called, but improperly, by non-Catholics, Passion week, its proper name being both in the Latin and the

Eastern church Holy week—*Hebdomas* (or *Septimana*) *sancta*, *major*, etc., and *ἑβδομα ἁγία*, *μεγάλη*, etc. In the calendar of the Latin Church, Passion week is the week which begins with Passion Sunday (*Dominica Passionis*), the fifth Sunday of Lent: the sixth Sunday is Palm Sunday (*Dominica in Palmis*, *ἑορτὴ τῶν βαΐων*) in the Latin and Greek churches. On that day the history of our Lord's Passion, as recounted in the Gospel of Matthew, is chanted alternately by three clerks in holy orders, one rendering the narrative portion (*evangelista*), another the words spoken by Jesus (*Christus*), the third those spoken by the apostles, the high priests, etc. In the afternoon or evening of the Wednesday, Thursday and Friday of Holy Week the office of Matins and Lauds is chanted, the most striking feature of the musical service being the rendering, on Holy Thursday and Good Friday, of the Lamentations of the Prophet Jeremiah in most exquisitely appropriate plain-chant melodies; this service is called *Tenebræ* because by gradual extinguishment of all the lights the interior of the church is left in darkness. In the morning service of Holy Thursday (Maundy Thursday) is chanted the noble hymn of triumph,

Pange, lingua, gloriosi corporis mysterium,  
Sanguisque pretiosi quem in mundi pretium  
Fructus ventris generosi Rex effudit gentium.

On Good Friday, in the morning service, the history of the Passion according to Saint John is chanted. Deeply impressive, in the service of this day, is the dramatic rendering of the *Improperia* or "reproaches" of Jesus to the Jewish people, while the clergy and people are doing reverence to the representation of the Crucified: "*Popule meus, quid feci tibi? aut in quo contristavi te,*" etc.—"My people, what have I done to thee, or wherein have I vexed thee?" and this strophe of one chanter is taken up by a second with: "*Quia eduxi te de terra Ægypti parasti crucem salvatori tuo.*" After each *improperium* one choir chants, in the Greek language, "Holy God," to which a second choir responds "Holy God" in Latin: then alternately in Greek and Latin the two choirs chant "Holy Strong," "Holy Immortal, have mercy on us." In the morning service of Holy Saturday the grand prose composition, *Exultet*, is sung to the finest melody in the whole repertoire of church music.

**Passion-play**, a species of mystery-play which was exceedingly popular in the middle ages. It was acted in Holy Week. Such plays were frequent in Provence, northern France and Italy, as well as in England. After the Reformation they were repressed in Germany excepting in those regions where the population still remained faithful to the Roman Catholic Church, that is, in Bavaria, the Tyrol and the Salzburg Alps. In the 18th century Carl Theodore and King Maximilian Joseph I. forbade the performance of such mysteries in Bavaria, making an exception in the case of the villagers of Oberammergau, where the play had been enacted since 1633. These villagers had escaped contagion from the plague that was raging in their neighborhood, and made a vow to perform such a play every 10 years. This they have done and their representation of the drama has drawn thousands of visitors from all parts of the world. There are about six hundred per-



## PASSION WEEK — PASSPORT

formers and the character of Christ is taken by a man remarkable for his religiousness and sanctity of life. Consult Grein, 'Das Oberammergau'sche Passionsspiel' (1880); Stead, 'The Passion Play' (1890).

**Passion Week**, the week before Holy Week, which latter is the last week in Lent, and was styled by the primitive Christians the "Great Week."

**Pas'sionists.** See ORDERS, RELIGIOUS.

**Pass'over** (Hebrew *pesach*, Aramaic *pascha*, a sparing), the Jewish feast to commemorate the sparing of the Israelite first-born and the escape out of Egypt. It falls on the first full moon of the spring, from the 14th to the 21st of the month Nisan. (See EASTER.) At this festival the Israelites while they remained in possession of Palestine, assembled in the tabernacle, and from Solomon's time in the temple. During the eight days of the feast they were commanded to eat only unleavened bread, because their hasty departure from Egypt obliged them to take their dough with them unleavened; hence the name of "Feast of Unleavened Bread." Every family ate, on the evening of the first day, a lamb, served up without breaking the bones. Offerings of firstlings of the flocks and herds, and first-fruits, were presented in the temple. The Passover was and indeed with the orthodox Jews still is the principal Jewish annual festival. The Seder is the great Jewish family reunion of the year. Wherever the traveler may be the rest of the year, his mind rests not in the spring until he is safely home again, so he may take part in the Seder around the family table.

The master of the house occupies the seat of honor at the head of the table. He is clothed in his best, over which he wears his white linen death shroud—the Kittel. A skull-cap of silk or velvet covers his patriarchal head, and he rests his arms on soft pillows enclosed in shams of immaculate whiteness. At his right sits his wife—at his left his eldest son; guests, sons, daughters, and servants, if there be any, occupy the remaining seats at the table, and symbolize the equality of all, before man and God, and commemorate the one time slavery of all Israel. On the table directly in front of pater-familias is a plate on which three flat cakes—known as matzoth, are placed, each covered with a spotless white cloth or napkin. Close at hand is a dish which contains a portion of the shoulder or the shank of a fowl, with a small bit of meat attached, roasted on the coals almost to the point of charring. In this dish one may also observe an egg, peeled of its shell, that has been roasted hard in hot ash. A third dish contains a goodly portion of horseradish or other bitter herb, and a fourth holds the Charoseth—a cement-like paste made of nuts, apples and spices of various kinds.

Each of these dishes has its peculiar significance. The matzoth represent the unleavened dough which the Israelites carried with them on their flight out of bondage; the shank-bone or shoulder blade represent the paschal lamb—which was by far the most important feature of the Passover in the days of the temple; the bitter herbs stand as a reminder of the bitter days of slavery in the kingdom of the Pharaohs.

These preliminaries having been properly set in place, the ceremony proper begins. The hands

are washed and various blessings are recited appropriate to the occasion. The master of the house, breaking one of the three matzoth in two, and pointing to the roasted bone and egg, lying before him, recites in Chaldaic, "Lo! this is the bread of affliction, which our ancestors ate in the land of Egypt; let all those who are hungry enter and eat thereof; and all who are in need, come, and celebrate the Passover."

The youngest male member of the family then asks the classic "four questions," the head of the house and all those about the table, reply, in Hebrew or in English: "Because we were slaves unto Pharaoh in Egypt, and the Eternal, our God, brought us forth from thence with a mighty hand and an outstretched arm; and if the Most Holy had not brought forth our ancestors from Egypt, we, and our children, and our children's children, would still continue to be slaves to the Pharaohs in Egypt."

As the story of the Exodus rolls on, each of the various dishes is taken in turn, and its significance explained in picturesque language. A portion of the Hallel is next recited, and the reply closes with a benediction, in which it is hoped that the Holy Temple will be rebuilt and the ancient rites and sacrifices restored. The hands are again washed, and after pronouncing grace over the matzoth, the meal proper is served.

In the days of the Second Temple this festival was observed in a most elaborate manner. In the year 65 A.D., we are told, 3,000,000 Jews visited Jerusalem for the celebration of the Passover, and in the days of Nero at the Passover celebration 265,500 lambs were slain, also indicating an attendance of nearly 3,000,000 Jews. The city could not accommodate all that came from far and near. Tents were accordingly thrown up outside of the city walls. The Roman authorities, fearing the spread of sedition during these days, took extraordinary police precautions to prevent political disturbances.

The Passover celebration of to-day differs, of course, from that of 2,000 years ago; yet it differs only in so far as the changed civil and economic conditions have had their effect on Jewish life. The sacrifices are not made and the journey to Jerusalem is not undertaken, for the Temple has been destroyed these many centuries. Nevertheless, apart from these features, the celebration of the Passover by the orthodox does not differ materially from the Passover as it was celebrated by Christ, and the Jews before His day.

**Passow**, päs'sō, **Franz Ludwig Karl Friedrich**, German philologist: b. Ludwigslust, Mecklenburg, 20 Sept. 1786; d. Breslau 11 March 1833. He was educated at Gotha and Leipsic, in 1807 was Greek professor at Weimar, and in 1815 became professor of archæology at Breslau; in 1829 director also of the museum of art there. His 'Greek-German Lexicon' (1819-24) formed the basis of Liddell and Scott's 'Greek Lexicon.' Other works of his are: 'Turnziel' (1818); 'Elements of the History of Greek and Roman Literature and Art' (1816). Consult Wachler, 'Passows Leben und Briefe' (1839).

**Pass'port**, a warrant of protection and permission to travel granted by a competent authority to persons moving from place to place. In some European states no person is allowed



## PASSY — PASTEUR

to leave the country without a passport from his government giving him liberty to do so; and passports may be even required by the natives when they travel from one part of the country to another. In Great Britain and in the United States the only species known are foreign passports. The regulations put in force regarding passports by the different countries have naturally differed greatly at different times, as during a time of war or internal disturbance compared with a time of peace; and while persons coming from one country may have to provide themselves with passports, citizens of another country may be freely admitted. It is of advantage to be provided with a passport even in countries where it is not demanded, as it furnishes a proof of the bearer's identity and nationality. Passports to British subjects are granted at the Foreign Office, London. In the United States passports, with description of the applicant, are issued by the State Department at Washington. They are good for two years from date, renewable by stating the date and number of the old one. The fee required is one dollar. They are issued only to citizens, native-born and naturalized.

**Passy**, pä-sē, France, a western suburb of Paris, since 1860 incorporated with the city. See PARIS.

**Past and Present**, a work by Thomas Carlyle, published in England in April 1843 and in May in the United States. It was written in seven weeks, as a respite from the harassing labor of writing 'Cromwell.' In 1842, the Camden Society had published the 'Chronicles of the Abbey of Saint Edmund's Bury,' written by Joceline de Brakelonde, at the close of the 12th century. This account of a mediæval monastery had taken Carlyle's fancy; and in 'Past and Present' he contrasts the England of his own day with the England of Joceline de Brakelonde.

**Pasta, Giuditta**, joo-dēt'tä päs'tä, Italian opera singer: b. Saronno, near Milan, 9 April 1798; d. Lake Como 1 April 1865. Her maiden name was Negri; her ancestry was Jewish; and her first attempts on the stage after her leaving the Conservatory of Milan met with little success. She married a tenor named Pasta in 1816, studied for a time with Scappa and made her first successes in Venice, Rome and Milan in 1819-20. At Paris she introduced the arpeggio embellishments to Rossini's music, which added much to her artistic fame. She made her first appearance in London in 1824, playing alternately there and in Paris. For 10 years her voice steadily improved, and even when it began to grow weak her dramatic ability was still crescent. As late as 1850 she sang in England and her voice was said to retain much beauty when she was 60; but as has been suggested her fame is due principally to her remarkable combination of fine singing and classic acting. Bellini wrote 'Sonnambula' (1831) and 'Norma' especially for her; the same is true of Donizetti's 'Anna Bolena.' Among her other favorite roles were Romeo in Bellini's 'Romeo e Giulietta,' Desdemona in Rossini's 'Otello' and Nina in Paisiello's opera of that name.

**Paste-board**. See PAPER AND PAPERMAKING; STRAW BOARD.

**Paste Jewels**. See GEMS, IMITATION AND ARTIFICIAL.

**Pas'tel**, in art, a colored pencil of pipe-clay, gum water, and the required pigment. The executed work is also called a pastel or a drawing in chalk. See CRAYONS.

**Pas'tern**, that part of the leg of a horse between the "fet-lock" joint next the foot and the coronet of the hoof. The first phalanx of the foot is called the great pastern bone; the second, the small pastern or coronary; the third, the coffin-bone, which is enclosed in the foot.

**Pasteur**, päs-tër, **Louis**, French chemist: b. Dôle (Jura) 27 Dec. 1822; d. Villeneuve l'Etang (Seine-et-Oise) 28 Sept. 1895. He was educated at the Royal College of Besançon and the Ecole Normale of Paris, in 1848 became professor in the Lycée at Dijon, in 1849 professor of chemistry at Strasburg, and in 1854 dean at Lille of the scientific faculty, which he organized. In 1857 he was made director of scientific studies in the Ecole Normale, in 1868 director of the chemico-physiological laboratory at the Ecole des Hautes Etudes, and in 1887 permanent secretary of the Academy of Sciences. In 1889 he withdrew from all other posts to give his entire attention to the management of the Pasteur Institute, built by popular subscription for the prosecution of research in the preventive treatment of infection. His first investigations, which aroused the wonder of the veteran chemist Biot and placed him high among the scientists of the time, had to do with optically active and inactive substances. His examination of two tartaric acids, one of which turned to the right the plane of a ray of polarized light while the second remained inoperative, proved that the inactivity of the latter was due to its being composed of two isomeric acids which diverted the ray with equal power in opposite directions. In his subsequent work, Pasteur applied these exacting methods of research, chemical and physical, to the solution of several complex phenomena. Fermentation had not then been explained. Pasteur showed that the various changes involved in the process were the result of the presence and growth of a micro-organism which he called the ferment. He was thus the founder of the science of bacteriology (q.v.), as he had previously been of stereo-chemistry (q.v.). He proceeded to demonstrate that the varieties of fermentation were due each to a special organism, and that when these atmospheric germs were absolutely excluded no change took place. These discoveries proved of great service to the industries of brewing and wine-making, in which they substituted scientific certainty for guesswork. To prevent the deterioration of wines and beers, as also of milk, a process of heating, known as "Pasteurization," was introduced, and large financial loss was avoided. In 1865 Pasteur began the study of the silk-worm disease, which had so impaired the value of raw silk as seriously to threaten the industry in France. He made investigations in the plantations of southern France and was finally able to announce the results of his experiments and the means to be taken for the extermination of the plague. The history of this investigation is of great interest. It was followed by a rapid increase in the annual value of silk, and the re-establishment of prosperity in the trade. Pasteur's work in preventive medicine is probably his best-known achievement. The discovery of Edward Jenner (q.v.) had never been utilized.



## PASTEURIZATION OF MILK—PASTORAL POETRY

Pasteur generalized it by determining that as each variety of fermentation is originated by a specific ferment, so in the case of various maladies the infection depended on the presence of a specific microbe. He found that "cultures," or artificial growths, of this microbe might be obtained, and that by a certain succession of such cultures the virus of the microbe became so weakened, or "attenuated," that by treatment with them animals, though a slight attack of the given malady appeared, were rendered immune. The application of this result to cholera in fowls and anthrax in cattle and sheep was very important. Pasteur finally extended it to inoculation for rabies with beneficent effect. His discovery of the anti-toxin followed (1885) long experimentation and was highly successful. For a description of it see HYDROPHOBIA. The Pasteur Institute was soon established, and similar ones arose elsewhere. Pasteur was the recipient of many distinctions, including election to the National Academy of Sciences in the United States. Among his principal works are: 'Etudes sur le Vin' (1866); 'Etudes sur le Vinaigre' (1868); 'Etudes sur la Maladie des Vers à Soie' (1870); 'Etudes sur la Bière' (1876). Consult: Gruber, 'Pasteurs Lebenswerk' (1896); Vallery-Radot, 'Vie de Pasteur' (1900).

**Pasteuriza'tion of Milk.** See MILK.

**Pasticcio**, päs-tīch'ī-ō, from the Italian signifying "medley," an inartistic device among musical composers of the 18th century, which consisted of adapting some of their earlier compositions to a new text instead of writing new music for it. Notable examples are the chorus 'For unto us a child is born' from Handel's 'Messiah,' originally the music of a madrigal written in 1712, and Gluck's 'Piramo e Tisbe' adapted to the best melodies of his earlier operas.

**Pastille**, päs'tīl or päs-tēl', a sugared confection; also an aromatic paste for burning, as a fumigator or disinfectant. It is composed of gum benzoin, sandalwood, spices, charcoal powder, etc.

**Pasto**, päs'tō, Colombia, province of the department of Cauca; also the capital city of the province, 100 miles southeast of Popayan, on the Rio de Pasto, a tributary of the Patia, and at the southeastern foot of the volcano of Pasto, which is nearly 14,000 feet above sea-level. The city itself is about 8,500 feet above the sea-level; lies in a basin, 2½ by 3 miles in extent, of rare fertility and of brilliant verdure; has a college, a seminary, convents of the Franciscans, Dominicans and Augustinians and an episcopal palace; and is well built and laid out. It was founded in 1539; was twice burned during the war of independence, in which its inhabitants, mostly of Indian descent, showed rare loyalty to the Spanish crown, held Bolivar in check for some time, and yielded only in 1822; and was destroyed by earthquake in 1834. The main industries are manufactures of hats, blankets and pottery. Pop. (estimated) 10,000.

**Pas'ton Letters**, the collected correspondence between 1424 and 1509 of the Paston family of Paston, Norfolk. Covering the period of the Wars of the Roses and written in the frankest and homeliest way, these letters give important information as to the manners and history of the 15th century, showing particularly how undis-

turbed by war the greater part of the people of England were. The Paston letters were first edited by John Fenn in five volumes (1787-1823); a popular edition by Ramsey appeared in 1840; but the best edition is that in the Arber reprints by Gairdner, in three volumes (1872-5) and enlarged to four volumes (1900-1).

**Pastor**, a genus of birds belonging to the starling family, found in the north of Africa, Syria, and India. The rose-colored pastor (*P. roseus*) is the only European specimen, and, being a good singer, is a favorite cage-bird. Its plumage is generally of a blackish-violet color, but various parts about the shoulders and abdomen are rose-colored. It has a prominent crest. In habits it much resembles the starling, and it is of about the same size. Compare MINA-BIRD.

**Pastor Fido**, päs-tör' fē'dō, II ('The Faithful Shepherd'), a pastoral drama by Giovanni Battista Guarini, played in Turin in 1585, but not printed until 1590. Composed in honor of the nuptials of a duke of Savoy, it has appeared in English in six different translations. It is the masterpiece of the author, and its influence can be seen in all subsequent literature of this class. It went through 40 editions during the author's life, and has been translated into almost all modern languages.

**Pas'toral Letters**, circular epistles addressed by a diocesan bishop to those under his jurisdiction for purposes of instruction or admonition in matters of doctrine or discipline.

**Pastoral Poetry**, the description in imaginative verse of country life, the loves of shepherds and shepherdesses, varied by the introduction of the supernatural powers supposed to haunt the woodlands,—nymphs, satyrs, etc. Pastoral poetry seems to have originated in Europe in the Idylles of Theocritus (q.v.), a poet of the Alexandrian period, but in Sanskrit literature there is a distinctly pastoral element, and 'Sakuntala' may be styled a pastoral drama. In the Hebrew Scriptures the book of 'Ruth' and the 'Song of Solomon' are pastorals. Theocritus may be taken as forming a school of pastoral poetry with Bion and Moschus (3d century B.C.). Virgil's Eclogues are largely made up of translations and imitations of the Greek pastoral poets and he goes so far as to transplant the scenery of Sicily to Italy. The modern Italian school is represented by the 'Pastor Fido' of Guarini; Spanish pastorals are those of Cervantes and Garcilaso de la Vega; Portuguese by those of Camoens. There was a great school of pastoral poetry in France, whose productions ranged from the artificiality of Fontenelle to the warmth of feeling and truthfulness of description which characterize Bernardin de Saint-Pierre. German pastoral is also voluminous and culminates in Goethe's 'Hermann und Dorothea.' Spenser and Sidney are the best representatives of English pastoral, though the masques of Ben Jonson are genuine examples of this style, which takes a high poetic and ethical tone in Milton's 'Comus.' Pope, Ambrose Philips, and Gay also wrote pastorals. The last sustained production of this class in the English language was the 'Gentle Shepherd' of Allen Ramsay (1725), although Tennyson's fine fragment 'Come down, O maid, from yonder mountain height,' is a delightful echo of the loveliest strains uttered



## PASTORAL STAFF—PASTURE

by the Greek pastoral poets. A good collection in English is 'English Pastorals,' edited by Chambers in the 'Warwick Library.'

**Pastoral Staff**, the official staff of a bishop or archbishop. The pastoral staff of an archbishop is distinguished by being surmounted by a cross, and is accordingly called a crozier. The pastoral staff is in the form of a shepherd's crook. When carried by a bishop it was held in the left hand with the crook turned outward, indicating his jurisdiction over a diocese; when assumed by an abbot, it was grasped in the right hand, with the crook turned backward, showing that his jurisdiction was limited to the members of his own house. The pastoral staff is made of ivory or wood, enriched with precious metal or jewels.

**Pastoral Symphony, The, or Recollections of Country Life**, Beethoven's Sixth Symphony F major, opus 68. The musician had a passion for the country, and has composed two pastoral symphonies of which the one here mentioned (1807) is the most famous. One passage of it suggests the sound of gnats buzzing in the evening twilight, and in some phrases are represented the notes of birds, and the murmur of winds and waters; the prevailing tone is joyous. It was produced for the first time at Vienna 22 Dec. 1808.

**Pastoral Theology**, that section of theology which treats of the practical duties of a Christian minister in his church and parish.

**Pastorale**, in music, a composition of an idyllic character; also a composition for a dance, generally in six-eight or twelve-eight time.

**Pastorels**, a variant form of Pastoureaux (q.v.).

**Pastorius, Francis Daniel**, American colonist: b. Sommerhausen, Germany, 1651; d. 1719. He visited England and there became a member of the Society of Friends and made the acquaintance of William Penn, to whose colony of Pennsylvania Pastorius, in 1683, emigrated at the head of a company of Mennonites from Germany and Holland, and settled at Germantown, now a part of Philadelphia. Piety and learning were united in Pastorius to practical energies and qualities of leadership, whereby the influence of his character was made deep and lasting among his followers. Within five years of his coming to America he signed a protest to the Friends' yearly meeting in Burlington, N. J., which declared slavery to be unchristian, and which, as the first formal anti-slavery declaration made in this country, was celebrated by Whittier in his 'Pennsylvania Pilgrim.' To the Germantown book of records Pastorius prefixed a Latin ode addressed to posterity, which was translated by Whittier. Pastorius also wrote a 'Geographical Description of Pennsylvania' (1700), which was first published with a German title.

**Pastoureaux**, päs-too-rō', bands of French peasants who attempted in the 13th and 14th centuries to better their pitiful conditions by appeal to arms. There were three of these risings: the first, in Berry in 1214, was aimed against both the feudal lords and the monasteries, but was quickly and severely repressed; the second, in Flanders, in 1250 under the lead of the "Master of Hungary," pretended to be a cru-

sade to recover the Holy Sepulchre; its members assumed priestly functions and denounced the wickedness of the clergy; nothing could be done to check its excesses until the body numbering 60,000 or 100,000 men divided after leaving Paris into several companies, which were speedily attacked and slaughtered by the king's forces. The third rising of the Pastoureaux in 1320 was again composed of illuminés and again under cover of a pretended crusade; it laid waste Berry, Saintonge, Aquitaine, and Languedoc, and killed 500 Jews at Verdun-sur-Garonne. Near Aiguesmortes they were hemmed in; many died of starvation and others were hanged and imprisoned.

**Pasture**, grass-covered land upon which domestic animals are placed to graze. In its broad application the term includes the unenclosed grazing areas of the western ranges, the Argentine pampas and the Russian steppes; in a narrower and more popular way it refers to the enclosed fields similarly used upon farms. Small enclosed pastures close to farm buildings are usually called paddocks. Since many things, especially drought, may occur to impair the productivity of pastures, it is customary to grow fodder crops, especially corn, in proximity to the pasture, and to cut this crop as occasion may require. This serves the double purpose of supplying the animals with needed food and preventing the injurious, close grazing of the pasture. An essential adjunct of pastures is an adequate supply of pure water available at all times to the animals; and a highly desirable feature is shade, best furnished by trees located at the highest points, the margins, and on the poorest soil of the field.

Pastures differ from meadows in the character and habits of the plants which grow upon them. Whereas meadow grasses and other plants are usually tall-growing, and ready to cut all at one time, the herbage of pastures is generally low-growing, and the various species reach maturity at various times throughout the season. The former are often "stooling" or "tillering" grasses, the latter creeping and mat-forming. The selection of species is largely dependent upon the climatic and soil conditions, and also upon the length of time the pasture is to remain. For temporary pastures short-lived grasses, etc., are often used, but for the permanent pastures the perennials and turf-forming species should be chosen. Timothy (*Phleum pratense*), the leading meadow and hay grass in the eastern United States, is sometimes seeded for pasture, but its stooling habit, its inability to form a good turf, and its liability to injury by the trampling of the animals, are decidedly against its use in pastures. Among the most popular grasses the following may be mentioned: For the Southern States, Texas blue grass, Bermuda grass, carpet grass, large water-grass are probably in most general use, the first two particularly. On light sandy soils creeping bent-grass, Kentucky blue grass, red fescue, and white clover are in popular use. On wet soils perennial rye-grass, red-top, or creeping bent-grass, and alsike clover are in general use. In regions where the rainfall is adequate and upon ordinary soils the following are general favorites: Kentucky blue grass, tall fescue, Canada blue grass, redtop, perennial rye-grass, orchard-grass, and white clover. Red clover and alsike are also planted to some ex-



## PATAGONIA — PATAN

tent, but they are rather tall growing for pasture plants. The botanical names and characteristics of these plants are described under GRASSES OF THE UNITED STATES.

In general, the best pastures are formed upon well drained, but moist, loamy soils, varying in quality from clay to rather sandy loam, but not usually including what are termed sandy and gravelly soils. As a prime necessity they must be rich in all plant foods, especially nitrogenous and organic material. The former is essential to the luxuriant growth of herbage, the latter to improve the physical qualities of the soil, particularly texture and water-retaining capacity. To supply these elements, barnyard manure is most frequently employed and, when properly cared for and applied, is best. It is insufficient, however, even with the droppings of the animals, to keep the land in its best producing condition. Hence, commercial fertilizers must be applied liberally; phosphoric acid and potash at any season and nitrate of soda and other quickly soluble fertilizers in the spring or during the summer. These remarks apply to the annual management as well as to first preparation. The land should be deeply plowed, thoroughly harrowed to make the surface as fine as possible, the seed sown on a windless day, if possible just before a rain. Since little weeding can be done, it is highly desirable to purchase as clean seed as possible, the high price for "re-cleaned" seed being more than repaid in the quality of the crop. Often for permanent pastures short-lived grasses may be mixed with the perennial sorts in order to choke weed-growth; the perennials do not suffer but soon gain possession of the ground. When the plants are growing well, the field should be mowed close to the ground in order to destroy the taller weeds and prevent their production of seed; and this should be repeated several times each year until the grass has full possession. This labor may be lessened in many cases by turning sheep upon the pastures previously occupied by cattle or horses, because the sheep eat many weeds that the other animals ignore. Harrowing pastures in early spring is considered advantageous, since it admits light, heat and air and reduces the struggle among the plants. Reseeding pastures is generally not advisable, plowing and planting to other crops for several years being preferable.

It is generally found advisable to pasture the various domestic animals separately, since cattle and horses may annoy or even injure one another, and since sheep crop the grass so closely that they deprive the larger animals of their share. Dairy and beef cattle are generally pastured separately because of the differences in their general management. Great care must be exercised to pasture no more animals upon a given area than can be easily fed from it. When too many are present the animals not only kill out the grass but encourage the growth of the weeds they will not eat. See LAWN; MEADOW.

**Patagonia**, păt-ə-gō'nī-ə, South America, a name formerly used of all the southern part of the continent, but now used of the region bounded on the north by the Rio Limay and the Rio Negro, the Atlantic on the east, the Strait of Magellan on the south, and the Andes on the west. The region was discovered by Magellan in 1520, was practically unexplored (save by Darwin in 1839) until 1869, and since then has

been explored by Musters, Moreno, Moyano, Fontana, various Argentinian army officers and scientists, and 1896-9 by a Princeton University expedition led by J. B. Hatcher. The country is a tertiary plateau with terrace-like drops to the sea level at the coast, so that the etymology of the name seems to be from Quichua *patacuna*, "terraces." There are many volcanic rocks, especially basalt; a few volcanoes even in the Andes, Fitzroy being the most important; many large salt lakes, mostly to the south of 48°—among them Lago Argentino, Viedma, San Martin, which is the source of the Santa Cruz, Buenos Ayres, and Nabuel Huapi. The climate is cold, the region lying between the isotherms of 14° and 7° C.; at Rawson the temperature has a maximum of 31°C. in January and a minimum of -7° C. in June; climate and temperature closely resemble those of South Africa. The flora is scanty in the extreme south and everywhere differs very remarkably from that of the surrounding country. Along the river courses there are willows; peculiar vegetation marks the salt lagoons, and in the tertiary plateau the plants resemble those of Mendoza and there are many cactuses. The fauna also is scanty; the birds are of particular importance as showing many unusual instances of specialization—families which everywhere else live in trees have here lost their arboreal habit and nest on the ground. There are wild horses and cattle. The natives are called Tehuelche; the northern branch is separated from the southern, which seems actually of different stock, by the Rio Senger. The "Patagonian giant" has been greatly exaggerated; Mr. Hatcher gives the average height of the men as 5 feet 11 inches, weight 175 pounds, and of the woman, height 5 feet 7 inches and weight about that of the men. They were nomads. The Roca expedition of 1880 almost wiped them out. The entire region was long unoccupied; then was disputed between Argentina and Chile; and was divided between these two powers, the Cordillera being the boundary, by the convention of 23 July 1881. Consult: Musters, 'At Home with the Patagonians' (1871); Campbell, 'Through Patagonia' (1901); Prichard, 'Through the Heart of Patagonia' (1902); and 'Reports of the Princeton University Expeditions to Patagonia, 1896-1899.'

**Patala**, pā-tā'la, the Hindu infernal regions, described in the Puranas as seven in number, each being more than 3,000 leagues in depth. They are inhabited by demi-gods of various kinds and orders, who live luxuriously in splendid mansions, feasting on choice meats and fruits, and quaffing delicious wines. They wander at their will amid glorious forests, along streams and by the side of lakes whose banks are covered with flowers, while the lotus floats upon the bosom of their waters.

**Pat'amar**, a native vessel common along the coasts of India. It is about 75 feet long, 20 feet broad, and 12 feet deep, with a burden of about 200 tons. It has two masts, with lateen sails. Smaller ones have but a single mast. They have a prow stem the same length as the keel.

**Patan**, pa- or pŭ-tän', variant spelling of Pattan (q.v.).



**Patañjali**, pa-tān'ja-lī, Sanskrit grammarian, who wrote about 140 B.C. (or possibly as late as 25 A.D.), a commentary called *Mahābhāshya*, or 'Great Commentary,' on the previous work of Pāṇini (q.v.), and especially on the criticism of Pāṇini by Kātyāyana; this work, edited by Kielhorn 1878-85, is one of the most important sources of our knowledge of Sanskrit grammar. Another Patañjali, sometimes identified with the grammarian, is the reputed founder of the Yoga system of philosophy, which proclaimed that salvation and bliss were to be attained by the union of the individual soul with the great soul, Içvara, and that this can be attained by austere life and meditation.

**Patapsco**, pa-tāp'skō, a river of Maryland, flowing into Chesapeake Bay, 14 miles south of the city of Baltimore. It enters the bay by a large estuary, which forms the harbor of Baltimore, and is navigable for the largest vessels. See BALTIMORE.

**Patas Monkey**, a reddish guenon (*Cerco-pithecus patas*) of western equatorial Africa, which is frequently seen in menageries.

**Patch, Kate Whiting**, American writer: b. Elizabeth, N. J., 22 Aug. 1870. She was married in 1893 to F. W. Patch, a physician of Framingham, Mass., and is the author of 'Middleway' (1897); and the juvenile books, 'Rainy Days and Sunny Days' (1899); 'Old Lady and Young Laddie' (1900); 'Prince Yellowtop' (1903.)

**Patch, Samuel**, American athlete: b. Rhode Island 1807; d. Rochester, N. Y., 13 Nov. 1829. He went to sea when very young, and later became a cotton-spinner at Paterson, N. J. He made a reputation for feats in jumping, the leap which he took from the bridge spanning the Passaic, a distance of 80 or 90 feet, attracting widespread attention, and he thereafter traveled over the country, jumping from topmasts and bowsprits of vessels. At Niagara Falls he made a leap of more than half the height of the falls, but dissatisfied with this performance he advertised a leap of 125 feet at the Genesee Falls, in which he lost his life.

**Patches**, are small pieces of silk or court-plaster used on the face to apparently heighten the complexion by contrast. During the 17th and beginning of the 18th century these fantastic ornaments were commonly worn by women and sometimes by men. In the United States the practice was revived in the 20th century by fashionable people in some circles of society.

**Patchogue**, pāt-chōg', N. Y., village, Suffolk County, on the southern coast of Long Island, on Great South Bay, and on the Long Island railroad; 51 miles east of New York. It was incorporated as a village in 1893. Its most important industries are oystering and fishing; it has good dock facilities, and is one of the chief harbors for the fish and oyster boats of the bay; it has also a cold storage plant, and a number of manufactures, including lace, paper, lumber, and surveyors' supplies. It is also one of the popular summer resorts of Long Island and contains several hotels. It has a high school and a public library. The governing body is a board of trustees, and the executive a village president, who holds office for a year. Pop. (1900) 2,926.

**Patchouli**, pāt-choo'lī, a perfume obtained from the dried leaves and branches of the *Pagostemon patchouli*, a mint of India and China, where it is cultivated on a large scale; the plant has also been acclimatized in France. The branches and young leaves are highly odoriferous, like sandal-wood, but the perfume is much more intense. The essence obtained from them by distillation is a kind of heavy dark-brown oil, which nullifies the effect of an equal weight of any other vegetable perfume which may be mixed with it. It is used in India to scent the costly Cashmere shawls, with the view of keeping out moths; hence real Cashmere shawls were known by their scent, until the French, who had succeeded in imitating the fabric, found out this secret also, and imported the plant for a like use. In Asia it is also used for scenting ink-cakes, tobacco, hair-oil, etc., and is everywhere valued as a preservative of woollens and linens from insects. The pure essence, having a disagreeably powerful odor, requires to be greatly diluted for the purposes of the perfumer.

**Paté de foie gras**, pā-tā' dé fwä grā, a French article of food, made from the livers of geese, and much relished by epicures. It is made in the form of a pie.

**Patella**, the kneecap or kneepan, a rounded bone developed at the knee-joint in the tendon of the large muscle of the thigh, which is made up of the rectus femoris, vastus internus and externus, vastus internus, and the quadriceps extensor cruris. This muscle becomes narrowed down at its lower end, and forms the ligamentum patellæ, which is fastened on the front surface of the tibia, and is one of the important muscles in extending the leg. It has developed at its lower end, the sesamoid bone, the patella, over which it slides, gaining power by this arrangement. It is a flattened triangular bone. Its upper or front surface is rounded and is attached to the tendon of the muscles; its lower or back surface is covered with cartilage and forms an important part of the knee-joint, articulating with the femur at different places as this bone is moved. In front of the patella, separating it from the skin, is a bursa. Affections of the patella are not rare. Inflammation of the bursa is common in those who are compelled to be on their knees continuously. A chronic condition known as housemaid's knee results from this, and is often extremely difficult to treat. An equally common condition is a mild inflammation of the synovial mucous membrane beneath the patella. This is a condition usually set up by violent athletics, excessive exertion, as in tennis, football, skating, bicycling, etc. It usually follows some injury of the knee, and results in partial stiffening of the joint. Rest, hot applications, and a plaster bandage are the best preventives of this condition. Following gross accidents, dislocation or fracture of the patella may result. Dislocation is a rare accident, and usually is the result of direct violence. The patella may be dislocated inward or outward; most frequently the dislocation is outward. The sudden limitation of motion, together with obvious deformity, renders the diagnosis simple. Reposition is also easy. Fracture may result from direct violence, or it may result from sudden forcible stiffening of the great muscles of the thigh.



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A transverse fracture usually obtains, one portion of the bone remaining fastened by the stiff ligament, the upper portion usually being pulled some distance—half an inch to two inches—away by the thigh-muscles. Treatment of this accident may be by rest, and by bringing the parts together after absolute muscular relaxation, further keeping them in position by a plaster of Paris bandage; or it may consist of the surgical procedure of wiring. In this operation an incision is made and the two fragments are firmly fastened in position by means of silver wire. Plaster bandages are worn for several months, as in the conservative operation, and the results will vary greatly, according to the skill of the surgeon, the severity of the injury, and the personal equation of the patient's own bone-vitality. The results in both instances are fairly satisfactory. A stiff knee may follow the surgical operation; a weak knee is always to be expected.

**Pat'en** (Latin, *patina*, a plate or dish), in ecclesiology, the plate or salver on which is placed the element of bread in the eucharistic service. In ancient times it was often made of wood or glass; but as the church became more wealthy, patens were made of gold or silver, some richly ornamented with gems and enamels.

**Patent Office, United States.** See PATENTS, THE LAWS OF.

**Patents, The Laws of.** The extraordinary industrial and commercial development of the United States during the 19th century was due primarily to three causes: physical, social, legislative. The extraordinary natural wealth of the country was not fully appreciated even 25 years ago. Its vast agricultural possibilities were disclosed earlier in the century with the opening up and development of the great West. Its abundance of forest lands, of course, were recognized, but not its great mineral resources, its great deposits of copper, its high grade iron ores, and the full meaning of the contiguity of these iron ores to vast coal fields bearing the richest deposits. These physical resources, however, might not have yielded to such rapid growth were it not that a race of men was at hand singularly adapted to carrying forward the work of the country's development. The aggressiveness, courage, energy and brains necessary for the work were the result in part, perhaps, of the assimilation of strong men of different nationalities, and partly, perhaps, to the energy derived from climatic conditions. The vast industrial development, however, which has gone forward with leaps and bounds in all sections of the country, would have been impossible had it not been for the wise laws which more than anything else have served as a stimulus to such development. It has been estimated that seven eighths of our industrial enterprises are dependent directly or indirectly upon our Patent System, or that such enterprises owed their being originally to our Patent Laws. The beneficence of our Patent System is now pretty generally recognized, but this attitude is of comparatively modern growth. The prejudice which existed against patents as monopolies during the 18th century and the early part of the 19th century was a perfectly natural one.

**Patent History.**—The granting of patents to individuals or guilds was of very early origin

and reached its greatest abuse in England during the reigns of Elizabeth and James, when the granting of exclusive monopolies under letters patent to individuals or corporations for the manufacture or sale of certain classes of commodities or luxuries, was an easy although scandalous method of filling the royal exchequer. The early monopolies were of two kinds, Legal and Illegal. To the first class belong such as are conferred on the inventors of a new manufacture or the introducer of new trade, and to the second class belong the exclusive grants to individuals or corporations to manufacture and sell commodities or necessities of life, such as salt, tobacco, etc., thereby restricting trade and preventing those who had established such industries from obtaining a livelihood therefrom. The famous Statute against Monopolies, 1623, put an end, however, to these abuses, but the word "patent" carried unfortunately the taint of its early abuse, and for a century or more patents were looked upon askance. The law of patents in its modern significance, however, did not begin to be understood until the 19th century had dawned. In the United States the law of patents rests not upon common law, but upon statutory provision. In early colonial days patents were issued by the Colonial governments. The earliest patent issued in this country appears to have been granted by the General Court of Massachusetts Bay Colony, in October 1641, to one Samuel Winslow for a process of manufacturing salt. The term of the patent was for ten (10) years and the grant was conditional upon works being established within the year. In 1656 Massachusetts Bay Colony granted a patent to John Winthrop, son of Governor Winthrop, with the "sole privilege of manufacturing salt after his particular method" for a term of twenty (20) years. Massachusetts, Connecticut, and Pennsylvania were the principal members of the thirteen original colonies which granted patents. The Articles of Confederation, adopted 12 July 1776, contained no provision for the granting of patents, but the States issued patents independently as the colonies aforesaid had previously done. In 1785 James Rumsey obtained patents from the States of Maryland, Virginia, Pennsylvania, and New York, for a new type of boat which during the previous year had had a trial on the Potomac River in the presence of George Washington.

The authority granted to Congress for the enactment of legislation affecting patents is derived from that section of the Constitution which empowers Congress to make laws which will promote the progress of the useful arts.

The first patent laws of the United States were enacted in 1790, and the person who had the honor of receiving the first patent issued by the United States was Samuel Hopkins of Vermont. The patent bore date of 31 July 1790, and was for a process of making pot and pearl ashes. If this early parchment is still in existence, the owner is a fortunate man, for the document is certainly a historical curio. It possesses a special interest as it bears the signatures of George Washington, as President, Thomas Jefferson, Secretary of State, and Edmund Randolph, Attorney General. All the early patents bore the signatures of the Presidents of the United States, were usually embossed on vellum in folio size and bore the great seal of the United



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States. Three patents were issued in 1790 and 55 in all under the Act.

The attitude of the public and of the courts up to this time was antagonistic to patents as a rule. The old prejudice against monopolies still lingered in the minds of man, and the vast advantages to be gained by liberal laws as a stimulus to invention were not yet understood. If a question of right under a patent were brought up for trial, the presumption was generally against the claims of the inventor. As time passed, however, and a broader and more intelligent spirit prevailed, more favorable laws were enacted and a more generous interpretation of old laws crept in. Under the earlier dispensation the inventor was obliged to meet the enormous outlay that the securing of a patent demanded, or he kept his invention secret. The latter method has resulted in so many cases in what are known as lost arts.

The patent statutes received the serious attention of Congress in the late 30's and a number of Acts were enacted, which placed the patent system on a substantial basis. The interest taken in the patent laws and the public demand for an extension of the system are evinced by the fact that new statutes were enacted in the years 1836, 1837, 1839, and 1842.

*What is a Patent?*—The term *patent* or *letters patent* is derived from *litteræ patentes*, signifying that which is open or disclosed in contradistinction to *lettre de caché*, that which is sealed or secret. This term is the keynote of the whole principle upon which the patent system is built up, namely, disclosure. The disclosure must be honest, absolute and unreserved. The penalty for mental crookedness or for ignorance in giving out fully and freely the nature of the invention is severe and direct and is nothing less than forfeiture of the patent itself. The reason for this is perfectly logical and arises from the very meaning, spirit and nature of the relationship existing between the patentee and the government. The term of a patent is 17 years. During this term of 17 years the patentee obtains a monopoly under which he secures exclusive right of manufacture, use and sale. The patent itself, however, is in the nature of a contract between the patentee and the government, presumably for their mutual benefit. The government grants to the inventor the exclusive right of manufacture and sale for 17 years on condition that the inventor shall disclose fully the nature of his invention or discovery, and shall allow the public the unrestricted use of the invention after this term has expired. If he fail in making full disclosure, he has not lived up to the terms of the implied contract and the patent thereby becomes null and void. It sometimes happens that an inventor discloses freely part of the invention, but cunningly conceals some essential step in the process, but if the case is tested within the courts and the real facts are brought to light, the patent will be declared invalid. At the end of the term of 17 years the patent becomes public property, and the article may be freely manufactured by any one. It can never thereafter, as in so many cases in the Middle Ages, become a lost art.

*Who May Obtain a Patent?*—In order to secure a valid patent, the applicant must declare upon oath that he believes himself to be the true,

original and first inventor or discoverer of the art, machine, manufacture, composition or improvement for which he solicits a patent; that he does not know and does not believe that the same was ever before known or used; and that the invention has not been in public use or on sale in the United States for more than two years before the application was filed, and that the invention has not been described in any printed publication for more than two years prior to the filing of the application. Any one who can subscribe to the above conditions may apply for a patent, irrespective of race, color, age, or nationality. Minors and women and even convicts may apply for patents under our law. The rights even of a dead man in an invention are not lost, for an application may be filed in his name by his executor or administrator, and the rights of his heirs thereby safeguarded. The patent in this case would issue to the executor or administrator and would become subject to the administration of the estate like any other property left by the deceased. Even the rights of an insane person may not be lost, as the application may be filed by his legal guardian. If foreign patents for the same invention have been previously issued, having been filed more than 12 months before the filing of the United States application, the patent would be refused. The applicant must state his nationality. It often happens that two or more individuals have jointly worked upon the invention, and in this case the several inventors should jointly apply for the patent. Should they not so apply the patent when issued would be invalid. If they are merely partners, however, and not co-inventors, they should not apply jointly for a patent, as the inventor alone is entitled to file the application. He may, however, assign a share in the patent to his partner, coupled with the request that the patent should issue to them jointly. It is of the greatest importance that these distinctions should be clearly understood; otherwise, the patent may be rendered invalid.

*What May be Patented?*—Any *new and useful* art, machine, manufacture or composition of matter, or any new and useful improvements thereon. The thing invented must be *new and useful*. These are conditions precedent to the granting of a patent. Of these two conditions by far the more important is the former, and it is concerning the interpretation of this word "new" and its bearing upon the invention that the principal work and labor involved in passing an application safely through the Patent Office is involved. When the invention has been worked out by the inventor and he is prepared to file his application, his attorney prepares the necessary papers, as provided for by law, namely: An Oath, a Petition, a Specification consisting of a description of the invention and concluding with claims which specifically set forth what the inventor claims to be the novel features of the invention, and drawings which are prepared and filed with the case, and in due course the application is ready for examination in the Patent Office. The question of whether the invention is *new* is then considered, and the burden of proof that the invention is not new rests upon the Patent Office. The examination consists in searching through the files of the Patent Office among the patents that have been already



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issued, and through such literature as may bear upon the subject. If any reference is discovered that anticipates the invention, as defined by the claims of the specification, the applicant is informed of the fact, and he is allowed to amend his papers and narrow the claims so as to avoid the prior patents, if possible. If his attorney considers the position of the Patent Office untenable, he may present arguments to show wherein he believes that the inventor is entitled to a patent. It is thus seen that the question of whether an invention is new is one of fact, and one of the greatest importance, and upon the showing that the inventor is able to make during the prosecution of the case, depends largely the future success of the patent. The evidence adduced in proving that the invention is not new must be tangible and accessible. A patent would not be refused or overturned on a mere mental concept. There must be some evidence of a substantial character that serves to show that the earlier idea was reduced to practice or at least that there was such a description or drawing made, as would be sufficient for one skilled in the art to reduce the invention to practice. If it has not been actually reduced to practice, it must be a concrete not an abstract idea.

It is essential that the application for a patent should be filed before the invention has been in public use or on sale for a period of two years. If the inventor has publicly used or sold his invention for a period of two years, it becomes public property and he cannot regain the right to obtain a patent. He may, however, make models and experiment with his invention for a much longer period, provided he does not disclose his invention to the public or put it into actual use or on sale for a period of two years. The word "useful" is not one which usually gives either the Patent Office or the inventor a great deal of trouble, as any degree of utility, however insignificant, will serve to entitle the inventor to a patent. It has often happened that an invention which appears, at the time the patent is applied for, to have no special utility, in later years owing to new discoveries or improvements in the arts is found to possess the greatest merit and value. Unless an invention is positively meretricious, therefore, it is difficult to assume that it either has no utility or never will have any. Patents are granted for "any new and useful art, machine, manufacture or composition of matter, or any improvement thereon." It is seen from the terms of the statute that almost any creature of the inventive faculty of man becomes a proper subject for a patent. The exceptions are very few. Patents will not be granted, for example, for any invention that offends the law of nature. Under this category may be mentioned perpetual motion machines. In case an application of this character is presented, the Commissioner politely informs the applicant that the matter cannot be considered until a working model demonstrating the principle of the invention has been deposited in the Patent Office. Inventions of an immoral nature will not be considered. Medicines and specifics are not now proper subjects for letters patent, unless some important new discovery is involved.

*Patented Articles Must be Marked.*—Arti-

cles manufactured and sold under a patent must be so marked that the public shall have notice that the article is a patented one. This notice consists of the word "Patented," together with the date when the patent was issued or the Serial Number of the patent. Damages in an infringement suit can not be recovered unless the defendant has received such notice that the article is patented. The term of a United States patent is 17 years. This term cannot be extended except by special Act of Congress. It is many years since a bill seeking an extension of the term of a patent has been passed by Congress.

*Appeals.*—If an application for a patent has been rejected, the applicant may appeal from the Primary Examiner to the Board of Examiners-in-Chief. He may further carry the appeal to the Commissioner of Patents, and in case he is not satisfied with the latter decision, he may carry the appeal finally to the Court of Appeals of the District of Columbia.

*Interference.*—If two or more individuals shall have invented the same thing at or about the same time, interference proceedings may be instituted to determine which applicant is the original or first inventor. Interference proceedings are instituted between applicants whose applications are pending or between a pending application and a patent already issued, provided the latter patent has not been issued for more than two years prior to the filing of the conflicting application. The proceedings are conducted before the Examiner of Interferences. Appeal may be taken from the Examiner of Interferences to the Board of Examiners-in-Chief, and from the Board of Examiners-in-Chief to the Commissioner, and thence to the Court of Appeals of the District of Columbia. Not all the claims for a patent are necessarily involved, only such as cover the particular feature of the invention which is declared to be in interference. The unsuccessful applicant by eliminating the claims or claim in controversy may procure allowance of the other claims not objected to, and have the patent issued. In determining the question of priority of invention, witnesses are examined and the proceedings are conducted much in the same manner as in a suit at law. The first step in the proceeding consists in filing with the Commissioner a Preliminary Statement made under oath, giving the date at which the invention was first conceived and reduced to some tangible form, such as the making of drawings, the construction of a model, or the disclosing of the invention to another. The object of the subsequent examination and cross-examination is to substantiate the date of invention as claimed by the applicants respectively, and to establish the priority of invention.

*Infringement.*—In case of an action for the infringement of a patent, the importance of the question of novelty appears from the special pleadings which the defendant may enter, which are as follows:

1. That for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect; or,

2. That he had surreptitiously or unjustly



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obtained the patent for that which was in fact invented by another, who was using reasonable diligence in adapting and perfecting the same; or,

3. That it had been patented or described in some printed publication prior to his supposed invention or discovery thereof; or,

4. That he was not the original and first inventor or discoverer of any material and substantial part of the thing patented; or,

5. That it has been in public use or on sale in this country for more than two years before his application for a patent, or had been abandoned to the public.

Damages for infringement of a patent may be recovered by action on the case in the name of the patentee or his assignee. The courts having jurisdiction over such cases have the power—(1) To grant injunctions against the violation of any rights secured by the patent; (2) to allow the recovery of damages sustained by the complainant through such infringement. In such a case the defendant is compelled to furnish an accounting showing the amount of the articles manufactured and sold and the profits derived from such sale.

*Design Patents.*—Design patents are issued for any new or original design, whether it be a work of art, statue, bas-relief, design for prints or fabrics, or for any new design or shape or ornament in any article of manufacture. The scope of the design patent was formerly very broad, but recent decisions and enactments have greatly restricted its availability and a design patent cannot now be obtained unless it possesses some inherent artistic quality. Mere utility is not sufficient to entitle a new design to letters patent. The terms of design patents are  $3\frac{1}{2}$ , 7 or 14 years.

*Caveats.*—Any one who has made a new invention or discovery, which is not yet completed or perfected, may file in the Patent Office a caveat, describing his invention, said caveat serving as notice to the Patent Office that the caveator is in possession of a certain invention partly developed, for which later he proposes to file an application for a patent. The caveat is filed by the Commissioner in the secret archives of the Patent Office, and is operative for a term of one year. The term may be prolonged from year to year by the payment of a small fee. The caveat should not be confounded with a patent, for it gives the inventor no real protection or monopoly. It simply entitles him to notice in case another inventor files an application for the same invention. In this event the caveator is entitled to three months' grace within which to file his patent application, whereupon an interference will be declared between the two inventions.

*Assignments.*—A patent or any interest therein may be sold or assigned like any other piece of property. An inventor may sell or assign his interest or a part interest in his invention, either before the application is filed or while the application is still pending. Under these circumstances the patent may be issued to the assignee or to the inventor and assignee jointly. The patent if already issued may be assigned by the owner whether he be the inventor or an assignee. The conveyance is effected by an instrument in writing stating the conditions under which the patent is assigned,

and the assignment should be recorded in the Patent Office.

### FOREIGN PATENTS.

*Canada, Dominion of.*—The laws of Canada follow somewhat closely the practice in the United States. The term of a patent is 18 years. The general practice, however, is to divide the fees making payment only for a term of six years at one time. Applications are subjected to examination as to novelty and usefulness, as in the United States. The application must be filed in Canada within one year of the date issue of the United States or other foreign patent. If the inventor neglects to file his application within the 12 months, the invention becomes public property. It is not permissible to import the patented article into the Dominion after 12 months from the date of the Canadian patent. Within two years from said date the manufacture and sale of the article under the patent must have been begun. These exactions may be relaxed under certain conditions.

*Great Britain.*—The term of the patent is 14 years. Under the Patent Act of 1902 which went into force on January 1, 1905, a limited examination is made to ascertain whether the examination is novel. In the examination, the Patent Office officials refer to all British patents, the applications for which were filed during the fifty years immediately preceding the filing of the application which is being examined. This examination is more thorough in its scope than would at first appear, as a publication in a patent or periodical outside of Great Britain will not in itself prevent the grant of a valid British patent. The application should, however, be filed before the invention is published in public print or becomes publicly known in Great Britain. In Great Britain the true inventor should apply for the patent in his own name; but if the invention has been conceived in a foreign country, the first introducer may obtain the patent whether he be the true inventor or not. Under these circumstances, therefore, a foreign assignee may apply for the patent in his own name without the true inventor being known. After the fourth year there are annual taxes, gradually increasing in amount.

*France.*—The term of a patent is 15 years. There is no examination as to novelty, and the patent is granted to the first applicant whether or not he be the true inventor. The life of the patent depends upon the payment of annual taxes. The patent must be worked in France within two years from the date of issue. If these conditions are not complied with, the patent becomes public property.

*Germany.*—The term of a patent is 15 years. The patent is issued to the first applicant, but if he is not the true inventor he should, before filing the application, obtain the written consent of the inventor. The application is subjected to a rigid examination. The patent is subject to an annual progressive tax, and must be worked within a period of three years.

*Austria.*—The term of a patent is 15 years. The practice is somewhat similar to the practice in Germany, although the examination is generally not so exacting. The patent is subject to an annual tax and it must be worked within a period of three years.

*Hungary.*—The term of a patent is 15 years. The laws are similar to those of Germany



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There is a progressive annual tax and the patent must be worked within a period of three years.

*Belgium.* — The term of a patent is 20 years. The first applicant obtains the patent whether or not he is the true inventor. There is a small annual tax, and the patent should be worked within one year of the working elsewhere.

*Italy.* — The term of a patent is 15 years. The patent is granted to the first applicant. The patent is subject to an annual tax, and the working must take place within two years.

*Russia.* — The term of the patent is 15 years. The patent is subject to the payment of annual taxes and must be worked within five years.

*Spain.* — The term of the patent is 20 years, subject to the payment of annual taxes. It must be worked within three years. The patent is issued to the first applicant whether or not he be the true inventor.

*Switzerland.* — The term of the patent is 15 years, subject to an annual tax. Working must take place within three years. Only the true inventor or his assignee can obtain a patent.

*Norway.* — Term of patent is 15 years, subject to a small annual tax. The patent must be worked within three years. The application must be filed in the name of the true inventor or his legal representative. Application must be filed within six months of the publication of any prior patent.

*Sweden.* — Term of patent is 15 years, subject to payment of an annual tax. The conditions are very similar to the laws of Norway, but the application should be filed before the issuing of a prior foreign patent.

*Denmark.* — The laws are similar to those of Sweden.

*Portugal.* — The term varies from one to fifteen years, the fees payable depending upon the term of the patent.

*Holland* has no patent laws.

*Commonwealth of Australia.* — Following the Act of Confederation in Australia the patent laws underwent an entire revision. The law now in force enables an inventor, under one application, to protect his invention in the six States forming the Commonwealth. The States which have confederated forming the Commonwealth are Victoria, New South Wales, Queensland, South Australia, Western Australia and Tasmania. New Zealand is not a member of the Commonwealth. The inventor or his assignee should apply for the patent. The application should be filed before the invention is publicly used or published in Australia, though a publication made more than 50 years ago is not a bar to the grant, unless it is shown that the invention has been used in Australia within 50 years. The term of the patent is 14 years, a tax being due before the expiration of the seventh year. When a patent is not worked within two years, the patentee may be compelled to grant licenses on such terms as the Court may deem just.

*New Zealand.* — The application should be filed before the invention becomes publicly known or is publicly used in New Zealand. The inventor or his assignee should apply for the patent. The term of the patent is 14 years, taxes being due before the end of the fourth and seventh years.

*British India.* — The patent is granted for 14 years, and closely follows the British practice. The application should be filed within one

year of the issue of the patent in any other country.

*Porto Rico.* — It is possible to procure protection for industrial property by registering a certified copy of the United States patent with the Civil Governor and complying with the other legal formalities.

*Philippines.* — The *modus operandi* is the same as that just described as applying to Porto Rico.

*Cuba.* — Since Cuba has become an independent republic, it has established a patent system. The term of the patent is 17 years. Working should be established within one year. No taxes after the issue of the patent.

*Mexico.* — The term is 20 years. No taxes are due after the issue of the patent.

*South American Republics.* — Patents are issued by all the South American republics. The principal countries in which patent protection is sought are Brazil, in which the laws are quite favorable to foreigners, Chile and Argentina. Patents are also frequently secured in Venezuela, Peru, Ecuador, Colombia, and Paraguay, but only for certain classes of invention, owing to the expense involved in procuring the patents.

*South Africa.* — Patents are obtainable in four important states, Cape Colony, Transvaal, Kongo Free State, and Orange Free State.

*Japan* has recently enacted a system of patent laws on a liberal basis.

*China* has no patent laws nor patent office.

The conditions under which foreigners may file applications in the countries having patent laws vary very greatly and no attempt has been made to specify under what conditions applications may be filed. In most countries, however, the issuance of a prior foreign patent will either defeat the issuance of the patent subsequently applied for in another country, or will render the patent invalid even if it is issued. Great care should be taken, therefore, to avoid having a foreign patent issue at such a time as to endanger the life of the patent at home.

*International Union for the Protection of Industrial Property.* — The members of the union are Great Britain, United States, France, Germany, Switzerland, Spain, Belgium, Italy, Netherlands, Denmark, Norway and Sweden, Portugal, Mexico, Servia, Tunis, Brazil, Guatemala, San Domingo, Queensland, New Zealand, Dutch East Indies, Dutch West Indies, Japan, and Cuba. The subjects or citizens of each of the contracting states shall enjoy, in all the other States of the Union, so far as concerns patents for inventions, trade or commercial marks, and the commercial name, the advantages that the respective laws thereof at present accord, or shall afterward accord, to subjects or citizens.

It is not possible in the short space allotted for this article to explain at length the various provisions of the treaty. Suffice it to say that one of the principal advantages gained by the union is the greater liberality shown to inventors and the extension of the term within which they may apply for patents in foreign countries. Under the provisions of the Industrial Union, patents which would be lost or rendered invalid by the premature issuance of a prior foreign patent may thus be saved. By examining the list given above, it will be observed that all the principal countries in the world have become members of the union with the exception of Austria and Hungary, Russia and Canada.



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*The Patent System an Industrial Foster Parent.*—Probably there can be no better way of estimating the debt which the country owes to the Patent System than by considering the growth of certain industries whose existence is dependent, either directly or derivatively, upon the patent laws. In the class of agricultural implements it is interesting to note that in 1850 the amount of capital engaged in this class of industry was only \$3,564,202. The growth has been startling and continuous as will be seen from the fact that the capital in 1860 had increased to \$13,866,389. In 1900 it had increased to \$157,707,951, while the value of the products had increased from \$20,831,904 in 1860 to \$101,207,428 in 1900, giving employment to 46,852 wage-earners. It is also interesting to note that through the entire range of agricultural implements from the crudest implement to the most complicated machine, the evolution is dependent almost entirely upon the patented improvements which have produced newer and better articles and at the same time greatly cheapened the cost of production. In the class of sewing-machines the increase has been no less rapid. In 1860 the capital engaged in this class of enterprise was \$1,494,450; in 1900, the amount of capital had risen to \$20,072,800; whereas the value of the finished product had risen from \$4,403,206 to \$21,129,561. The bicycle industry is another industry which is largely dependent upon the patent system. In 1890 there were only 27 bicycle manufacturers in the United States; in 1900 there were 312, and the value of the product had increased from \$2,568,326 to \$31,915,908, and the capital in about the same ratio, the increase being from \$2,058,072 to \$29,783,659; employment being given to over 17,000 employees. The typewriter industry is almost entirely dependent upon patents, the increase being also striking. In 1890 there were 30 establishments, employing a capital of \$1,421,783, and producing a product of \$3,630,126; whereas in 1900, there were 47 establishments employing a capital of \$8,400,431, and producing a product of \$6,932,029. In electrical apparatus the inventions which have made possible the enormous growth of this industry, have been almost entirely dependent upon patented inventions. In 1880 there were only 76 establishments and the capital employed amounted to \$1,509,758; in 1900, there were 580 establishments and the capital invested amounted to \$83,130,943, while the value of the product had increased from \$2,655,036 to \$91,348,889. The first phonographs and graphophones were produced in 1877. The annual products from this industry in 1900 amounted to \$2,246,274. There are over 7,700 establishments engaged in the manufacture of photographic materials and apparatus. The capital of these establishments amounts to \$18,711,339, and the annual product amounts to \$31,038,107. Many chemical processes are dependent entirely upon patents. In a minor way it may be mentioned that \$3,226,646 are employed in the manufacture of oleomargarine, yielding an annual production of \$12,499,812. Over \$41,000,000 are engaged in the manufacture of glucose, yielding products to the value of over \$21,000,000. The wood pulp industry is one which is dependent for its existence upon the patent system. It originated with the wood

pulp patent of Volter in 1858, following with the soda fibre and sulphite fibre processes, and now gives an annual paper yield amounting to over \$18,000,000, while the price of paper has never been less than during the past decade. To Charles Goodyear is due the great impulse given to the rubber industry, owing to the introduction by him of the process of vulcanization. The amount of rubber and elastic goods and rubber boots and shoes now manufactured amounts to \$93,716,849. The wonderful improvements which have been made in the iron and steel industry have originated in almost every case from patented inventions. In 1900 the number of blast furnaces, rolling mills, forges and bloomeries comprised 668 establishments, with a capital of \$573,391,663, employing 222,490 wage-earners, who receive in wages \$120,820,276; with products to the value of \$803,968,273. These figures would of course be greatly increased if the capital included the issued certificates of the United States Steel Company. The records of the printing industry are full of interest, owing to the number of establishments of which there is a record in the United States, amounting to 15,305. The capital employed amounts to \$192,443,708, and the amount of products \$222,983,569. It is safe to say that almost every article which the printer touches owes its origin to some patented device or apparatus.

The growth of the Patent System is also well illustrated by noting the increase in the number of patents issued from year to year. Between 1790 and 28 July 1836, only 9,957 patents had been issued. Between the years 1836 and 1850, 6,980 were issued, making a total of 16,937 up to 1850. During the year 1850, 884 patents were issued; during the years 1905-6, 31,837 patents were issued, and up to 1 July 1906 the total number of patents issued amounted to over 850,000.

*The Patent Office.*—The Patent Office is not an independent department of the government, but is a branch of the Department of the Interior. The Patent Office force in November 1903, consisted of the Commissioner of Patents, 266 examiners, including 39 principal examiners, 1 examiner of interferences, 3 examiners-in-chief, and 223 assistant examiners of various grades. The entire force of the Patent Office, including clerks, stenographers, messengers, etc., amounts to 722 persons. The department is housed within the Patent Office building at Washington. The quarters, however, are extremely cramped and inadequate, as a large part of the building is devoted to the use of the Department of the Interior. The fact that more modern and commodious quarters are not allotted to the Patent Office, is due to no lack of funds on the part of the patent department, which is a paying institution. The business of the office shows a profit during the fiscal year ending 30 June 1906, of \$273,148.44; this being the total excess of receipts over expenses for the fiscal year. The balance in the United States Treasury due to the Patent Office amounted on 1 Jan. 1905, to \$5,863,866.76. The annual surplus amounts to some \$150,000, but the Patent Office is not allowed to make use of this sum, as it can only use the amount of funds provided by Congress for the running



expenses of the office. This amount is often inadequate, and the work of the office is often hampered by lack of funds. It is possible that at some future time the large fund now deposited in the United States Treasury to the credit of the Patent Office may be used in the erection of a more modern and commodious building, as every effort should be made to perfect and facilitate the work of this most important department of the Government.

CHARLES ALLEN MUNN,  
*Managing Editor 'Scientific American.'*

**Pater**, pā'tēr, **Walter Horatio**, English essayist: b. London 4 Aug. 1839; d. Oxford 30 July 1894. He was educated at King's School, Canterbury (which he describes most exquisitely in his "imaginary portrait" of 'Emerald Uthwart') and Queen's College, Oxford, and in 1864 became a fellow of Brasenose College. He had at first intended to take orders in the Church of England, and then, as his views changed, had thought of becoming a Unitarian minister, but in 1864 he had abandoned both projects, and while perhaps not entirely abandoning belief in Christianity came to regard religious themes from a standpoint almost purely philosophical. His first published work was 'The Renaissance: Studies in Art and Poetry' (1873), a work which brought him a select if not a wide circle of enthusiastic admirers. It was followed by 'Marius the Epicurean: his Sensations and Ideas' (1885), a highly subjective study of the mental history of a Roman youth represented as living in the time of Marcus Aurelius. These two works exhibit to the full their author's peculiar characteristics of style—the most precise statement of thoughts and impressions, the utmost delicacy and refinement, and rhythm whose charm is rarely surpassed, but also a subtlety that perplexes and obscures at times, and a serious want of vigor. While 'Marius' remains, perhaps, his greatest achievement, his 'Imaginary Portraits' (1887) is his most thoroughly delightful work, and in the same vein as the four stories in this volume are 'The Child in the House' (1894) and the 'Esmerald Uthwart' and 'Apollo in Picardy' included in the 'Miscellaneous Studies' (1895). His other volumes comprise: 'Appreciations' (1889); 'Plato and Platonism' (1893); 'Gaston de Latour,' an unfinished romance (1897); 'Greek Studies' (1897). Pater's style is peculiarly his own and represents the extreme limit of ultra-refinement attained in English prose in the 19th century. It does not stimulate, it is true, but its charm is very great. Consult Greenslet, 'Walter Pater' (1903).

**Pat'era**, an ancient vase or plate usually made of gold, silver, bronze, or marble, in which the Greeks and Romans offered wine to the gods at festivals and sacrifices. In architecture, the representation of a cup, usually in bas-relief, and employed to decorate friezes.

**Paterculus**, pa-tēr'kū-lūs, **Gaius Velleius**, Roman historian: b. Campania about 19 B.C.; d. after 30 A.D. In boyhood he entered the army, and later was with Tiberius in Germany, Pannonia, and Dalmatia. He was a favorite with Tiberius, and when the latter became emperor in 14 A.D. he made Paterculus prætor. Further details concerning his life are lacking, but his death is supposed to have occurred at the hands of a

former friend, Sejanus, about 31 B.C. His reputation as a historian rests chiefly upon his 'Historiæ Romanæ,' which purports to be a universal history though really dealing chiefly with that of Rome. It begins with a full and valuable account of the fall of Troy, but is unfortunately not quite complete. The style is excellent and the character drawing is forcible. There have been many editions of the work, among them: Burmann's (1719); Ruhnken's (1779); Orelli's (1835); Halm's (1876); etc.

**Paternoster**, pā'tēr-nōs'tēr, the opening words of the Latin version of the Lord's prayer, hence employed to denote the prayer itself. This prayer was given on two different occasions: first, in the sermon on the mount, when Christ, addressing the multitude, warned them against the vain repetitions of the hypocrites and heathens in prayer. On the second occasion it was cited to certain of his disciples, when it was introduced by the words, "When ye pray, say, Our Father" (Luke xi. 2-4.) Its use in the liturgy or Holy Communion service is frequently alluded to in the writings of the early church fathers. So deep was the veneration for it that none but baptized persons were allowed to use it. Among the earliest patristic writings after the apostolic age there are two commentaries on this prayer—one by Tertullian, and another by Cyprian—both written within about a century and a half after the death of Saint John the Divine.

**Paterson**, **John**, American soldier: b. New Britain, Conn., 1744; d. Lisle (now Whitney's Point), N. Y., 19 July 1808. He was graduated from Yale in 1762, engaged in law practice at New Britain, but in 1774 removed to Lenox, Mass., where he continued his practice, and in that year was elected a member of the Provincial Congress. In 1775, after the battle of Lexington, he joined the Federal army; under his supervision the first redoubt at Boston was constructed, and he defended it with his men at the battle of Bunker Hill. He served in Canada, and later under Washington in New Jersey, participating in the battles of Trenton and Princeton. In 1777 he was made brigadier-general; in the battle of Stillwater and at the defeat of Burgoyne performed distinguished service, and later was at the battle of Monmouth. He was mustered out of service as major-general in 1783, and subsequently joined the militia during Shays' Rebellion in 1786. In 1794 he removed to Lisle, N. Y., afterward served four terms in the Legislature and was the first presiding judge of Broome County, N. Y. He was member of Congress in 1803-5 and subsequently lived in retirement.

**Paterson**, **Robert** ("OLD MORTALITY"), Scottish stonemason: b. near Hawick, Scotland, 1715; d. Bankend, England, 29 Jan. 1801. He served his apprenticeship as a stonemason with his brother near Lochlaben, and in about 1740 married and rented a quarry, making a business of carrying gravestones to Galloway. His house was burned, and he was taken prisoner on the retreat of Prince Charles in 1745. While in England he became so interested in restoring and erecting headstones on the graves of the Covenanting martyrs that when released he remained with his family only a short time, and in 1758 deserted them, devoting the remainder of



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his life to the "unusual business of his pilgrimage." The story was told to Scott by Joseph Train and became the foundation of the former's novel, 'Old Mortality.'

**Paterson, William**, English financier, founder of the Bank of England: b. Skipmyre, Dumfriesshire, April 1657; d. London January 1719. He was brought up in England, may have been a peddler in his early days, but soon became a well-to-do merchant, and at 23 a member of the Merchant Taylors Company. He took part in planning the revolution of 1688; as early as 1691 proposed the formation of the Bank of England and in 1694 became one of its directors. In 1695 he attempted to carry out a long cherished scheme of a free commonwealth and emporium of trade in Darien; the colony was entirely unsuccessful, and Paterson for a time lost his reason. On his return to Great Britain he promoted the Walpole Sinking Fund, the scheme of 1717 for the conversion of the national debt, and the Union of Scotland and England. Paterson wrote several pamphlets on economic and political questions. Consult the 'Life' by Bannister (1858).

**Paterson, William**, American jurist: b. at sea 1745; d. Albany, N. Y., 8 Sept. 1806. He was brought to America by his parents when a child, was graduated from Princeton in 1763, admitted to the bar in 1769 and engaged in practice in New Jersey. In 1776 he was a delegate to the New Jersey State constitutional convention and was appointed attorney-general of the State in that year, which office he held for 10 years. He was a delegate to the Continental Congress in 1780-1, and in 1787 a member of the National constitutional convention, where he proposed the "New Jersey plan," which was to leave in the hands of the "sovereign States" practically all laws excepting those concerned with regulating commerce, levying duties, and providing the means of war. There was to be one legislature, in which each State should have one vote, and all executive and judiciary committees were to be removable by Congress. This plan was opposed by Edmund Randolph, who presented the plan for a national government, and ultimately the two plans were merged in one and adopted. He was United States Senator from New Jersey 1789-90, governor of New Jersey 1791-3, and was appointed by Washington associate justice of the Supreme Court in 1793. The city of Paterson, N. J., was named in his honor, and his letters have been published and edited by Mills, entitled 'Glimpses of Colonial Society and the Life of Princeton College 1766-1773, by One of the Class of 1763' (1903).

**Paterson, N. J.**, industrial city, the third in population in the State and the capital of Passaic County, situated 17 miles northwest of New York city, on the Passaic River, which for several miles, on the east and north, forms the boundary line of the municipality. The city is built chiefly on a plain surrounded on the north and west by high hills. A portion of the town, however, is situated on the hills rising from the north bank of the river and on the high ground around the point where the Passaic River makes its way through the hills and descends to the level of the plain over the celebrated Passaic Falls. The descent is about 70 feet; the perpen-

dicular fall being some 50 feet. In the abundant power afforded by this waterfall is found the reason for founding the city at this point, and its growth to one of the most important manufacturing centres of the country. Pop. (1840) 7,596; (1850) 11,334; (1860) 19,586; (1870) 33,579; (1880) 51,031; (1890) 78,347; (1900) 105,171. Of the population in 1900, 38,791 were of foreign birth. Three important railway lines pass through Paterson: the Erie; Delaware, Lackawanna & W.; and the New York, Susquehanna & W.

**Industries.**—Because of its great silk manufacturing industry Paterson is called "The Lyons of America." It is the principal silk manufacturing centre of the Western hemisphere. In 1900 the number of silk mills in the city was 136, with a total capital of \$19,025,564, employing 15,943 wage-earners (exclusive of salaried officers and clerks), whose total annual wages amounted to \$6,291,998. The value of the product of these mills was \$26,006,156. There were also 30 establishments engaged in dyeing and finishing textiles—almost exclusively silk—with combined capital of \$2,826,293, employing 2,707 workers, whose wages amounted to \$1,184,764. The total product of these dyeing establishments was valued at \$3,836,409. The total annual product of the silk manufacturing business, therefore, including dyeing and finishing, amounted in 1900 to \$29,842,565; this being considerably more than half the total value of manufactured goods of all kinds produced in the city. In 1902 according to the New Jersey bureau of statistics the value of the product of the silk industry had increased to \$32,896,717. Steel and iron manufactures rank second in importance. There were in this line 37 establishments with capital amounting to \$6,668,425, employing 3,854 wage-earners, who received \$1,844,745 in wages. The value of the product was \$5,906,517. In 1902 the product of this industry amounted, according to the State bureau of statistics, to \$10,117,480. The greater part of the steel and iron business is done by the two great corporations engaged in the manufacture of locomotives. This has long ranked second in importance among the industries of Paterson. The city having been one of the two or three earliest to engage in the manufacture of locomotives, it has ever since ranked among the most important centres in the country for this industry. Brewing ranks fourth in value of annual product. The capital invested is reported as \$5,685,849; number of persons employed 245, earning \$167,575, and the value of the product \$1,859,537. Condensed statistics as given in the U. S. Census Report for 1900 of the total manufactures of Paterson in 1890 and 1900, are as follows: Capital invested in 1890, \$27,603,549; in 1900, \$43,510,481. Value of products, 1890, \$42,263,531; 1900, \$52,287,975. Average number of wage-earners, 1890, 23,198; 1900, 30,190. Total wages, 1890, \$10,439,725; 1900, \$12,812,538.

The number and variety of smaller industries is considerable, and it is noteworthy that the decade above reported upon shows an increase of over 66 per cent in the number of establishments and 23 per cent in value of products.

**Banks.**—Paterson has three national banks with a combined capital and surplus of about \$2,000,000, and five savings banks and trust companies. The oldest of these, the Paterson Sav-



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ings Institution, has deposits amounting to \$10,000,000.

*Government.*—The city government comprises a mayor, elected for two years, 22 aldermen, commissioners of public instruction, park commissioners, commissioners of assessment of taxes, board of health and free public library trustees. The various commissions are appointed by the mayor, and, with exception of one or two, confirmed by the board of aldermen. The tax levy for the year 1903 was \$1,360,776.

*Education.*—The public school system is efficient and progressive. There are 21 public schools, including the high school and 19 school buildings. The number of pupils registered is 16,191 and the number of teachers employed, 393. The total appropriation for the department of public instruction is \$325,750, of which \$277,250 is required for salaries. There are also a half dozen or more private schools, some of them of excellent standing.

*Libraries.*—The Free Public Library is managed on progressive lines and is popular and successful. The building and all except some 3,000 of its 36,000 volumes were destroyed in the great fire of February 1902, but prompt measures were taken for re-establishment, and in two years 18,000 volumes had been collected in the temporary building, and a new, carefully planned and beautiful building, costing \$200,000, was far advanced toward completion. There are published in Paterson, five daily newspapers (one in German) and four weekly (one in Dutch).

*Religion.*—There are upward of 75 churches in Paterson, representing nearly all the principal denominations. The most prominent are the Presbyterian, Episcopalian, Methodist Episcopal, Reformed and Roman Catholic. There are also three Jewish synagogues. There are a flourishing Y. M. C. A. and Y. W. C. A., each with a handsome building. There are two large and well supported hospitals—the General Hospital and Saint Joseph's—also an isolation hospital for contagious diseases which is considered a model among institutions of its kind; two orphan asylums, an Old Ladies' Home, and a Children's Day Nursery with a building recently erected by Mrs. Garret A. Hobart.

*Parks and Cemeteries.*—About 6 miles of the more important streets of Paterson are paved with vitrified brick,  $3\frac{1}{2}$  miles with asphalt,  $4\frac{1}{4}$  "Belgian block," and some 63 miles are macadamized. Paterson has two parks of moderate area, but well kept, presenting pleasing examples of landscape gardening, and affording somewhat exceptionally picturesque and charming distant views. The parks are situated one at either end of the town and both border on the Passaic River. The Eastside Park contains 60 acres and the Westside 30 acres. Also situated one at the east, the other at the west side of the town, are two cemeteries, beautifully laid out. In Cedar Lawn Cemetery is the costly mausoleum of the late Hon. Garret A. Hobart, Vice-President of the United States.

*Public Buildings.*—The city contains a considerable number of handsome buildings. The most important buildings in the business section are the City Hall, and on the square surrounding it, five modern and costly bank buildings, several large office buildings, and a block below the building of the Paterson Savings Institution. Main Street contains large and handsome department stores of metropolitan character and ap-

pointments. The new County Court House is built of white marble at a cost of about \$400,000. Adjoining the Court House is the new Post-office. One block to the east of the City Hall stands the Hamilton Club, the handsomest club house in New Jersey. The most notable churches are the Church of the Redeemer, Presbyterian, Saint Paul's Protestant Episcopal, Saint John's Roman Catholic, and the Second Presbyterian. The Danforth Memorial Library building is perhaps the most notable and beautiful public building in the city. It was erected in 1903-4 as a memorial to the late Charles Danforth, with funds presented to the Public Library trustees by his daughter, Mrs. Mary E. Ryle.

*History.*—The town of Paterson was founded by, or had its origin in the "Society for Establishing Useful Manufactures," which was chartered by the legislature of New Jersey in 1791, and in the summer of 1792 the site, by the "Great Falls of the Passaic" was fixed upon as the location for the mills and the town. The charter of the society was drawn up by Alexander Hamilton, who was greatly interested in founding a system of American manufactures. He has often been considered the founder of Paterson, and there is evidence that he influenced the newly formed corporation in selecting the site for the town, but he appears to have had little connection with the enterprise afterward. Cotton manufactures were the first, and for many years the most important carried on, but have long since been superseded. Woolen and paper manufactures were also extensively carried on in the early and middle part of the last century, and it was in Paterson that Samuel Colt manufactured the first of his revolving pistols. His venture in Paterson, however, was not a success. The first locomotive manufactured in Paterson was finished in 1837 after 16 months' labor upon it. It was not until 1840 that the silk industry was successfully established by John Ryle, a young Englishman who had recently come to this country. From very modest beginnings silk manufacturing in Paterson has advanced in 60 years to the vast proportions shown in the statistics at the beginning of this article. At midnight on Saturday, 8 Feb. 1902, a fire broke out in the lower part of the city west of Main Street, and rapidly burned its way through the very heart of the business section of the town. The fire was not subdued until Sunday night. The Public Library, two bank buildings, five churches, the largest stores and other prominent buildings and about 250 dwellings were destroyed. The City Hall and the Hamilton Club, two of the best buildings in the city, were burned out, but the walls were left intact and the exteriors not seriously damaged. The total loss was \$6,000,000, on which insurance was paid to the amount of \$4,011,000. The mayor promptly declined all outside aid, the citizens raised a large fund for the relief of the destitute, and immediately set to work to rebuild the city far better than before. In less than a month another calamity came upon the city in the shape of the greatest flood ever known in the Passaic Valley. Great loss of property followed in Paterson, and hundreds of the poorer class were again driven from their homes. In October 1903 another great flood occurred, causing heavy loss. The city, notwithstanding, is prosperous and progressive.

G. F. WINCHESTER,  
*Librarian, Free Public Library.*



## PATHFINDER—PATHOLOGY

**Pathfinder**, a nickname given Gen. John C. Frémont (q.v.) because of his explorations of the Far West from 1837 to 1853.

**Pathfinder, The**, a novel by James Fenimore Cooper (q.v.), published in 1840. It takes its title from a nickname applied to the hero, Natty Bumpo, and is third in order of the so-called 'Leatherstocking' tales.

**Pathology**. (Gr. *πάθος*, suffering and *λογία*, doctrine of disease) is the science which treats of all departures from the normal condition of the animal or plant. Owing to the great range of variation in the anatomy and functional behavior of organs and tissues, it is difficult to set up a standard which may be considered as normal, and we are forced to adopt for this purpose the usual or average condition. Pathology treats of all abnormalities in the process of development of the individual and of their results. It considers all the untoward results of outward influences, be they physical or chemical, or of those more complex influences which we may designate biological, as well as those subtle characters of the organism itself which, often hereditary, render it more or less prone to these influences, and give it the power of arranging a protection for itself and recovering its normal state.

*Historical*.—Within recent centuries the various subdivisions of pathology have acquired such importance and have been so systematically studied as to constitute almost independent sciences. The science of pathological anatomy, for example, is a development of the last 300 years, while that of pathological chemistry dates only from the middle third of the 19th century. Pathology in its broad sense, however, must be recognized as existing, though in a crude and imperfect form, even in the very beginnings of science. Throughout the history of medicine the student must observe the distinction between the products of objective investigations—the direct observation of nature—and the ever-recurring philosophical or speculative systems of medicine built upon some fanciful or arbitrary foundation and rounded off with apparent logic to satisfy the innate cravings of man for order and completeness. To the former is due the real and steady progress of medicine, while only too often the systems based on speculation have retarded progress. Observation and hypothesis are, however, so mixed together and entangled that it is not possible to consider one without the other.

The earliest beginnings of pathology are to be found in the writings of the Hindus, Chaldeans, Chinese, and Egyptians, where, although medicine was under the sway of priests, and incantations were the main therapeutic agencies, there can still be recognized a vague knowledge of the more obvious diseases. In Greece the records contain only similarly obscure conceptions until about 400 B.C., when there arose the Hippocratic school, of which the most important writings are attributed to Hippocrates himself. The great services of this school lay in their separating medicine from religion, in making abundant accurate observations on the symptoms and course of diseases, and in instituting a rational hygienic and dietetic system in the treatment of disease. The pathology of Hippocrates was a humoral pathology with only the most meagre basis of anatomy or physiology,

inasmuch as human dissections were not practised. The next advances were made by the Greeks in Alexandria, where the study of anatomy flourished under Herophilus and Erasistratus about 300 B.C. In Rome, Celsus, Aretæus, and, above all, Galen, who flourished in the latter half of the 2d century, contributed not only to the knowledge of disease, but also to that of anatomy and physiology; and Galen, adopting and expanding the Hippocratic teachings, so welded together the knowledge of the times, filling the gaps by ingenious speculation, that his system, treating of the whole realm of medicine, became supreme in its apparent infallibility, and dominated medical thought and practice until the 16th century. During all this time no important advance was made, the literature consisting largely of compilations and translations, preserved and transmitted to western Europe by the Arabs, all difficulties being decided by a reference to the authority of Galen.

With the revival of learning and the introduction of the practice of dissecting the human body there arose those great medical reformers, Vesalius and Paracelsus, who pointed out errors in Galen's system. The former overthrew his supremacy so far as it referred to anatomy, and the latter endeavored to break the shackles of all authority and tradition. In the 17th century Harvey by his discovery of the circulation of the blood completed this overthrow from the physiological side. These men, however, formed no satisfactory substitutes for the universal authority in medicine of Galen, and to satisfy this craving numerous more or less fanciful systems arose in the 17th and 18th centuries, which were concerned mainly with the nature of the processes of life, and made sweeping generalizations as to the relation of these to the pathology and treatment of diseases. Descriptive anatomists, such as Malpighi, by the aid of the newly improved microscope added greatly during this period to the store of anatomical knowledge which Vesalius had so enriched. It was not until the latter half of the 18th century, however, that there began with Morgagni, John Hunter, and his nephew and pupil, Matthew Baillie, the systematic study of pathological anatomy. In Morgagni's book, '*De Sedibus et Causis Morborum*' (1761), we have really the foundation of that study, and the museum of Hunter has formed a model for similar institutions all over the world. Great progress resulted in this century too from the studies of Haller and Wolff in the domain of physiology and embryology—all this regardless and, indeed, in spite of the ever-recurring speculations and systems which occupied so dominant a place in the medicine of the period.

The 19th century was ushered in by the epochal researches of Bichat, who, in recognizing the tissues and studying disease with reference to them, rather than to regions or organs, made an advance overshadowed only by the later discovery of the cell. Following him came the Parisian school of pathological anatomists including Corvisart, Laënnec, Cruveilhier, and others, whose teachings were carried to England and Germany by their many scholars. Rokitsky (1804-78) by taking advantage of the extraordinary opportunities offered in Vienna, greatly advanced the knowledge of pathological anatomy. Doubtless the greatest name in the



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history of pathology is that of Virchow (1821-1902), who, spurred on by the discovery of the cellular structure of plants and animals by Schleiden and Schwann, soon convinced himself that every animal tissue is composed of and derived from cells, that no cell arises except as the offspring of a previously existing cell, and that spontaneous generation of cells is impossible. The application of these fundamental ideas to pathology resulted about the middle of the 19th century in the establishment of the doctrine of cellular pathology, which inaugurated the most important epoch in that science. The enormous amount of work which has followed has been entirely a confirmation and elaboration of these principles. The value of the experimental method, which has contributed so largely to exact pathological knowledge, although introduced by John Hunter and practised by Virchow and others, came into full general recognition especially by the work of Traube and of Cohnheim (1839-84).

During the last three decades of the 19th century the researches of Pasteur and of Koch, who have been followed by many workers in the fields opened by them, have shown the paramount importance of the relation of microscopic plants and animals to the production of disease. Physiological chemistry, established as a science by Liebig in the middle third of the 19th century, has cleared up many obscure problems. More precise methods of clinical research and experimental study of the problems of pathological physiology have added their important results. The last decade has been marked especially by those investigations into the laws of immunity which have been crowned with such brilliant success and have conferred such inestimable practical benefits on mankind, the names of Metchnikoff, Behring, and Ehrlich being most prominently associated with these advances.

*Definitions and Classifications.*—Although human pathology in its broadest sense comprehends the entire science of medicine, as distinguished from the practice of the medical art, the term is sometimes used in a restricted sense as equivalent to pathological anatomy, the knowledge of which first placed pathology upon a scientific foundation. This knowledge is obtained by post-mortem examinations and by microscopical study of diseased tissues (pathological histology). But not less important than the knowledge of morbid structure is that of the altered activities or functions of the body in disease. This latter branch of pathology, which is called pathological physiology, rests upon clinical observations and upon experiment (experimental pathology). Even in the more comprehensive works on pathology it is customary to include only a relatively small part of the subject-matter of pathological physiology, the larger part being assigned to works on clinical medicine. Both pathological anatomy and pathological physiology have been greatly advanced by the aid of chemistry (pathological chemistry). The term "general pathology" is used to include both general pathological anatomy and general pathological physiology, and embraces the consideration of such topics as the nature and causes of diseases, morbid processes common to many diseased conditions, and disturbances of function resulting from such processes. What is known as etiology, or the causation of diseases, is a subject of such extent and complexity that

only certain of its aspects are usually treated of in works on pathology, other aspects being referred to the departments of hygiene, including bacteriology and clinical medicine. The terms comparative pathology, animal pathology, and vegetable pathology, are self-explanatory. The limitations of the present article are such that attention will be given mainly to a necessarily brief presentation of some of the more important general pathological processes, with particular reference to man.

*Pathological Conditions.*—In the study of pathological conditions a knowledge of the normal is indispensable, for in all cases we deal with a modification of the normal, not with an independent condition. It is furthermore necessary to know intimately the influences which cause the abnormal condition, and then the object of study is the reaction of the organism to the particular influence concerned. It is obvious, then, that the only logical plan by which we may approach the study of morbid changes is by considering them in relation to their causative factors. In general these causative factors are either physical or chemical. To this classification the animal and plant parasites are no exception, for they injure either by their physical presence or by their chemical products. Of the relation of psychical suggestion to the causation of disease we know so little that it would not be profitable here to discuss it.

The direct result of the pathological action of any of these agencies is an injury to the structures of the body which results in a disturbance in their function, but usually there is so closely associated with this injury a reaction on the part of the tissues, which tends toward the restoration of the body to the normal, that what is observed clinically as the evidence of disease is a combination of the anatomical injury, the disturbance of function and the health-giving reaction, which last often produces the dominant symptoms. Indeed, so complicated and ineffectual are many of these reactions that frequently they appear more hurtful than beneficial and leave behind them disabilities which could not be directly produced by the primary injurious agent, although in the absence of such a reaction that agent might have caused the death of the individual. An example of this is seen in the deformity of the chest and the destruction of the lung that may result from a purulent inflammation of the pleura.

*Degenerations.*—We may recognize in diseased cells various grades in the intensity of action of injurious agents, various lesions according to the nature of the agent, as well as varying types of reaction. The milder of these changes, in which often occur visible alterations in the cell or even its partial disintegration, are usually spoken of as degenerations; while the complete death of cells, which may be produced by the more severe affections, is spoken of as necrosis. For example, in certain infectious diseases the glandular organs after death are found swollen and opaque, and microscopical examination of the cells of such organs shows that they are enlarged and loaded with unused proteid granules. This so-called parenchymatous degeneration is interpreted as a nutritive disturbance produced by the poison of the disease, and it represents the mildest grade of damage to cells.



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*Fatty Degeneration.*—The same agencies acting with greater intensity, or other morbid influences, as poisons, lack of oxygen, etc., may cause the analogous but more severe change, in which, with the partial disintegration of the cells, fat is stored up in globules in the protoplasm, so that the tissue after death may be opaque, yellow and swollen. It is probable that this fat is derived from the adipose tissues of the body, whence it is transported to the degenerating cell, and not from the substance of the cell itself. The condition must be distinguished from that of certain tissues of the body in which normal cells ordinarily contain droplets of fat.

*Glycogenic Degeneration.*—Similarly, under certain conditions, glycogen may appear in cells where it is not normally present, as in the kidney in diabetes; and the deposit of calcium salts in and about degenerated cells is not uncommon in the arteries of elderly persons, in healed tuberculous foci, and in some other conditions.

*Amyloid Degeneration.*—Not precisely analogous to these forms of cellular change is the amyloid or waxy metamorphosis, in which, after the long-continued absorption of a poison, there is deposited between the cells in various organs, especially the spleen, liver, kidney, and intestines, a curious, firm, translucent, nitrogenous substance which gives some of the chemical reactions of cellulose, and which has been named amyloid. Such a process is most frequently seen in long-standing cases of chronic suppuration, syphilis, tuberculosis, cancer, and dysentery.

*Hyaline Degeneration.*—In the so-called hyaline degeneration an intense poison is operative and results in the destruction of a part or the whole of the cell, or even of groups of cells, and their transformation into a homogeneous clear mass. Such changes are seen in the muscles in typhoid fever, in the lymph-glands about tuberculous foci, etc. Such changes in cells are gradual and lead progressively to their greater and greater disintegration, until they may finally entirely disappear in fragments or become completely replaced by the lifeless material which has collected in the cell-body during the process and is usually regarded as an index of the progress of the change.

*Atrophy.*—Another retrograde change is the wasting away and disappearance of tissue under the influence of the various conditions which produce the so-called atrophy. In old age, with diminished powers of utilizing nutrition certain tissues decrease in bulk from the decrease in size and disappearance of their cells. So, too, the wasting of a paralyzed limb is due to the disappearance of muscle-cells for lack of use.

*Necrosis.*—When, however, the intensity of the injury is such that the rapid and complete death of the cell occurs, the process is spoken of as necrosis. The greatest variety of agencies may produce this ultimate local death of the tissues, such as a mechanical and physical violence, irritant chemicals, the poisons of bacteria, the cutting off of the blood-supply, and so on. There are many familiar examples of the process, such as the core of a boil, the sequestrum which is cast out from the cavity of the bone in osteomyelitis, the gangrenous toes of an old man with diseased arteries, and the opaque tissue in an infarction. Microscopically the criterion of the death of the cell is the breaking up and disappearance of the nucleus, together

with the disintegration of the protoplasm. It is a peculiarity of the fluid of the tissues that when they come into contact with dead cells coagulation occurs and a net-work of fibrin is formed throughout such cell-masses. When the death of cells occurs within the living tissues from any cause this coagulative process leads to the formation of a firm and swollen mass in the position of the dead cells (coagulative necrosis).

*Thrombosis.*—When such a destruction takes place in a blood-vessel, or in the heart, the same coagulative influence—usually explained as due to a fibrin-ferment given off from the dead cells—affects the passing blood, and a fibrinous coagulum which soon entangles red and white blood-corpuscles is formed. This is the process of thrombosis, which may occasion the partial or complete occlusion of the vessel. Frequently portions of such a thrombus or antemortem coagulum may be detached and swept along with the blood so as to lodge in another vessel and plug it, thus hindering the passage of blood. This forms one common example of the general process of embolism.

*Embolism.*—By embolism is understood the occlusion of a vessel by some material, the embolus, brought to it from a distance along the blood-stream.

*Infarction.*—Such a stoppage of the blood-flow by an embolus may entirely cut off the nutriment of the tissue supplied by that vessel, and the result will then be the death of that tissue and the production of an infarction. The most serious effects of the plugging of a vessel by a thrombus or an embolus are manifested when the occluded vessel supplies a vital organ, such as the brain or the heart, or when the main pulmonary artery is occluded.

*Inflammation.*—Most of the influences which lead to the death of cells do so, however, in such a way as not to leave the neighboring cells uninjured; and in that case, as well as in many instances in which the insult to the cells does not actually result in the death of any of them, there follows the common reaction on the part of the organism, which is called inflammation, and which may be regarded in its essential features as a process tending to the protection of the individual. The injured area and the tissue around it become swollen, reddened, painful and, if superficially situated, also hot, and the pain and swelling add to the impairment of function. By microscopical investigations it is found that in the neighborhood of the injured cells the blood-vessels become dilated, the blood flows at first rapidly and then more slowly through them, and fluid exudes through their walls into the surrounding tissue; not only this, but the cells of the blood, both white and red, pass through their walls into the meshes of the tissue, the white corpuscles or leucocytes, by virtue of their automatic motility, being attracted by the chemiotactic substances set free by the injury of the cells, or produced by parasitic invaders, the red ones following passively in their wake. The chief protective activity is ascribed by many to the leucocytes which, acting as phagocytes, engulf and destroy the bacteria or other noxious substances which may be present. Here, as in the case of the thrombus formation, the dead or injured cells set free a fibrin-ferment, and from the exuded coagulable fluid a fibrin-network



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is formed throughout the inflamed tissue. The inflammatory exudate composed thus of fibrin, free fluid, or serum, and red and white cells from the blood, may be distributed throughout the tissue about the point or injury; or if the irritant affects the lining of one of the large body-cavities it may be poured into this cavity and may line its surface with a shreddy layer of opaque yellowish-white material constituting the so-called fibrinopurulent or serofibrinous peritonitis, pleuritis, meningitis, or pericarditis, as the case may be. Mild irritants acting upon a mucous membrane may produce hyperæmia, with excessive secretion and the outwandering of a few leucocytes (catarrhal inflammation); a more intense irritant may give rise to a fibrinopurulent exudate (so-called croupous inflammation), which in the case of lobar pneumonia fills the alveolar cavities of the lung; while an extremely severe injury may cause the death of the superficial cells so that the coagulated exudate entangles in its meshes the necrotic surface of the tissue and forms thus a false membrane (diphtheritic inflammation). In some instances bacterial irritants are so specialized and localized in their action that the inflammatory reaction surrounds the primary focus of injury, the phagocytic cells advance toward the central mass of necrotic cells and, by the aid of digestive ferments derived from bacterial or other cells, bring about a liquefaction of the tissue. This results in the formation of an abscess in which the fluid exudate, rendered opaque and thick by the presence of numbers of often degenerated leucocytes, constitutes pus.

*Repair and Healing.*—Very soon there is a reaction of a different type on the part of the organism; it is as if a sense of incompleteness were felt from the injury or loss of the cells; and a process of repair is begun. In its purest form this is seen in the healing of wounds, but it is essentially the same after other injuries, although it may be masked by the evidences of acute inflammation. In its essentials this repair consists in the sprouting from the old blood-vessels of new ones, accompanied by young connective-tissue cells, the offspring by division of the old ones, so that soon a soft and vascular new connective tissue is formed. Over this "granulation-tissue" the epithelium grows by division of its cells; later the contraction of this young fibrous tissue, with the obliteration of many of its blood-vessels, leaves a hard white fibrous mass, the scar.

When this cicatricial process occurs on the surface of the body the results are mainly beneficial, although even here deformities may result from contraction of extensive scars; but when scar-tissue replaces (between the coils of intestine or of the layers of the pericardium) the fibrinous exudate which has glued them together, the so-called adhesions may be a menace to life by causing intestinal obstruction or by overworking the heart. Scars in the brain may give rise to epilepsy.

*Regeneration.*—The process of healing exemplifies the regeneration of tissue, which is much more limited in the higher animals than in the lower vertebrates and the invertebrates, in which a whole region of the body may sometimes be reproduced. In general, the more highly specialized the cells and tissues the less is their power of regeneration, so that ordinarily in man and

higher vertebrates result of repair is the replacing of lost muscular, glandular, or nervous tissue by connective tissue.

*Chronic Inflammation.*—Many examples of such replacement of highly specialized cells by connective tissue may be seen in the so-called chronic inflammation of the organs. Thus in chronic Bright's disease of the kidneys the loss of the tubular epithelium is followed by a growth of fibrous tissue throughout the kidney, leading to its induration. So too, in general paresis the cortex of the brain becomes contracted and hard owing to the overgrowth of neuroglia which follows the destruction of the nervous elements. In a similar way is explained the new growth of interstitial or fibrous tissue in cirrhosis of the liver, fibroid myocarditis, locomotor ataxia, and other chronic inflammations. One of the most ineffectual attempts at restitution is that seen in the arteries in which degeneration of the walls results in thick scars which themselves may break down or become calcified and rigid, constituting atheromatous degeneration. It is in connection with this arterio-sclerotic process that aneurisms or localized dilations of the arteries usually occur.

*Cirrhosis of the Liver.*—There is, however, sometimes observed in the chronic inflammations of an organ an attempt, although often only abortive, at regeneration of the essential tissue, as in many cases of cirrhosis of the liver, in which the effort at repair has resulted not only in the formation of bands of scar-tissue throughout the organ, but actually in the production of sprouts of cells from the bile-ducts which are progressing toward the formation of new liver-cells, although not all authorities are agreed in this interpretation of the appearances.

*Hypertrophy and Hyperplasia.*—One of the most interesting pathological adaptations is the capacity of certain organs of the body to meet prolonged demands upon them for extra work by an increase in the size or number of their specialized cells. This so-called functional hypertrophy is illustrated by enlargement of the heart when called upon to overcome obstacles to the circulation, as in valvular disease of this organ, and by enlargement of one kidney after extirpation of the other.

*Anæmia and Leukæmia.*—The bone-marrow, which is now recognized as the chief seat of production of the blood-cells, affords in certain conditions an excellent example of hyperplasia or response, often excessive, to the demands for its products, for in all types of anæmia, the obscure pernicious form as well as those whose causation is well known, there is new growth of the marrow-cells, which form red corpuscles. So in the leucocytosis, or increase of circulating white corpuscles, which accompanies many acute inflammatory processes, as pneumonia, the production in the bone-marrow of leucocytes becomes very abundant. Similarly in the disease leukæmia, of whose cause we are ignorant, the excessive formation of the various forms of white corpuscles produces the remarkable condition of the blood which gives the disease its name.

*Uncompensated Heart Disease.*—The compensation brought about by functional hypertrophy of an organ may in process of time be broken with disastrous consequences, as is illus-



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trated most strikingly in instances of broken compensation on the part of the heart. On account of the degenerative changes in the muscle, or the inability of the process of hypertrophy to keep pace with the demand, the heart finally proves unable to propel the blood with the requisite speed and pressure, and there ensue the various phenomena which result from the stagnation of the blood in the veins—the so-called chronic passive congestion with cyanosis and transudation of the fluid into the cavities of the body and the meshes of the tissues, the latter process producing one type of dropsy or œdema. Other types of dropsy, such as that associated with Bright's disease, are referred by many to changes in the vascular walls.

*Tuberculosis.*—Of the more specialized forms of inflammation produced by certain bacteria or other parasites, the effects of the tubercle bacillus are especially important owing to the enormous prevalence and destructiveness of tuberculosis. The lodgment and growth of the tubercle bacillus in the tissues produces first a death of cells, and then, about these points of necrosis, little nodules of non-vascular tissue, rich in cells, the tubercles, which later themselves coalesce and undergo necrosis. More diffuse changes, and especially acute exudative forms of inflammation, may also be caused by the tubercle bacillus, all, however, undergoing the same widespread necrosis. Combinations of these processes produce the great destruction of tissue seen in pulmonary phthisis and other tuberculous diseases.

*Syphilis, Leprosy, etc.*—Similar in many respects to the tubercles are the gummata produced by the unknown virus of the syphilis, and the nodules of leprosy. The nodules formed in glanders and actinomycosis more closely resemble ordinary inflammations.

*Typhoid Fever.*—The changes in typhoid fever are characteristic in that the bacillus affects chiefly the lymphoid tissues, first of the intestines, and then of the mesenteric glands and spleen. A great swelling of this tissue is produced by the formation of new cells which may undergo necrosis so that in the exposed lymphoid structures of the intestine ulceration ensues.

*Other Bacterial Diseases.*—In many other bacterial diseases the reaction to the attacks of the bacteria is less characteristic. In some, as diphtheria and tetanus, the organisms produce their effect by a toxin which they distribute from the localized area of their growth; in others a less intense toxin is produced, but the bacteria themselves are distributed throughout the body (septicæmia, pyæmia).

*Exanthematic Diseases.*—There is a large group of infectious diseases, including the exanthematous fevers, as smallpox, measles, scarlet fever, and typhus fever, and also yellow fever, in which while there are all the appearances of an acute infection, the specific agents of infections are unknown, unless indeed the protozoan organisms recently described in some of them prove to be such.

*Protozoan Infections.*—Within recent years protozoan organisms have assumed great importance in the etiology of disease, and the minute study of the life-cycle of these parasites is fast leading to the adoption of hygienic measures of a rational type in combating these infections.

Examples of such diseases are malaria caused by *Plasmodium malariae*, amœbic dysentery, caused by *Amœba coli*, and the sleeping-sickness of negroes in Africa, caused by a trypanosome. The recognition of the conveyance of the parasites of malaria and of yellow fever by a genus of mosquitoes (*Anopheles*), serving as intermediate or definitive hosts, is the basis of the efficient preventive measures recently adopted against these diseases.

Similarly a great group of parasitic affections is due to the invasion of worms and of insects while the role of fungi and other vegetable parasites is almost as important.

*Fever.*—One of the most common reactions of the body, not only to the invasion of bacterial and other parasites, but also to certain nervous and other disturbances, is the elevation of the body-temperature, which in association with other symptoms constitutes fever. This is due to disorder of the nervous centres which control the regulation of the bodily heat, both the production of heat and the discharge of heat being abnormal.

*Immunity.*—For special treatment of this topic see IMMUNITY.

*Organic Insufficiency.*—Certain organs, such as the thyroid, adrenals, pancreas, etc., whose functions are as yet but imperfectly known, may be partly or completely destroyed in the course of a disease, and such a loss is usually followed by far-reaching general effects which are difficult of interpretation. For example, the destruction of the adrenal glands is followed by the well-known symptoms of Addison's disease—weakness, nausea, and pigmentation of the skin—while the destruction of the Langerhans' islands in the pancreas results in diabetes, and that of the thyroid in myxœdema, diseases whose main characters are very constant and peculiar. Similarly it seems probable that marasmus in infants may be associated with disease of the thymus, acromegaly with changes in the hypophysis; while for many other diseases, such as exophthalmic goitre, rickets, gout, and even epilepsy and certain mental affections, an origin of this nature is possible, although by no means proven. The recognition of the nature of certain of these diseases has marked an epoch of great importance in medicine, and the fact that some of them, notably myxœdema and cretinism, may be cured or greatly ameliorated by the administration of extracts of these glands promises much for the future, when the relations of those which are yet imperfectly studied become known. See ORGANOTHERAPY.

*Congenital Malformations; Monsters.*—Great difficulty is met in the attempt to explain the origin of congenital malformations. That they are the result of peculiarities of the germ-cells or of disturbances in development is certain, but the nature of these disturbances is obscure. Experimental embryology, it is true, has shed some light upon them in showing that some may be produced by the action of injurious physical and chemical agencies during the incubation of the egg; and the evidences of pressure, amniotic and placental adhesions, etc., in the malformed foetuses themselves explain others; but as to the origin of the greater number knowledge is wanting. In many instances the same malformation occurs in several members of the same family and seems hereditary.



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When only one individual is concerned there may be all grades of defective or superfluous development from such familiar conditions as hare-lip to those in which the medullary groove has failed to close (*spina bifida*), or in which the tissue which should form the brain has remained spread over a deformed spine so that only a thin membrane is there to represent the brain (*acrania*). Such extreme malformations as the latter are incompatible with life after birth.

When two individuals are concerned they may be practically perfect but united, as in the case of the Siamese twins, at some point in the body; or with a more marked malformation they become more or less completely merged in one another. Sometimes one is relatively perfect while another very incomplete individual or part of one is fused into the body at some point and projects, as the so-called parasitic monster. A still more rudimentary mass, containing many of the tissues of a second individual, may be completely included within the body of the first and form there a sort of tumor called a *teratoma*. The simplest form of such tumors is the so-called dermoid cyst, which occurs most frequently in the ovary.

*Tumors.*—These are masses of atypical tissue which appear at some point or points in the body and proceed with an unlimited growth without serving any useful function, but rather to the injury of the organism. Much obscurity prevails as to their nature and origin, various theories ascribing their growth to disturbance of the equilibrium between tissues, to continued injury or irritation of the tissues, to congenital misplacement of embryonal cells which remain latent and begin to grow later, perhaps not until advanced age, and finally to protozoan parasites. During recent years many authors have described structures in the cells of cancerous tumors which they have regarded as parasites and the cause of the tumor growth, but as yet it cannot be said that there is convincing evidence as to the validity of any of these supposed parasites, and investigators are practically as much in the dark as ever with regard to the causation of the growth.

Tumors are usually composed of cells which, although atypical in form or arrangement, so closely resemble those normally present in the body—generally those in the immediate neighborhood or continuous with the primary growth—that they are regarded as developed from these analogous cells and are classified on this apparent histogenetic basis, their names being usually a combination of that of the tissue with the termination—*oma*. Thus a fibroma is a tumor derived from and composed of fibrous tissue; an epithelioma, one composed of epithelial tissue; a lipoma, one composed of fatty tissue; etc. Sarcoma and carcinoma, however, are so called from the resemblance of the former to flesh, and the latter from its fancied resemblance to a crab.

Tumors grow sometimes by the continual new formation of cells within themselves producing circumscribed, rounded masses which push aside the surrounding tissue (benign tumors). Others rapidly invade by means of sprouts of cells the crevices of the surrounding tissue so that that tissue is destroyed, and on encountering lymphatic or blood-vessels they penetrate their walls and distribute the cells into the blood or

lymph stream so that new cell-colonies are formed in the organ in which these floating emboli lodge (malignant tumor). Such secondary tumor-masses are spoken of as metastatic nodules, and are always due to the transportation of cells. They may be very numerous and much more bulky than the primary growth.

Benign tumors may spring from the various forms of connective tissue, fat, fibrous tissue, bone, etc.; from epithelium, neuroglia, and so on. They produce disturbances only by their bulk and the pressure they exert upon surrounding tissues. Malignant tumors may similarly arise from tissues of the connective type, from epithelium or from endothelium. They injure the organism not only by their bulk, but also by their destructive invasion of the surrounding tissues, and apparently likewise by the elaboration of a poison which aids in producing the cachexia so frequently seen in these cases. The most important of the malignant tumors are the sarcomata, which resemble in structure embryonic connective tissue, and the cancers or carcinomata, which spring from epithelium, commonly in such situations as the skin, the lining of the stomach or intestine, the breast, and the uterus. Carcinomata are composed of communicating masses or strands of epithelial cells imbedded in a frame-work of connective tissue.

The great loss of life caused by the various kinds of tumors renders their study a matter of extreme importance, and the discovery of their causes and of trustworthy methods for their prevention and cure, to which many investigators are devoting their attention, constitutes one of the chief aims of modern medicine.

*Bibliography.*—Haeser, 'Lehrbuch der Geschichte der Medizin' (Jena, 1875–82); Chiari, in Neuburger und Pagel's 'Handbuch der Geschichte der Medizin' (Jena, 1903); Virchow, 'Hundert Jahre allgemeiner Pathologie' (Berlin, 1895). Consult also general text-books of pathology by Rokitsansky, Förster (with historical introduction), Virchow (cellular pathology), Klebs, Ziegler, Orth, Birch-Hirschfeld, Wagner, Cohnheim, von Recklinghausen, Cornil and Ranvier, Perls, Hamilton, Green, Delafield and Prudden, Schmaus, Kaufmann, Dürck, Ribbert, Stengel, Aschoff and Gaylord, Krehl, 'An American Text-Book of Pathology,' edited by Hektoen and Riesman. For details of the subjects of general pathology and pathological anatomy, references to the literature will be found in Ziegler and other of the larger text-books; also in Lubarsch and Ostertag's 'Ergebnisse der allgemeinen Pathologie'; 'Virchows Archiv,' founded in 1847, is a rich mine of special contributions to pathology. Among authors of works on bacteriology in relation to disease may be mentioned: Flügge, Muir and Ritchie, Abbott, Sternberg, Baumgarten, McFarland, Park, Kolle and Wassermann; of works on the theories of immunity, Metchnikoff (*L'Immunité*), Aschoff, 'Ehrlich Side-chain Theory,' also a good review by Ritchie in 'Journal of Hygiene' (1902). There are works on congenital malformation by Förster, Ahlfeld, Dareste, Duval, Marchand, Ballantyne, Taruffi. On tumors, in addition to the general text-books, consult Virchow, 'Die krankhaften Geschwülste,' and Borst, 'Die Geschwülste.'

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**Patiala**, püt-ê-ä'lä, or **Puttiala**, Sikh native state in the Punjab, lying in the Cis-Sutlej group, with the exception of a small part in the hills near Simla. Two railway lines cross the state and the Sirhind Canal irrigates a large part of it. The rajahs have long been faithful to England, showing their loyalty in 1857, and in 1898, when the rajah, who died in 1900, personally took the field in the Tirah campaign against the Afghans. The state has valuable deposits of copper, lead, slate, and marble; its area is 5,951 square miles, and population (1901) 1,586,030, of which about one third are Sikhs, one fourth Mohammedans, and a small proportion Jains. The capital city is Patiala, on the Rajpura-Bhatinda railroad; pop. (1901) 53,545.

**Pat'ina**, in the fine arts, the fine green rust with which ancient bronzes and copper coins and medals become covered by lying in particular soils, which, like varnish, is at once preservative and ornamental. An artificial patina is produced by the forgers of antiquities. The name is also applied to a bowl of metal or earthenware. See **PATEN**.

**Patkul**, pät'kool, **Johann Reinhold**, Livonian soldier: b. Livonia, Russia, about 1660; d. near Posen, Prussia, 10 Oct. 1707. He was of a noble family, received a military education, and entered the army, but withdrew to enter upon a diplomatic career. He involved himself in intrigues which resulted in his being summoned to Stockholm, where, finding himself precondemned he fled to Courland, and was branded as a traitor by the Swedish government. He entered the service of Augustus II., elector of Saxony and king of Poland, as privy councillor, and was largely responsible for the alliance of Russia and Denmark with Augustus against Sweden. He was accused later of treasonable relations with Austria and Sweden, and was arrested by Augustus. The Peace of Altranstadt, which Augustus was compelled to sign in 1706, stipulated the surrender of Patkul, who was tried by court-martial on the homeward journey of the Swedish troops, broken alive on the wheel, decapitated, and drawn and quartered at a monastery near Posen. Consult: Buchholz, 'Beiträge zur Lebensgeschichte J. R. Patkuls' (1893).

**Patmore**, pät'mör, **Coventry Kearsey Dighton**, English poet: b. Woodford, Essex, 23 July 1823; d. Lymington, Sussex, 26 Nov. 1896. He was the son of Peter George Patmore, a writer of some note in his day, and published his first volume of poems in 1844, narrative pieces of little interest in themselves, but displaying no little descriptive power and poetic insight. From 1846 to 1868 he was an assistant in the British Museum, and in 1854 published the first part of his most widely known poem, 'The Angel in the House.' It was entitled 'The Betrothal,' and was followed in 1858 by 'The Espousal.' It proved popular both in England and this country, was parodied and occasionally scoffed at, but many of its admirers as well as its critics failed to detect the mystical significance its author intended it to have. Patmore was a mystic through much of his career, and in this work he was typifying heavenly love by earthly affection. It was succeeded by 'Faithful Forever' (1860), a poem of disappointed love, and 'The Victories of Love,' a

poem of bereavement (1862). Later volumes of verse include 'Amelia, Tamerton Church Tower, etc.' (1878) and 'The Unknown Eros and Other Odes,' in which latter, mingled with much of mysticism, will be found at least two of the most touching poems in the English language, 'Toys' and 'It was not Like Your Great and Gracious Ways.' Patmore was also the author of several volumes of prose, 'Principles of Art' (1889); 'Religio Poetæ' (1893); and 'Rod, Root, and Flower' (1895). About 1868 he became a Roman Catholic, and some of his latest verse betrays his change of thought in this respect. At his best Patmore takes high rank as a poet, and in spite of many trivialities his verse is more often melodious than otherwise. Consult: Champneys, 'Memoirs and Correspondence of Coventry Patmore' (1900).

**Pat'mos**, Turkish island in the Ægean Sea, off the coast of Anatolia, now called **PATMO**, **PATIMO**, or **SAN GIOVANNI DI PATMO**, and belonging to the vilayet of Jezairi-Bahri-Zefid. It measures 10 miles from north to south, six from east to west, and contains about 15 square miles of rather rocky, unfertile soil. It once did a flourishing business with Ephesus, but at the beginning of the Christian era was a desert, used as a place of sequestration. Here St. John was exiled, and wrote the Apocalypse. At the close of the 11th century a monastery was built here in honor of St. John, which has a very valuable collection of ecclesiastical MSS. Consult: Guérin, 'Description de l'Ile de Patmos et de l'Ile de Samos' (1856).

**Patna**, pät'nä, more correctly **Pattana** ("the town"), India, (1) a city of Bengal, capital of a district and a division of the same name, on the right bank of the Ganges, 397 miles by rail northwest from Calcutta. The city proper is one and a half mile in length by about half that extent in breadth; but with its large suburbs stretches nine miles along the Ganges, and presents externally a striking appearance from the river, many large and handsome flat-roofed houses with carved balustrades being interspersed with temples, mosques, and tombs, Saracenic gateways of red stone, large granaries, wide ghats, or stairs from the water, and bastions projecting into the stream—the whole backed by a height on the land side. The adjacent cantonments at Dinapur are handsome and well laid out. Patna is a stronghold of Mohammedanism, and the chief seat of the opium trade. A large trade is carried on in oil-seeds, rice, saltpeter, wheat, indigo, sugar, and provisions; among the manufactures are table-linens, wax candles, lacquered wares, and bird cages. Patna has been identified with the ancient Pataliputra—Lotus City, which was probably founded in the 5th century B.C. Megasthenes, a Greek historian, who visited it about 300 B.C., describes it under the name Palibothra, and a Chinese pilgrim of the 7th century A.D. has also left an account of it. The native name Azimabad was given to it in honor of Azim, grandson of Aurungzebe, who was at one time its governor. The English, French, and Danes had factories here formerly, but eventually the British traders drove out their rivals. In 1763 disputes about transit duties arose between the East India Company's servants and the native government. The result of the war which followed was



the expulsion of the native forces, and the district coming into possession of the British. Patna was the headquarters of the Wahabi or Mussulman conspiracy of 1864. Pop. (1901) 135,172. (2) The district has an area of 2,076 square miles, pop. (1901) 1,623,856. (3) The division has an area of 23,675 square miles, pop. (1901) 15,464,400. (4) A native Rajput state, feudatory to the Central Provinces, area, 2,399 square miles, pop. (1901) 277,566.

**Paton**, pāt'n, **Sir Joseph Noel**, English painter: b. Dunfermline, Scotland, 13 Dec. 1821; d. Edinburgh 26 Dec. 1901. He became first known to the public by his water-color painting of 'The Combat between Bothwell and Balfour' (1838); and soon afterward grew into popularity as an illustrator of books and magazines. In 1843 he attended the art school of the Royal Academy in London, and exhibited in 1844 his well-known picture, 'Ruth Gleaning.' The following year he exhibited 'Rachel Weeping for Her Children,' in 1846 'Oberon and Titania,' and 'Christ Bearing the Cross.' He painted for Queen Victoria 'The Queen at the Deathbed of the Prince Consort.' He was more or less of a Pre-Raphaelite, but his drawing while graceful, is sometimes weak, and his color lacking in harmonious arrangement. His skill as a sculptor and his learning as an archæologist were almost equal to his pictorial skill, and he wrote graceful verse and published 'Poems by a Painter' (1861) and 'Spindrift' (1867).

**Paton, Lewis Boyles**, American Congregational clergyman: b. New York 27 June 1864. He was graduated from the University of New York in 1884, studied at Princeton Theological Seminary 1887-90, was instructor in Old Testament criticism at Hartford Theological Seminary 1892-3, and associate professor 1893-1900. Since 1900 he has been Nettleton professor of the same subject. He is the author of 'Early History of Syria and Palestine.'

**Paton, William Agnew**, American author: b. New York 20 April 1848. He has written 'Down the Islands: a Voyage to the Caribbees' (1887); 'Picturesque Sicily' (1897).

**Patras**, pä-träs', or **Patræ**, pä'trê, a seaport of the northwestern Peloponnesus or Morea, on the Gulf of Patras, which leads into the Gulf of Corinth. The port is ill-protected and owes its importance to its position; olive oil, wines, raisins, and sheepskins are exported, and there are mills, foundries, and cotton and silk factories. The city is essentially modern and lies some distance from the old town, which had a great commerce in the 5th century B.C., and again in the 1st when it was rebuilt by Augustus and became famed for its cloth manufactures and as the site of the Oriental worship of Aphrodite. Now the city is a station of the Austrian Lloyds, and the Mediterranean and New York Steamship Company connects it with New York city. It has several consulates; pop. (1896) 37,985.

**Pa'triarchs**, the three fathers of the Hebrew race, Abraham, Isaac, and Jacob. The patriarchal government prevails in a state of society in which the people are not yet organized into a nation, but consist of independent tribes, clans, or families under the government of the head of the family. Later the title patri-

arch was assumed by the presidents of the sanhedrim, which exercised authority over the Jews of Syria and Persia after the fall of Jerusalem. The patriarchate of Tiberias for the Western Jews lasted till 415, that of Babylon for the Eastern Jews till 1038. From them the term was borrowed by the Christians, who applied it to the bishops of Rome, Constantinople, Alexandria, Antioch, and Jerusalem. These patriarchs consecrated and supervised the archbishops and bishops within their jurisdictions. While with the patriarchate of Rome was united the primacy of the Roman see throughout the world (see PAPACY), the four heads of the Eastern Church preserved the title of patriarch. The Armenian, Abyssinian, Jacobite, and Maronite Churches have patriarchs of their own. The Patriarch of Constantinople is the primate of the Greek Church in the Turkish empire, and bears the title of œcumenical. (See GREEK CHURCH.) The authority of the Patriarch of Moscow which extended over the Russian Church, was superseded, during the reign of Peter the Great, by the holy synod.

**Patriarchs Militant.** See ODD FELLOW.

**Patricians** (Latin, *patricius*, from *pater*, father), the name given by the Romans to the members and descendants by blood or adoption of the original *gentes* of which the Roman people was composed, until the plebeians became a distinct class of citizens. The other sections of the Roman population, the clients, and slaves, did not belong to the *populus Romanus*. During the first centuries of the republic there was an almost uninterrupted struggle between the patricians and plebeians, in which the former fought hard to retain their exclusive rights, but which ended in the establishment of the political equality of the two orders; only a few insignificant offices remained the exclusive privilege of the patricians. The formation of a new aristocracy, founded on wealth and on the holding of the offices of consul, prætor, and curule ædile, made the patricians of still less account. When the seat of government was removed to Constantinople, Constantine the Great, desirous of restoring the ancient Roman ranks, instituted a new patrician dignity, which was a mere personal title, and which could be acquired only by high birth and distinguished merits. Under the Carolingians and the succeeding emperors the title of patrician denoted an exalted rank, and was connected also with the government of Rome and its provinces, and the support of the Papal See. Charlemagne assumed the title of a Roman patrician before he was declared emperor, and Henry IV., as such, deposed Pope Gregory VII. In modern times a few noble families in the imperial cities were called patricians, because they were especially entitled to certain high offices. In some Italian cities the title of patrician is still used to denote a member of the nobility.

**Patrick (Patricius), Saint**, the apostle of Ireland: b. Kilpatrick, Scotland, 373; d. Saul, near Armagh, Ireland, 493. At 16 Patrick (or Succath, for such was his original name) was carried off by pirates. They sold him to an Ulster chieftain, whose flocks he tended for six years. At the end of that period he made his escape to France, became a monk, and lived



for some time in Saint Martin's abbey at Tours, and afterward in the monastery of Lerins. Here he was moved by visions to undertake the conversion of the pagan Irish. Having been ordained a bishop and received the papal benediction, he went over to his field of labor about 432. Here he founded over 360 churches, baptized with his own hand more than 12,000 persons, and ordained a great number of priests. He made his see at Armagh about the year 454. Many miracles are ascribed to him, particularly the extirpation of all venomous creatures in the island. On his death his relics were preserved at Downpatrick till the time of the Reformation. His literary remains consist of his 'Confessions' and a letter addressed to a Welsh chief named Corotic, both written in barbarous Latin, but of historical value. Consult: Wright, 'Saint Patrick's Purgatory' (1843); Todd, 'Life of Saint Patrick' (1863); Stokes, 'Tripartite Life of Saint Patrick' (1887); Robert, 'Etude Critique sur la Vie de Saint Patrice' (1884).

**Patrick, Saint, Order of.** See ORDERS AND DECORATIONS.

**Patrick, Simon,** English Anglican bishop: b. Gainsborough, Lincolnshire, England, 8 Sept. 1626; d. Ely, Cambridgeshire, 31 May 1707. He was educated at Queens College, Cambridge, became rector at Covent Garden in 1662, in 1678 was appointed Dean of Peterborough, became Bishop of Chichester in 1689, and of Ely in 1691. A man of vast learning and a wise ecclesiastic, he was the author of numerous devotional treatises, some of which are still read. A complete edition of his works edited by Alexander Taylor and including Patrick's 'Autobiography' was published in 1858.

**Patrimonium Petri**, păt-rĩ-mō'nĩ-ũm pē'trĩ, or **Patrimonium Ecclesiæ**, the territory of the papal government during the time when the temporal power of the pope was a reality. In a narrower sense it denotes the territory nearest Rome which became the property of the papal curia in the 8th century. Dante, however, attributes the original territorial possessions of the Roman bishopric to the gift of Constantine.

**Patriofe'lis**, a creodont animal found fossil in the Middle Eocene formations of Wyoming, which was about the size of a lion, but was of aquatic, or semi-aquatic, habits, and preyed much if not altogether upon the turtles which abounded in the shallow waters of that region during Eocene times. See CREODONTA.

**Patriotic Societies**, in the United States are those organizations which aim to preserve the important events in American history, and have especially to do with cherishing the deeds and memories of Colonial and other wars. Among the societies of the colonial period are: Society of Mayflower Descendants (q.v.), Society of Colonial Wars (q.v.), Founders and Patriots of America (q.v.), Society of Colonial Dames of America (q.v.), National Society of Colonial Dames (q.v.), Society of Daughters and Patriots of America (q.v.), Holland Society (q.v.), New England Society (q.v.).

In commemoration of the Revolutionary War there are numerous organizations, including the Society of the Cincinnati (q.v.), Sons of Revolutionary Sires (q.v.), Society of the Sons of the American Revolution (q.v.), Naval Order of the United States (q.v.), Military Order

of Foreign Wars (q.v.), Saint Nicholas Society of New York (q.v.), and others. Subsequent societies were the General Society of the War of 1812 (q.v.), Veteran Corps of Artillery (q.v.), American Order of the Louisiana (q.v.), the Aztec Club (q.v.), and the Association of Mexican Veterans (q.v.).

As the outcome of the Civil War the following were among the patriotic societies organized: Military Order of the Loyal Legion (q.v.), Grand Army of the Republic (q.v.), Union Veteran League (q.v.), National Association of Naval Veterans (q.v.), Medal of Honor Legion (q.v.), United Confederate Veterans (q.v.), United Daughters of the Confederacy (q.v.), United Sons of Confederate Veterans (q.v.).

Other patriotic societies include the Order of Indian Wars of the United States (q.v.), Society of Veterans of Indian Wars (q.v.), Spanish War Volunteers (q.v.), Society of Spanish-American War Veterans (q.v.), Mount Vernon Ladies' Association (q.v.), Ladies' Hermitage Association (q.v.), Landmarks Club of Los Angeles (q.v.), Colorado Cliff Dwellers' Association (q.v.), Thomas Jefferson Memorial Association (q.v.), and the American Scenic and Historic Preservation Society. Under the heading of patriotic societies may also be included the numerous State and local historical societies. See HISTORICAL SOCIETIES, AMERICAN.

**Patriots' Day**, in Massachusetts, the anniversary of the battles of Concord and Lexington, 19 April 1775. The day was first observed in 1894.

**Patripas'sians.** See SABELLIUS.

**Patris'tic Theology**, that section of Christian literature and doctrine which is contained in the writings of early fathers of the church, a term generally confined to writers of the first five or six centuries of the Christian era. They are generally classed as Apostolic Fathers, who were nearest to and partly contemporary with the Apostles, namely, Barnabas, Clement, Ignatius, Hermas, and Polycarp; the ante-Nicene Fathers, who lived between 167, and the Nicene Council 325, and the post-Nicene Fathers. The Eastern and Western Church have each four authors who are recognized as fathers par excellence. Those of the Eastern Church are Athanasius, Basil, Chrysostom, and Gregory Nazianzen; while those of the West are Jerome, Ambrose, Augustine, and Gregory of Rome.

See Migne, 'Patrologiæ Cursus Completus' (388 vols. 1857-66); Pusey, 'Library of the Fathers' (47 vols. 1838-80); Lightfoot, 'Apostolic Fathers' (1889); Farrar, 'Lives of the Fathers' (1888); Harnack, 'Dogmengeschichte' (trans.) and 'Geschichte der altchristlichen Litteratur' (1893-7); Krüger, 'History of Early Christian Literature' (1895).

**Patroclus**, pa-trō'klūs, the friend and brother in arms of the Greek champion Achilles, was the son of Menœtius, one of the Argonauts. On accidentally killing Clysonymus, in his early life in a game of dice at Opus, he saved himself by flight, and reached Thessaly where he was kindly received by Peleus, who educated him as the companion of his own son. He accompanied Achilles to Troy, and remained, like him, inactive, when the anger of Achilles kept him from taking a part in the war. At length Achilles



## PATROL — PATTEN

permitted Patroclus to go forth to battle, where he was arrayed in the armor of Achilles. Apollo stunned him and rendered him defenseless, and he was slain by Euphorbus and Hector. The Greeks recovered his body, which they interred with the highest marks of honor, and established solemn funeral games to his memory. Achilles then avenged his friend by challenging Hector and slaying him in single combat.

**Patrol'**, a military term applied to the walking or marching round of a guard to watch and observe what passes, and to secure the peace and safety of a camp or other place. Also men on guard who go the rounds in the night; a detachment whose duty it is to guard; or a policeman whose duty it is to patrol a certain district or beat for the protection of property and to preserve the peace. Such policemen are frequently called patrolmen. In early American history the word patrol was applied to a military system adopted by the parishes of most of the Southern colonies, notably South Carolina. The patrol was a sort of police for the parish, and was designed especially to prevent and subdue insurrections among the slaves. In South Carolina the patrol was established by law in 1704. The patrollers furnished their own pistols and horses. They rode from plantation to plantation and arrested all slaves who could not show passes from their owners. This system soon became general through the South, and continued under various forms for many years.

**Patron**, among the Romans, a name denoting a patrician who had plebeians under his immediate protection, and whose interests he supported by his authority and influence. When Rome had reduced many nations under her yoke, noble Romans were sometimes the patrons of whole cities and provinces, and such patronage even descended by inheritance in some families. Patron was also the title of every advocate who represented the interest of another, his client. In later times the term patron was applied to every protector or influential promoter of the interests of others; hence the saints who were believed to watch over the interests of particular persons, places, or trades were called patron saints.

**Patron Saint**, the canonized saint who is sometimes credited with watching over, protecting or interceding for certain persons, places, trades or institutions. Thus Saint George is commonly called the patron saint of England, Saint Denys of France and so on. In the Middle Ages every trade had its patron saint. Saint Clair was the patron of lamp-lighters; Saint Cloud of nailers; Saint Blanc or Blanchard of laundresses; Saint Peter of fishermen; and Saint Dunstan of goldsmiths. The patron of an individual is generally the saint by whose name he was baptized.

**Patrons of Husbandry.** See GRANGERS.

**Patronym'ic**, a name which designates a person in reference to some of his ancestors, either immediate or remote. In Sanskrit, Greek, and Latin patronymics are very common. In Sanskrit they have 13 recognized terminations. In Greek the suffixes were *idēs*, *iōn*, *iadēs*, *eides*, etc., for the masculine, and *ias*, *is*, *as*, etc., for the feminine. Achilles is called by Homer both Pelides and Æacides, Peleus being his father's name and Æacus that of his grandfather. The

Latins borrowed their patronymic terminations *ides* and *is* from the Greek. Among modern languages the Russian, Danish, German, and English have adopted patronymic terminations, the suffixes being respectively *vitch*, *sen*, *sohn* or *son*, and *son*. The Norman *Fitz*, the Welsh *Ap*, the Irish *O*, and the Highland *Mac* are prefixed to the paternal name, which thus becomes a patronymic. See NAMES (PERSONAL).

**Patroons'**, a popular name applied in colonial days to a special class of settlers in the New Netherlands. In 1629 the Dutch West India Company, in order to effect a permanent agricultural colonization of New Netherlands, granted a charter of "privileges and exemptions" to any members of the company who would within four years plant a colony of 50 anywhere in New Netherlands, except on Manhattan Island. These wealthy grantees were called Patroons, and were privileged to rule their colonies in absolute feudal style, the colonists being bound to them for a certain number of years. This system was soon found to be disadvantageous, since it tended to debar the less wealthy class of individual colonists. In 1640 the charter was modified and extended to any good citizen of the Netherlands. The system gave New York during the colonial period a sort of landed aristocracy. Under the English regime some of the regulations of the system were changed, and after 1775 the patroons, or "Lords of the Manor," became merely landed proprietors. The system occasioned some trouble between landlord and tenant, which culminated in 1839 in the anti-rent agitation (q.v.).

**Pattan**, pa-tän' (incorrectly **Patan**, **Patn**, **Puttun**, or **Pathan**: Hindustani, "city"), a common city name in eastern India. The two most important towns of this name are: Pattan in Baroda, on the Sarasvati, in the province of Gujarat, Bombay presidency, with a large fraction of its population of 32,646 (1891) composed of Jains, who have 108 temples in this sacred city. Swords, lances, and knives are made here, as well as a very beautiful sort of pottery. Pattan in Nepal, on the south bank of the Baghmati, two miles southeast of Katmandu, has many beautiful ruined palaces and temples and a population of about 30,000. It was formerly the capital city of Nepal.

**Pattee**, pät-tē', **Fred Lewis**, American educator: b. Bristol, N. H., 22 March 1863. He was graduated from Dartmouth in 1888 and is professor of English literature in Pennsylvania State College. He has published 'The Wine of May and Other Lyrics' (1893); 'History of American Literature' (1896); 'The House of the Black Ring' (1905).

**Pat'ten**, **George Washington**, American soldier and poet: b. Newport, R. I., 25 Dec. 1808; d. Houlton, Maine, 28 April 1882. He was graduated from Brown University in 1825, from West Point in 1830, served in the Seminole wars and in the war with Mexico, and was brevetted major for gallantry at Cerro Gordo where he lost his hand. He served on various military commissions during the Civil War until 1864 when he was retired with the rank of lieutenant-colonel. As a poet he earned the title "poet-laureate of the army." Among his lyrics are: the well-known 'Seminole's Reply'; 'Joys that We've Tasted'; 'Episode of the



Mexican War.' He also published: 'Artillery Drill' (1861); 'Cavalry Drill and Saber Exercise' (1863); 'Voices of the Border,' poems (1867); etc.

**Patten, Simon Nelson**, American sociologist: b. Sandwich, Ill., 1 May 1852. He was educated at Northwestern University, Illinois, and the University of Halle, Germany, taking the degree of Ph.D. at Halle in 1878. On his return to the United States he taught in the public schools, and in 1888 became professor of political economy at the University of Pennsylvania. He has contributed to sociological journals, and written 'Premises of Political Economy' (1885); 'Economic Basis of Protection' (1890); 'Theory of Dynamic Economics' (1892); 'Theory of Social Forces' (1896); 'Development of English Thought' (1899); 'Theory of Prosperity' (1902); 'Heredity and Social Progress' (1903). As a writer he is suggestive and original, but some of his conclusions are regarded as eccentric and are not accepted by sociologists; he has, however, advanced some theories of acknowledged value, particularly in his study of the dynamic forces of society and his discussion of value and price.

**Patterns.** In decorative art this is the common term for a body of ornament covering a given surface. Thus a paper hanging for walls or a piece of textile fabric or an inlaid floor is decorated according to a pattern, or with a pattern, which will be laid out according to a general design including many minor parts. The colored plate gives many patterns of different epochs and intended to be carried out in many different materials from which, indeed, the examples have been taken. Thus Figs. 1, 2, 3, and 5 are from Chinese and Japanese enameling on metal. Fig. 4 is a Japanese painted pattern, but the same pattern is carried out in enameled inlay and by piercing a thin board and the like. Figures 6, 7, and 8 are from Indian and Persian manuscripts, the decorative accompaniment of the lettering, and very similar patterns are found in oriental glazed tiles. Fig. 9 is from an Indian lacquered box; for the Indian work of this kind, though immeasurably inferior to the Japanese in finish and perfection of make, has often beautiful patterns applied to it. Fig. 10 is a Persian Niello, that is to say, an inlay of black upon a ground of white metal; the ground in this case being mainly cut away so that the black insertion covers most of the field. Fig. 11 is the corner of a Persian carpet; and this composition of conventional flowers should be compared with Fig. 6, that the reader may see this illustration of the wonderful skill of the Persians in such design. The Persians have always been the most able composers of flower patterns and leaf patterns in which natural forms are not closely followed. Figs. 12 and 13 are from Persian enameled pottery, tiles and the like, and here again the power of this race over floriated design is seen. Fig. 14 is from a French inlay of wood, light upon dark, of the 17th century, and Fig. 15 is a later piece of work of the same character, though here the veining of the wood is allowed to affect the general composition of the pattern. Figs. 16 and 21 are pieces of French embroidery of the 17th and 18th centuries, the patterns, being wrought with a needle upon the black and buff backgrounds. Fig. 17 is a painted cartouche, perhaps intended

for an heraldic escutcheon, though the bearings have not been put in. Fig. 18 is a wall decoration in color from the Chateau of Versailles. Fig. 19 is a piece of inlaid marble work of the 17th century. Fig. 20 is taken from a piece of Rouen ware, the most decorative variety of French faïence and the earliest to reach artistic perfection, dating from the 17th century. Fig. 22 is from a gilded and embossed leather wall hanging, and Fig. 23 from an embroidered wall hanging, each of the 17th century and probably of French origin, though the leather hangings of Spain are the more celebrated. Fig. 24 is from a piece of French porcelain of the 18th century, not from the royal manufactory of Sèvres, but from one of the private manufactories of the time, in which beautiful work was done. Figs. 25, 26 and 27 are textile fabrics of the 17th and 18th centuries. Such pieces were made for furniture covering and for curtains, but very similar patterns were woven on a small scale and in heavy and solid silk for ladies' wear. Finally Fig. 28 is a pilaster or stile of the wood-work in a drawing room, painted in delicate flower patterns directly upon the wood. RUSSELL STURGIS.

**Patterson, păt'ér-sôn, Daniel Tod**, American naval officer: b. on Long Island, N. Y., 6 March 1786; d. Washington, D. C., 15 April 1839. He entered the navy as a midshipman in 1800, was attached to the frigate Philadelphia under Captain Bainbridge, and was captured when that vessel was overhauled by a flotilla of Tripolitan gunboats after striking a reef in 1803. He remained a prisoner until 1805, and in 1807 received the rank of lieutenant, becoming master-commandant in 1813. He commanded the United States naval forces at New Orleans in 1814 and greatly assisted General Jackson in the defense of the city, receiving the thanks of Congress for his services. He captured the pirate Lafitte (q.v.) and destroyed his defenses on the island of Barataria, and in 1815 was promoted captain. In 1826-8 he commanded the Constitution, was navy commissioner in 1828-32, commanded the squadron in the Mediterranean in 1832-6, and was then transferred to the command of the navy yard at Washington.

**Patterson, Elizabeth.** See BONAPARTES OF BALTIMORE.

**Patterson, Joseph**, American banker: b. near Norristown, Pa., 25 Sept. 1808; d. Philadelphia, Pa., 25 Sept. 1887. He became a banker and during the Civil War, through his influence, the bankers of the country made a loan of \$50,000,000 in gold to Secretary Chase, at the famous conference in New York, and \$100,000,000 more in the year following. Secretary Chase constantly sought his advice on the financial policy of the administration. He was twice tendered the office of comptroller of the United States treasury which he declined as he did also the offer of the post of assistant-treasurer at Philadelphia. He was president of the Philadelphia clearing-house association from 1869 until his death.

**Patterson, Robert**, American soldier: b. near Hillsborough, County Down, Ireland, 30 May 1743; d. Philadelphia, Pa., 22 July 1824. He came to America in 1768 and settled in Pennsylvania where he engaged in teaching, and in



## PATTERSON — PATTISON

1774 was principal of the academy at Wilmington, Del. He volunteered in the Federal army at the outbreak of the American Revolution, and rose to the rank of brigade major. In 1779 he was appointed professor of mathematics in the University of Pennsylvania in which office he remained for 35 years, acting as vice-provost in 1810-13. In 1799 he was chosen president of the select council of Philadelphia, and in 1805 was appointed director of the mint by President Jefferson. He published: 'The Newtonian System' (1808); a treatise on 'Arithmetic' (1819); edited various educational works; etc.

**Patterson, Robert**, American pioneer: b. Pennsylvania 1753; d. near Dayton, Ohio, 5 Aug. 1827. He removed to Kentucky in 1775, and assisted in the construction of the fort at Royal Spring (now Georgetown), in defense of which he afterward fought bravely. In 1776 he was one of seven men who made the daring expedition to Fort Pitt in quest of ammunition, receiving on the return trip a severe wound from a skirmish with the Indians in which all the party were either killed or wounded. He fought under Daniel Boone at the battle of Lower Blue Lick, being second in command; was colonel in the Miami expedition of 1782, and served under Logan in his expedition against the Shawnees in 1786. He built the first house in Lexington, Ky., in 1779, owned one third of the city of Cincinnati, Ohio, when laid out, and founded Dayton, Ohio. Consult J. H. Patterson, 'Concerning the Forefathers' (1903).

**Patterson, Robert**, American soldier: b. Cappagh, County Tyrone, Ireland, 12 Jan. 1792; d. Philadelphia, Pa., 7 Aug. 1881. He came to America when very young. He served in the War of 1812, afterward becoming a prominent merchant of Philadelphia, and was one of the "five Colonel Pattersons" who nominated Jackson for the presidency. He organized, in President Jackson's honor, the great civic parade held in Philadelphia in 1833, and in the Mexican War served with distinction. At the outbreak of the Civil War he was mustered into service as major-general and placed in command of the Department of Washington, where he rendered excellent service in training the raw recruits. He was retired in July 1861. In 1865 he published 'A Narrative of the Campaign in the Valley of the Shenandoah' in explanation of his conduct of affairs, which received much attention and went far toward clearing away the censure to which he had been subjected for his conduct in that campaign.

**Patterson, Robert Mayne**, American Presbyterian clergyman: b. Philadelphia 17 July 1832. He was graduated from Princeton Theological Seminary in 1859, has held Presbyterian pastorates in Pennsylvania, and edited 'The Presbyterian Journal' 1880-93. Among his numerous works may be named 'Elijah, the Favored Man' (1880); 'Isaiah and the Higher Critics' (1889); 'American Presbyterianism' (1896).

**Patteson, păt'e-sòn, John Coleridge**, English missionary and martyr: b. London 1 April 1827; d. island of Nukapu, Melanesia, 20 Sept. 1871. He was educated at Eton and Oxford, was elected fellow of Merton in 1852, and in 1853 was appointed curate of Alfington, Devonshire. In 1855 he sailed with Bishop Selwyn to New

Zealand, and the next 16 years were spent in missionary labors in the Melanesian and other South Sea islands. He was consecrated bishop of Melanesia in 1861. Greatly beloved by the Melanesians, whom he protected to his utmost against the white kidnappers of the Pacific, he was killed by the natives of Nukapu, one of the Santa Cruz group, in revenge, it is supposed, for relatives carried away by the white slavers. Consult: Yonge, 'Life of John Coleridge Patteson' (1874); Awdry, 'The Story of a Fellow Soldier' (1875).

**Patti, păt'ē, Adelina Maria** (originally ADELA JUANA MARIA), Italian singer: b. Madrid, Spain, 19 Feb. 1843. The daughter of Italian opera singers, she was brought up in New York, where she was trained by Strakosch, who married one of her elder sisters, Amelia, and where her wonderful voice, when she was only in her 7th year, saved her family from poverty. It was nearly ruined by overwork, however, and she only retired from the concert stage in time to save it. On 24 Nov. 1859 she made her début in opera in New York as Lucia, and on 14 May 1861 in London as Amina, going in the next year to Paris, where she stayed until 1870, singing at the same time in Italian opera in London and Madrid. Her success everywhere was tremendous, partly because of her personal grace and charm, but mostly due to her pure style and her clear, pure-toned voice, which has wonderful range, though no great power. The Italian operas in which she most frequently sang were 'Sonnambula,' 'Lucia di Lammermoor,' 'Il Barbiere di Siviglia,' 'Don Pasquale,' 'La Traviata,' 'Rigoletto,' 'Don Giovanni,' 'Il Trovatore,' 'I Puritani,' and 'Ernani.' She occasionally sang Wagnerian songs in concert. In November and December 1903 she made an American concert tour, which was a great financial success, and which showed that her vocal powers were only slightly impaired. She married 1868 the Marquis of Caux, equerry to Napoleon III., left him in 1877, was divorced in 1885, and married in June 1886 the tenor Niccolini, after whose death, 18 Jan. 1898, she married in 1899 Baron Cederstrom, with whom she lives at Craig-y-Nos, in Wales.

**Patti, Carlotta**, Italian concert singer, sister of Adelina Patti (q.v.): b. Florence 1840; d. Paris 27 June 1889. She was first trained as a pianist, but devoted herself to vocal music, and in 1861 appeared in concert in New York; her lameness prevented her from staying on the operatic stage. She sang in London in 1863, made several tours in Europe and America, and 3 Sept. 1879 married Ernest de Munck, a violoncellist. Her execution was excellent, and her voice a remarkably high and flexible soprano.

**Pattison, păt'ĩ-sòn, Dorothy Wyndlow**, best known as "SISTER DORA," English nurse: b. Haukswell, near Richmond, Yorkshire, 16 Jan. 1832; d. Walsall, Staffordshire, 24 Dec. 1878. She was a sister of Mark Pattison (q.v.). In 1864 she entered a Church of England Sisterhood of the Good Samaritan at Coatham, adopting the name of "Sister Dora." The next year she was sent as nurse to a cottage hospital at Walsall. She at once endeavored to render herself a good surgical nurse, and from 1867 to 1877 was in sole charge of a new hospital at Walsall, built in 1867. She resigned in February 1877, in



order to take charge of the municipal epidemic hospital at Walsall. She shrank from no labors, however difficult or repulsive, and her natural qualifications as a nurse were reinforced by the skill she acquired in surgery. She was greatly beloved by the poorer classes among whom she labored, and in her memory a window was placed in the Walsall parish church and a statue of her erected in Walsall in October 1886. Consult: Lonsdale, 'Sister Dora' (1880); Ridsdale, 'Sister Dora' (1880).

**Pattison, Mark**, English scholar and clergyman: b. Hornby, Yorkshire, 10 Oct. 1813; d. Harrowgate, Yorkshire, 30 July 1884. He was educated at Oxford, and in 1839 became a fellow of Lincoln College, Oxford. In 1843 he took priest's orders in the English Church and was appointed a tutor in Lincoln College the same year. He was at this time a follower of Newman, but presently drifted away from Tractarianism and became in his later years an extremely liberal member of the Anglican communion. In 1861 he became rector of Lincoln College and engaged actively in the work of university reform, and under him his college developed its resources and came into prominence in the University. He was a most thorough scholar, but often caustic in speech and always impatient of anything like pretense. To the famous book 'Essays and Reviews' he contributed 'Tendencies of Religious Thought in England 1688-1750,' and he was the author of 'Suggestions on Academical Organization' (1868); a 'Life of Isaac Casaubon' (1875), his principal work; 'Life of John Milton' (1879), which has often been reprinted; 'Sermons' (1885); 'Memoirs' (1885), a somewhat morbid piece of autobiography extending only to 1860. Consult Tollemache, 'Recollections of Pattison' (1885).

**Pattison, Robert Emory**, American politician: b. Quantico, Md., 8 Dec. 1850; d. Philadelphia, Pa., 1 Aug. 1904. He was graduated from the Philadelphia Central High School in 1870 and admitted to the bar in 1872. He engaged in law practice, but soon turned his attention to politics, and in 1877-82 was city comptroller of Philadelphia. Owing to a split in the Republicans, in 1882 he was elected governor of Pennsylvania, although his party was in the minority, and served four years when he resumed his law practice. He was president of the Chestnut Street National Bank, of the United States Pacific Railway Commission in 1887-90, and in 1891-5 again served as governor of his State.

**Pattison, Thomas Harwood**, American Baptist clergyman: b. Cornwall, England, 14 Dec. 1838; d. Rochester, N. Y., 13 Feb. 1904. He was graduated from Regent's Park College, England, in 1862, came to the United States, and last occupied the chair of homiletics and pastoral theology at the Rochester Theological Seminary. He has published: 'Present Day Lectures' (1872); 'The History of the English Bible' (1894); 'The Ministry of the Sunday School' (1902); etc.

**Pat'ton, Francis Landey**, American educator and theologian, 12th president of Princeton University: b. Warwick, Bermuda, 22 Jan. 1843. He was educated at Knox College, Toronto, the University of Toronto, and at Princeton Theo-

logical Seminary, where he was graduated in 1865. He was pastor of the 84th Street Church, New York, 1865-7, of the Nyack Presbyterian Church 1867-71, of the South Church, Brooklyn, 1871, and of the Jefferson Park Presbyterian Church, Chicago, 1874-81. While in Chicago he edited the 'Interior,' a religious weekly, was professor of theology in the Presbyterian Theological Seminary, and was prominent in the anti-heresy movement in the Presbyterian Church, being prosecutor of Professor David Swing (q.v.). He was moderator of the Presbyterian General Assembly in 1878. In 1886 he was elected professor of ethics at Princeton College, having removed to Princeton in 1881 to occupy a chair in the Theological Seminary, endowed by Robert L. Stewart and styled "Relations of Philosophy and Science to the Christian Religion." In 1888 he was chosen president of Princeton University, then called the College of New Jersey, but adopting the title of University in 1896. His administration was marked by great growth in the wealth and in the numbers of students of the University. In 1902 he resigned, and a few months later was elected president of Princeton Theological Seminary. In 1891-2 he was prominent in the opposition within the Presbyterian Church to the action of Union Theological Seminary in upholding Dr. Charles A. Briggs (q.v.), who was accused of heresy. He has published 'The Inspiration of the Scriptures' (1869), 'Summary of Christian Doctrine' (1874), and many papers on philosophical and theological subjects. As a preacher he combines erudition, logic, and dry humor.

**Patton, Frank Jarvis**, American soldier and inventor: b. Bath, Maine, 1852; d. New York 12 Nov. 1900. After graduation from West Point in 1877, he was assigned to the 21st infantry, rose to the rank of 1st lieutenant in 1884, and resigned from the service in 1889. He experimented much with electricity, and was the inventor of the multiplex telegraph system. Among other devices of his was that of the gyroscope, used to determine the position of vessels in mid-ocean. At the time of his death he was interested in a business concern formed for the promotion of his invention for the manufacture of carbide.

**Patton, Jacob Harris**, American historian: b. Fayette County, Pa., 20 May 1812; d. 1903. He was graduated from Jefferson College, Pa., in 1839 and from Union Theological Seminary in 1846. He was tutor in Union Seminary in 1843-6; in Nashville University 1840-3, and in the New York Classical School in 1846-87, since when he has devoted himself to literature. Among his publications are: 'A Concise History of the American People' (1869-82); 'Yorktown, 1781-1881' (1882); 'Natural Resources of the United States' (1888); 'Political Parties in the United States' (1902); etc.

**Patuxent**, pa-tuks'ent, a river of Maryland, rises in the north of the State about 20 miles east of the city of Frederick, flows southeast and then south, and empties into Chesapeake Bay through a large estuary. It is 90 miles long, is navigable for almost 50 miles, and contains oyster beds of great value.

**Patzcuaro**, pät'thkwä-rō, Mexico, city in the state of Michoacan, 30 miles southeast of Morelia and a little southeast of the lake of



## PATZUM — PAUL

the same name, on the shores of which was the city of Tzintzontzan, the capital of the Tarascas and the centre of the great Michoacan empire. The present city is 7,500 feet above the sea-level and occupies much the same site; is an old and picturesque town, with the tomb of Vasco de Quiraga, an early bishop of Michoacan and missionary to the Indians; and is famed for the handiwork of the natives, notably colibri feather cloaks and furniture. There are sugar, tobacco, and mining industries centred here. Pop. about 8,000.

**Patzum**, pät-soom', Guatemala, town in the department of Chimaltenango, situated 23 miles northwest of the town of Chimaltenango, at an altitude of 6,500 feet and near the source of a mountain torrent. There are coal, silver, antimony, and lead mines near the city, which is itself devoted mostly to wool-weaving and to handling the produce of the surrounding fertile country. Pop. (1892, estimated) 6,500.

**Pau**, pō, France, capital of the department of Basses-Pyrénées, on a lofty ridge on the right bank of the Gave-de-Pau, here crossed by a fine bridge, 58 miles east-southeast of Bayonne, and commanding a magnificent view of the Western Pyrenees. It has several squares, notably the Place Royale, with a finely planted promenade, and a marble statue of Henry IV., and the Place-de-la-Comédie, communicating with a suburb by a bridge which spans a deep ravine. The most conspicuous and interesting edifice is the castle in which Henry IV. was born, crowning a lofty peak at the western extremity of the town, and overhanging the Gave. It is a huge, angular, and irregular structure, flanked with towers, of which five still remain, the highest (the Tour de Gaston-Phœbus) or dungeon having a height of 100 feet, and another, called the Tour de la Monnaie, being the traditional asylum which Margaret of Valois gave to Calvin and other persecuted reformers. Great part of the castle was restored in good taste by Louis Philippe. Pau has a court of appeal for the departments of Basses-Pyrénées, Hautes-Pyrénées, and Landes; courts of the first resort and commerce; an academy, college, museum, library, a winter palace, since 1896, in Beaumont Park, agricultural society, and society of science, literature, and art. The manufactures consist of napkins, excellent table linen, rugs, carpets, paper, and leather. The trade is in wine, Bayonne hams, salt provisions, excellent chestnuts, printed cottons, iron, etc. Pau has given birth to two sovereigns, Henry IV. and Bernadotte (Charles XIV. of Sweden). It is a favorite resort of the English in winter, having a mild, dry climate, with no sudden variations of temperature; it is a convenient starting-place for travelers desirous of exploring the Pyrenees. Pop. (1901) 34,692.

**Pauer**, pow'ër, **Ernst**, Austro-English musician: b. Vienna, Austria, 21 Dec. 1826. He was educated in Vienna and Munich and was successful, both as a director of musical societies and in giving historical piano recitals. In 1866 he was appointed pianist at the Austrian court, and since 1870 he has lectured in England and Ireland on the history of music. He was appointed professor of the National Training School for Music at Kensington Gore in 1876, in 1878 was a member of the musical board at Cambridge, and in 1879 was appointed examiner there. He

has edited the works of various great composers and among his operas are: 'Don Riego' (1849); 'Die Brautschau Friedrichs des Grossen' (1861); etc.

**Paul, Saint.** See SAINT PAUL.

**Paul**, the name of five popes, as follows:

**Paul I., Saint:** d. Rome 28 June 767. He was the successor of Stephen III., his brother, in 757. He was ably supported in his pontificate by Pepin I., king of the Franks, who assisted him in disputes with the Lombards and the Byzantine emperor.

**Paul II.** (PIETRO BARBO, pē-ā'trō bār'bō): b. Venice 26 Feb. 1418; d. Rome 28 July 1471. He was a nephew of Pope Eugenius IV., became a cardinal in 1440, and succeeded Pius II. in 1464. His first endeavor was to form an alliance of the Christian princes against the Turks, who at the time threatened to invade Italy, but in this he failed. He sought to stem the pagan tendencies of the Renaissance spirit, and took stringent measures against the heretical teachings of some of the Humanists of the time, even to closing the Roman Academy.

**Paul III.** (ALESSANDRO FARNESE, ä-lës-sän'-drō fär-nä'së): b. Canino 29 Feb. 1468; d. Rome 10 Nov. 1549. He was made a cardinal in 1493 and subsequently became bishop of Ostia and the dean of the Sacred College. He was elected to the papal chair in succession to Clement VII. in 1534. He had previously urged the summoning of a council of the Church and after he became pope called a council to meet at Mantua in 1536, at Vicenza in 1538, and at Mantua again in 1542. Disputes between Charles V. and Francis I. prevented the assembly of the council on each occasion, but in 1545 it met at Trent. (See TRENT, COUNCIL OF.) He was a vigorous suppressor of heresy, re-established the Inquisition in Italy, approved the Order of Jesuits, condemned slavery in 1537, and excommunicated Henry VIII. of England.

**Paul IV.** (GIOVANNI PIETRO CARAFFA, jō-vän'nē pē-ā'trō kă-rä'fä): b. Naples 28 June 1476; d. Rome 18 Aug. 1559. He became archbishop of Brindisi in 1518, founded the order of secular clergy known as Theatines in 1524, was made cardinal in 1530, and in extreme old age (1555) succeeded Marcellus II. He nevertheless displayed a vigor in his pontifical office, which had not been looked for in one of his advanced age and previous studious habits. He established a censorship, completed the organization of the Roman Inquisition, undertook the alleviation of the burdens of the poor and the more vigorous administration of justice, and also banished his own nephews from Rome on account of their dissolute life. He joined with France in the war for the conquest of Naples (1555-7) and condemned the provisions of the Peace of Augsburg.

**Paul V.** (CAMILLO BORGHESE, kă-mēl'lō bōr-gä'së): b. Rome 17 Sept. 1552; d. there 28 Jan. 1621. In the earlier part of his career he was prominent as a theologian, and in 1596 he became a cardinal. He succeeded Leo XI. in 1605. He was a vigorous, able administrator and among important incidents of his pontificate were: a conflict with Venice which resisted him so stoutly that he excommunicated the doge and senate, the establishment of the Congrega-



## PAUL — PAUL OF SAMOSATA

tion of the Oratory, and the orders of the Ursulines and the Visitation; and great activity in mission work in heathen lands. The arts also flourished under his direction. Consult T. A. Trollope, 'Life of Paul V.' (1861).

**Paul I.**, czar of Russia, son of Peter III. and Catharine II.: b. 1 Dec. 1754; d. 24 March 1801. His father refused to acknowledge his legitimacy, and his mother treated him with great severity so that his naturally good disposition became morose, sullen, and fitful. He succeeded her, in spite of her plans to exclude him from the throne, in 1796, removed all her favorites, punished his father's murderers, released Kosciusko and other captive Poles, re-established the rule of male succession to the throne, bitterly opposed everything French, even suppressing pamphlets which approached Jacobin sentiments merely in containing such words as "citizen," "society," etc., and after the French invasion of Egypt formed an alliance with England against the Republic, sending armies to Holland, to Switzerland (under Khorsakoff), and to Italy (under Suvaroff). The defeat of the second army followed close on the heels of the great victory of the third. Suvaroff barely escaped, and Paul, won by Napoleon's artfulness and out of humor with his English allies, who refused to surrender to him the island of Malta, to which he held title through Louis XVIII., his royal guest, now broke with the English, joined Napoleon most heartily, dismissed Louis from Russia, and formed with Sweden, Denmark, and Prussia the armed neutrality, which was calculated to ruin England. But his despotism at home, his demands that everybody prostrate himself before him, and the rumor that he intended to disinherit his son Alexander, roused a plot against him, to which Alexander was privy. Paul was to be forced to abdicate and Alexander would then become regent. But when the conspirators broke into his room and bade him sign his abdication, he refused, attempted to make his escape, and was killed, probably being strangled with a sash. Consult: Bienemann, 'Aus den Tagen Kaiser Pauls' (1886); Schiemann, 'Die Ermordung Pauls und die Thronbesteigung Nikolaus I.' (1902).

**Paul, Charles Kegan**, English publisher and author: b. White Lackington, Somerset, 8 March 1828; d. London 19 July 1902. He was educated at Oxford, took orders in the Church of England, was made curate of Great Tew (1851) and Bloxham (1852), and after 10 years of teaching at Eton became vicar of Sturminster, Dorsetshire. His views gradually developed a positivist character, and he therefore withdrew from his living and became reader for the publishing-house of H. S. King, to whose business he later succeeded. His firm published many important works and the 'Nineteenth Century Review.' In consequence of financial troubles the concern was transformed into a limited company, of which Paul was manager until his retirement in 1899. Toward the close of his life he entered the Roman Catholic communion. Among his works are: 'William Godwin' (1876); 'Biographical Sketches' (1883); 'Faith and Unfaith' (1891); 'Memories' (1899).

**Paul, John.** See WEBB, CHARLES HENRY.

**Paul, Lewis**, English inventor: d. Brook Green, Kensington, April 1759. In 1738 he ob-

tained a patent for a cotton and wool spinning machine, this patent comprising an invention now in use in most of the world's cotton-mills. This invention consists of two pairs of rollers, one of which revolves at a velocity greater than that of the other. Cotton and wool are stretched ("drawn") by being passed between these rollers. His invention never brought Paul substantial returns, and was commercially successful only when later employed by Arkwright. Among his other inventions are those of a carding-machine and another spinning-machine. Paul was a correspondent of Dr. Johnson.

**Paul and Virginia**, novel by Bernardin de Saint-Pierre (q.v.), published in 1787. The story is in two parts, the first dealing with the idyllic friendship of Paul and Virginia, who grow up together, and the second with the dawning of their love for each other, with Virginia's death in shipwreck, and with Paul's death of grief. The style is delicate, the tone rather morbid; but the book has long been famous. It introduced into France the school of exotism or exoticism. Several operas have been written on the theme; one by Kreuzer, played at the Opéra Comique in 1791; another by Lesueur in 1794; and a third with libretto by Carré and Barbier, and music by Victor Massé, which was first played at the Théâtre Lyrique in Paris 15 Nov. 1876. The popular painting by Cot, commonly called 'Paul and Virginia,' more properly is called 'The Storm' and possibly was not intended to illustrate this story.

**Paul Clifford**, a novel by Bulwer, published in 1830. It derives its name from that of its hero, and the author's purpose in writing it was to appeal for an amelioration of the British penal legislation, by illustrating to what criminal extremes the ungraded severity of the laws was driving men who by nature were upright and honest.

**Paul Pry**, a comedy by John Poole, published in England in 1825 and often attributed to Douglas Jerrold. The character from which the play takes its name is that of a meddlesome mischief-maker drawn from one Thomas Hill, a journalist.

**Paul Veronese.** See VERONESE, PAOLO.

**Paul of the Cross, Saint**, Italian religionist, founder of the Order of Passionists (q.v.): b. (PAOLO FRANCESCO DANEI) Ovada, near Genoa, 1694; d. Rome 18 Oct. 1775. With a few associates he led a life of religious retirement on Mount Argentaro (Orbitello), where it was divinely revealed to him that he was to be the founder of an order, and even the habit was shown. The Bishop of Alessandria permitted Paul to assume this habit, and, as a layman, to preach repentance. In 1727 he was ordained priest, and in 1737 established on Mount Argentaro the first Passionist settlement. Benedict XIV. formally approved the order in 1741. Paul was canonized in 1867; his day is 16 November.

**Paul of Samos'ata**, a heresiarch of the 3d century. He became patriarch of Antioch in 260, and acquired great wealth. He caused the hymns of the Church to be abolished and others sung in praise of himself, and surrounded himself with a number of young and beautiful women. In defiance of the ecclesiastical canons he held the office of *duccenarius*, a sort of procuratorship under the emperor. He was a friend



## PAUL OF THEBES — PAULDING

of Zenobia, queen of Palmyra, an admirer of his eloquence. He taught that there was only one God, who is the Father; that the Word or Wisdom of God was not a substance or person, but was in the divine mind as reason in men; that Christ was a mere man who acquired this Word or Wisdom of God, becoming by it both God and the Son of God, though both in an improper sense, and gradually acquiring his knowledge and virtues. His opinions were condemned in a council held about 264. Failing, however, to retract them he was deposed at the council of Antioch in 269. He passed the latter years of his life in obscurity.

**Paul of Thebes, Saint**, early Christian hermit: b. Thebes, Upper Egypt, 228 A.D.; d. 340. He is the first Christian hermit, as distinguished from the still earlier ascetics, of whom anything is known. In 250 A.D., during the Decian persecution, he retired to a desert cave, and there lived until his death, a near-by spring and palm supplying him with food, clothing, and shade. In later years ravens ministered to him, as to Elijah. He received in his seclusion Saint Anthony, who became his successor in the establishment of the hermit life. Jerome wrote his life, and rejected as incredible many of the fabulous tales told regarding him, which could scarcely have been more remarkable than those still narrated. His day in the Roman Catholic Church is 15 January.

**Paul of Venice, or Brother Paul** (Fra Paolo). See SARPI, PAOLO.

**Paulanites.** See ORDERS, RELIGIOUS.

**Paulding, pâl'ding, Hiram**, American naval officer: b. New York 11 Dec. 1797; d. Huntington, N. Y., 20 Oct. 1878. He entered the navy in 1811, distinguished himself in the War of 1812, particularly at the battle of Lake Champlain, and after the war served on the Constellation of Decatur's squadron against the Barbary powers. In 1822-3 he was 1st lieutenant of the Sea Gull, said to be the first steam-vessel used in war, in an expedition by Porter against West Indian pirates; and, made captain in 1844, cruised for three years (1844-7) in the sloop Vincennes in East Indian waters. He commanded at the Washington navy yard in 1851-4, and in 1854-7 was in command of the home squadron. In December 1857 he arrested William Walker (q.v.), the filibuster, at Greytown, Nicaragua. He acted without instructions, and his conduct in apprehending Walker on foreign soil was not approved by President Buchanan, who relieved him of his command. The republic of Nicaragua, however, presented to him a sword, and offered also a large tract of land, which the United States government did not allow him to accept. On the outbreak of the Civil War he was called by Lincoln to Washington to assist Secretary Welles in putting the navy in trim, and in April 1861 destroyed the navy yard at Norfolk, Va., to prevent its valuable stores from falling into the possession of the Confederates. In 1861 he was retired on the age limit, in 1862-6 was commandant at the New York navy yard, in 1866-9 governor of the naval asylum at Philadelphia, and in 1870-1 port-admiral at Boston. He was promoted rear-admiral on the retired list in 1862. He wrote, 'Journal of a Cruise Among the Islands of the Pacific' (1831).

**Paulding, James Kirke**, American author: b. Nine Partners, Dutchess County, N. Y., 22 Aug. 1779; d. Hyde Park, N. Y., 6 April 1860. At 19 he removed to New York, the home of his brother William, and of William Irving, who had married Paulding's sister and who was the means of his acquaintance with Washington Irving. In 1807 the two Irvings and Paulding brought out the first copy of 'Salmagundi,' a satiric literary periodical, which met with immediate success, but was discontinued at the end of a year, when the publisher refused to pay the authors. Paulding was not, however, dependent on his writings for support as he held a public office in New York city. In 1812 he gained fresh praise by a spirited national satire, 'The Diverting History of John Bull and Brother Jonathan,' which allegorizes the difficulties between Great Britain and the United States. The same theme was cleverly treated in prose in a pamphlet called 'The United States and England,' which brought him the post of secretary to the board of navy commissioners. Much of his time and energy were spent in writing editorials for the New York *Evening Post* and in other political hackwork, and many of his literary ventures during this time were of little value and had small success; this is notably true of 'The Backwoodsman' (1818), an epic of pioneer life, and of a new series of 'Salmagundi' (1819). But in the lighter vein of humor and fiction he was more at home; 'Köningsmarke,' a story of the early Swedish settlers (1823), 'John Bull in America, or the New Munchausen' (1824), 'The Merry Tales of the Three Wise Men of Gotham' (1826), a 'Chronicle of the City of Gotham' (1830), and the very successful story, 'The Dutchman's Fireside,' are the best of his works. From 1825 to 1837 he had been navy agent at the port of New York, and in the latter year became secretary of the navy, in which position he stubbornly opposed the introduction of steam-driven vessels into the navy. He retired in 1841, published a Revolutionary novel called 'The Old Continental' (1846), 'American Comedies' (with his son William Irving Paulding, 1847), and 'The Puritan and His Daughter' (1849), another historical novel. His verse was mediocre, the tongue-twisting lines beginning "Peter Piper picked a peck of pickled peppers," which appeared in 'Köningsmarke,' being his surest claim to poetic fame. As a politician he was very conservative; his 'View of Slavery in the United States' defends the institution. His true literary strength lay in his fund of original humor. His selected works (1867-8) and his 'Literary Life' (1867) were edited by his son William Irving Paulding.

**Paulding, John**, American soldier: b. New York 1758; d. Staatsburg, N. Y., 18 Feb. 1818. He enlisted in the Federal army at the outbreak of the American Revolution, served through the war and was three times taken prisoner. His fame rests upon his being one of the captors of Major André, for which service to the American cause he received a silver medal from Congress and a pension of \$200. A monument was erected over his remains at Peekskill, N. Y., in 1827 by the city of New York, and the monument erected at Tarrytown, N. Y., on the spot of the famous capture has the figures of Paulding and his companions reproduced in the act of searching André for the secreted papers.



## PAULICIANS — PAULINE EPISTLES

**Paulicians**, pâ-lîsh'anz, Manichæans and Gnostics who in the 8th century assumed the name of Paulicians, from Paul their leader, to save themselves from persecutions. As iconoclasts they were favored or persecuted by the Greek emperors according as the latter were favorable or otherwise to the worship of images, which the Manichæans totally rejected. In the 9th century they were subjected to violent persecution. Many of them were put to death; others fled to Mohammedan countries. When the Crusades had opened a way to the middle of Europe, companies of this sect passed as pilgrims from the Holy Land up the Danube, and entered Italy with the Levant trade through Venice. The Vaudois and Albigensis sects (Waldenses and Albigenses) are said to have sprung from this stock. Such is the account given of them by Photius and Petrus Siculus, but a different view has been taken by modern ecclesiastical historians. According to these writers the sect was founded by one Constantine of Mananalis, who conceived so great a veneration for the Apostle of the Gentiles that he assumed his name. They rejected the adoration of the Virgin and the saints, and refused homage to the cross; they denied the validity of the sacraments, interpreting spiritually baptism and the Lord's Supper; would not recognize any priestly dignity; and their public worship was altogether free from ritual. A remnant of this sect is said by a modern Greek historian to have survived at Philippopolis to the beginning of the 19th century. See RELIGIOUS SECTS.

**Pauline Epistles**, the name by which 13 books of the New Testament are commonly known, namely, Romans, 1 and 2 Corinthians, Galatians, Ephesians, Philippians, Colossians, 1 and 2 Thessalonians, 1 and 2 Timothy, Titus, and Philemon. A 14th book, the Epistle to the Hebrews, has been widely regarded as from Paul's pen, but the marked variance in form, style, manner of reasoning and type of thought from the epistles generally recognized as his, has caused this epistle, which neither claims Paul as author nor was attributed to him by the earlier Fathers, to be at the present time all but unanimously regarded as non-Pauline.

Of the four first-named of these 13 epistles, Paul's authorship has never been doubted by any sober criticism. Van Manen and a few other critics have lately revived the view of Bruno Bauer, that no writings at all of the apostle have been preserved, but with no influence on the general opinion of scholars. The claim that there are decided inconsistencies in these letters is dismissed with practical unanimity as "hypercriticism," and it is recognized that in no period of the history of the Church before 125, soon after which the epistles appear to have been widely accepted, would the four chief epistles fit as they fit into the circumstances of the apostolic age, so far as they can be known, as for instance, the Judaistic controversy among the Galatian churches. But, to leave out of account the later unanimous tradition of the Christian Church touching the Pauline epistles, before the close of the 1st century the letter of Clement of Rome to the church at Corinth decisively attested Paul's authorship of First Corinthians, and the likeness which runs through the four great epistles makes testimony to one to be indirectly testimony to all. It would, indeed,

be incredible that any writer of the 2d century, especially a Christian chiefly intent on foisting on the church at large under the name of Paul his own doctrinal views, could have conceived and depicted with such consistency and vividness such a nature as that of Paul,—fervid, profound, impetuous, self-mastered, tender, strong, a personality so rich in so many elements of character.

If the four chief letters are accepted as Pauline, because certified to by unanimous tradition, undisputed by sound criticism and sufficiently self-evidencing, it will follow for similar convincing reasons that First Thessalonians, Philippians and Philemon should also be accepted, as, indeed, they are to-day by the great majority of unbiased critics. On careful consideration Second Thessalonians will commend itself as Pauline alongside the First Epistle, which in style it strongly resembles, but not so closely as to necessitate the hypothesis of copying, while the difference between the two epistles in the presentation of the eschatological teaching would be unnatural, if another were writing under the name of Paul. In spite of an unlikeness in style to the epistles already discussed, the Pauline authorship of Colossians has found steadily increasing favor among critics, so that it is now quite generally accepted, especially in view of the facts that the historical notices seem too natural to have been fabricated, and that the errors against which it was directed prevailed in that form only early. If Colossians can be accepted as Paul's own, no reason remains for doubting his authorship of Ephesians, for the unlikeness in style to his earlier writings is no greater than was the case with its sister epistle, and the great likeness of Ephesians to Colossians, which has been used in argument against the genuineness of the former, is no more than might easily have resulted when two letters were written practically simultaneously. As touching ten of the epistles then the tradition of the church has after long and keen debate been verified by the verdict of critical scholars, in most cases with practical unanimity, in the remaining cases by a decisive majority.

With the "Pastoral Epistles," so-called, First and Second Timothy and Titus, the case stands otherwise and is still open. The traditional and patristic attestation is as strong for these epistles as for the rest, for the rejection of them by the heretic Marcion should be explained as due to his hostility toward their teachings. The argument against accepting them is threefold: first, that no place can be found for them in the life of Paul so far as it is known to us from Acts; second, that the style both in use of words and in general tone is decidedly unPauline, and, third, that they presuppose conditions ecclesiastical and doctrinal which could not have existed in the Church till the 2d century. In answer to the first it should be said that, if Paul was released from his first imprisonment, there was opportunity for the composition of these letters and for all that that carries with it, and that history and tradition are quite as consistent with release as with a fatal issue of his case. As to the second class of arguments it must be recognized that we do meet language and a literary tone in some degree new, although but a brief interval between their appearance and that of preceding letters could have elapsed, but this



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might be due to any of several things, the use of a literary assistant, for example, who somewhat modified the Apostle's own style, and the existence of such circumstances can no more be positively denied than asserted. As to the third, it ought to be noted that there exist no standards by which to measure the rapidity of development in the life and organization of the primitive churches; and, further, that the ecclesiastical constitution of the churches, the heretical views which seem later to have merged into Gnosticism and the hostile relation of the Roman government, all seem less developed than we should expect to find them even as early as the year 100, much later than which those who doubt the Pauline authorship usually date their composition. Perhaps no positive answer can now be given to the problem as to the genuineness of the Pastoral Epistles, although there is a growing agreement that the historical notices which they contain are largely genuine, a fact which additionally complicates the problem. While the attempts to remove all the difficulties which surround these letters have not yet been fully successful, it seems on the other hand impossible to disprove their Pauline authorship.

In the following survey of the several epistles and their various occasions and characters, no attempt has been made to date them absolutely, but only relatively by placing them in connection with other parts of Paul's work as a missionary. (For an approximation to the absolute dating see article NEW TESTAMENT CHRONOLOGY.)

What has usually been regarded as the earliest of Paul's extant writings is the First Epistle to the Thessalonians, but naturally it does not follow that he had never written such letters before, any more than that all which he wrote afterward have been preserved. On his second great missionary tour, after a short work at Philippi, his first work in Europe, Paul next preached at Thessalonica, now Saloniki, then the capital of one of the four divisions of Macedonia, and a busy and important city. Here for three weeks he preached in the synagogue, and then elsewhere to the Gentiles for we know not how long, possibly for months. But after a time the hostility of the Jews succeeded in driving Paul and his companions out of the city, and passing through Berea he went on to Athens, from which place Timothy was sent back to Thessalonica, not to rejoin the Apostle until after he was established at Corinth. His news was such that Paul at once wrote to the church touching three points: after expressions of gladness at their faith steadfast amid persecution, he assured them, in reference to calumnious accusations of which the rumor had been brought to him, that he really was still profoundly interested in them, and had repeatedly endeavored to revisit them; he warned them against heathen vices, and also against idleness and pauperism, and, finally, he instructed them about the resurrection of the believing dead at the return of Jesus which they were to expect. A second letter to the same church soon followed the first, by which in some sense it was occasioned. It seems that the stress laid upon the expected return of Jesus had led some to regard it as imminent, and to correct this misunderstanding of his views Paul wrote again in much the tone and even the language of the first, but adding

the corrective teaching that much must happen before Christ comes.

Because of the very uncertainties which attach to it the Epistle to the Galatians may best be discussed next. The destination, the place of writing and the date of this epistle are all uncertain and strongly disputed. Those to whom it was addressed were formerly looked for with practical unanimity in the northern part of the Province of Galatia, but of late many scholars have located the Galatian churches in the southern part of the Province, in the cities of Pisidian Antioch, Iconium, Derbe, Lystra and their neighbors. Certainly on this theory the Epistle gains greatly in vividness. The date and place of writing go together, and hang somewhat on the answer to the question of destination. If the Galatians of the letter are to be found in northern Galatia, then it is all uncertain when and where the letter was written, after the Thessalonian Epistles and before the Cæsarean imprisonment. On the South Galatian theory, it might even have preceded First and Second Thessalonians though probably not, and must have been written before Paul left Antioch for the last time, on his third tour. But whatever the uncertainties which thus surround the letter, when we take it up to read all is distinct. The Galatian churches had been approached by teachers who insisted that Christianity was incomplete and salvation impossible if keeping the law of Moses was not added to that simple faith in the crucified Christ which had been the converting message of Paul. To meet this condition he wrote with the utmost ardor and force, urging first that the message which he had presented must be adhered to because it had come to him by revelation and hence was finally authoritative, and then, not to rest in authority alone, that this view was the only one which was consistent with the facts of Judaism itself and with Christian experience; finally he sets forth the power of Christianity to secure a good life, the indwelling Spirit of God. While in his surprise and distress at the threatened apostasy of his converts Paul is much less considerate of form and phrases of address than is his wont, partly as a result the epistle is one of unsurpassed intensity, vividness and force.

After a stay of 18 months in Corinth where the Thessalonian letters were written, Paul left the church which he had founded there, and, having visited Jerusalem and Antioch, established himself at Ephesus for a three years' ministry in that city. During the latter part of this time disquieting rumors reached him in various ways as to the condition of the Corinthian Church. It was rent into factions; it was tolerating gross immorality; the meetings for worship were disorderly, and even the Lord's Supper was a scene of confusion; more than one question had come to be of such practical importance that the church consulted the apostle about it by letter, and, finally, reiterated instruction on the topic of the resurrection had become indispensable. Out of this situation grew the First Epistle to the Corinthians with its wealth of practical directions, warnings, instructions and exhortations beyond all Paul's other writings.

To the first letter to the Corinthians he was later obliged to add a second. While much of the purpose of First Corinthians seems to have



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been gained by it, at the same time disaffection against Paul and keen hostility to him appear to have even increased in some quarters so greatly that until this sentiment could be changed it seemed best not to revisit Corinth himself. He had sent both Timothy and Titus on special missions, and in his anxiety himself removed from Ephesus to Macedonia in order to know soonest and surest the condition of the church and their attitude toward himself, his anxiety being rendered keener from the nature of a letter which he had sent, which it had cost him pain to write and which might have been too severe in tone for his purpose, a letter which can scarcely have been our First Corinthians, and must be lost, unless the acute but unverifiable suggestion of several critics be correct, and Second Corinthians (x.-xiii.) constitute the kernel of the supposedly lost letter. In the state of mind natural to any ardent and affectionate nature in the face of intense and unscrupulous hostility Paul wrote the most personal of all his letters, a letter largely autobiographic in character, by turns tender and severe, pleading and sarcastic, though these qualities are most strikingly present in the second part of the letter, which, as has just been said, some would separate from the rest. In marked contrast to the First Corinthian Epistle, the great value of which lies in its practical instructions, the interest of the Second lies mainly in the revelations which Paul makes as to his history and sentiments and relations to friend and foe. The effect of the Epistle must have been salutary if not, indeed, completely satisfactory, for the letter to the Romans proves that he was soon after present in Corinth.

The Epistle to the Romans, the longest and apparently the most carefully prepared of all his epistles, was addressed to a church which he had not planted and which he had never visited. Naturally it must be more general in character than the rest, for there was nothing in the occasion of it which would limit its purport and scope. Having now completed the work which had pressed upon him in the eastern world, having established Christianity in the great centres of Syrian Antioch, Pisidian Antioch, Ephesus and Corinth, beside many less important places like Philippi and Thessalonica, the apostle's eye now turned westward and his thought fixed itself next on Rome, the capital of the world, whither everything in the empire tended, whence influence radiated to every part of the empire. While of course the fact that Christian work was effective at Rome would not ensure that it would reach the upper classes elsewhere, yet the fact would immensely increase its influence in the classes that might be touched. We have no historical basis as to when or how Christianity was planted at Rome; we only know that it was in existence and that in the constant ebb and flow of migration the faith of its members was widely and favorably known. While to many there Paul with his wide acquaintance would naturally be personally known, a supposition with which the number of his greetings at the end of the Epistle is in perfect harmony, yet to more he must have been still unknown, and doubtless not a few would by the persistent misrepresentations of his enemies have been brought into a temper of hesitancy and suspicion about him. Because he hoped soon to visit

Rome, and because at the same time his projected journey to Jerusalem would certainly delay the visit, how much he could not and did not foresee, he wrote a letter which might prepare the way for his later ministry with the church at Rome. With a dignity and thoroughness worthy of the occasion, Paul proceeded to write his answer to the three great questions then dominating theological controversy: How can a man secure God's forgiveness and favor? What will be the life of a forgiven believer? How does this gospel of a grace that comes indiscriminately to Jew and Gentile on the sole condition of faith, fit with the ancient promises to Israel, and how explain the failure of the Jews to accept this gospel of Christ? Accompanying his answer to these questions with statements which involve his conclusions on almost every doctrinal point, the letter continues beyond the theological discussion to furnish a rapid summary of the duties of the Christian life with more stress than he elsewhere laid on the duties of the citizen toward those in public authority.

As perhaps the next letter after those to the Corinthians was written at Corinth, so after the letter to the Romans the next letters were written from Rome. There are four letters which were penned while Paul was living a prisoner in his own hired house in Rome, and three of the four, those to the Ephesians, to the Colossians and to Philemon constitute the most closely related group among the Pauline epistles. The only clue as to whether Philippians preceded the others of this group in time or followed them, is found in Paul's expressions of feeling as to whether he might expect release as the result of his appeal to Cæsar. These statements are, however, too uncertain to justify positive conclusions as to the order of the four epistles. In character the Epistle to the Philippians is the least doctrinal in substance and the most affectionate in tone of all Paul's letters. Such doctrinal teaching as is found in this epistle is enwrapped in the incidental declarations of the Apostle or in his abrupt and stern denunciations of certain unnamed errorists against whom he warns the Philippians. Their false doctrine seems to have been at least remotely akin to that of the Judaizers whom he had combated in the Epistles to the Galatians and the Romans, possibly still more closely to that of the nameless faction condemned in Second Corinthians. The occasion of this letter was gratitude for the once more repeated gifts of the Philippian Christians toward his support, and its tone throughout is that of joy. Even when he speaks of his own privations, his expressions are in harmony with his injunction, "Rejoice in the Lord always; again I will say, rejoice."

The Epistle to the Colossians is apparently, like that to the Romans, addressed to a church which Paul did not found and had never visited, though its existence was probably due to the radiating influence of his long work at Ephesus, the metropolis of western Asia Minor. Epaphras, presumably the founder of the Colossian church, had visited Paul in his Roman imprisonment, and we may well suppose that it was from him that Paul had learned the effect on Christian faith and life which the teaching of certain errorists was having. It is hard from



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the statements of the Epistle to deduce with certainty the exact nature of the views combated, but the errors seems to have been both speculative and practical. While on the one hand they involved an asceticism in closest harmony with the practices of the Jewish Essenes, on the speculative side they anticipated to some extent the developments of later Gnosticism. To meet this false philosophy a true conception of the place of Christ and of his relation to the universe was needed; so the dominant note of the Epistle is the sole and supreme greatness of Christ, who by His unity alike with God and men obviates the necessity of angelic mediators and even precludes the possibility of their activity. This conception consistently carried out cuts the ground from under false asceticism and every form of mere legalism, and no less requires and ensures the highest type of personal and social morality.

The sister epistle, to the Ephesians, includes a surprising number of the same thoughts and words, but they are used with a complete lack of all apparent imitation to bring out a wholly different general idea. While here, too, Christ is exalted, the main thought is the oneness of all Christians, that the work of Christ results in the removal of all barriers that separate men, notably of the hedge of the Mosaic law which had divided Jews and Gentiles. It has been plausibly held by many that the destination of this letter was a wider circle of readers than the single church at Ephesus, it being a circular letter to all the churches in the region, of which circle the churches at Ephesus and Laodicea would be positively known to us. On the one hand we know from Colossians that a letter was simultaneously despatched to the Laodiceans, on the other doubt is cast on the present address, "in Ephesus," by a little but weighty evidence for its omission. Further that no personal salutations are added is somewhat surprising when we remember how long Paul had worked at Ephesus, but natural if the letter was equally intended for other churches, and the conception of Christian unity which dominates the Epistle is admirably fitted to be the theme of a circular letter. This hypothesis, while not to be regarded as already proved, if, indeed, ever provable, seems well to suit the conditions of the case, and in some respects the Epistle gains in significance when thus regarded.

Another epistle, certainly despatched with that to the Colossians, is the letter to Philemon, who was, as we infer, a well-to-do Christian residing at Colossæ. One of his slaves, Onesimus by name, had run away, stealing as he left, and in far away Rome had come under the influence of the same Paul under whose influence his master, Philemon, had earlier been converted. Paul had found the fugitive slave, now a changed man, to be very useful for service to himself, but unselfishly sent him home with a letter intended and admirably adapted to secure pardon and favor from his master, who is even bidden to treat him as a loved brother. This brief letter is not only a delightful bit of self-revelation on the part of Paul, but was arranged with consummate tact to secure its purpose.

The three epistles, two to Timothy and one to Titus, usually called from the subjects which they chiefly treat the Pastoral Epistles, agree

very closely in style, in matter, in the ecclesiastical conditions pictured, and, finally, in the fact that their composition must, in the practically unanimous judgment of scholars, stand outside the life of Paul as presented in Acts. If not genuine, their occasion and purpose and the time and place of their composition must remain a matter of unsupported conjecture. If they are authentic works of the Apostle, Paul must have been released from his first imprisonment at Rome, and have traveled widely in the further course of his missionary work, although no record of it is preserved outside these letters. During this period of his life he must have made the visit to Spain, which he purposed when he wrote to the Romans, and of which some tradition remained in the churches; he made a tour in Crete; he again visited Miletus, if not Ephesus as well; he found his way to Troas and Corinth and we know not how many other such cities, and he expected to spend a winter in Nicopolis. Probably before he reached Nicopolis, he was arrested, taken again to Rome, had a preliminary hearing of his case, and with the expectation of a dreary winter in a chill dungeon he wrote to his beloved Timothy to come if possible before winter and to bring with him a cloak and some parchments which had been left at Troas. From uncertain points on this route from Rome to Timothy at Ephesus and Titus in Crete, perhaps the former from Macedonia, the latter from Corinth. These letters agree closely: in each Paul gives to the man addressed a certificate of appointment and authority, really intended to influence the churches over whom each was set and quite likely useful, not to say necessary, for that purpose; gives directions as to church life and administration; gives serious warnings against a type of error which is not clearly defined, but seems a jumble of pagan philosophy and Jewish fable, not unlike the Colossian heresy. While in these letters there is more of restraint than was common to the Apostle, a fact which their semi-official character may explain, in the second letter to Timothy, in point of date the last attributed to him, he poured out his very heart in expressions of personal sentiment and Christian experience and assurance, so tender, so strong, so fitting that from many critics who reject the most part of the Pastoral Epistles as interpolation or forgery of a much later date, these words at least have forced a recognition of themselves as of necessity genuinely Pauline.

Taken as a whole, no more remarkable series of letters has ever been penned than the Pauline Epistles. They have too often been regarded merely from the dogmatic and critical standpoint. Whatever the significance of the critical discussions for which they furnish large material, however rightly they have been considered important and profound, even inspired and authoritative statements of theological and ethical truths, beyond these they are personal communications of a great soul to those whom he trusted, sometimes his beloved friends, and as such also they should be regarded. In them the practical leader, the profound thinker, the religious enthusiast, the friend sympathetic with others and himself hungry for sympathy, uncaps his very soul, and lets us see all his thoughts in their



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making, hear the sob of his often lonely and disappointed spirit, count his heart-throbs, as it were; and none ever better stood the test of such intimacy. Beside their worth to criticism and theology these letters greatly serve psychology and the study of Christian experience; beside being historical sources and canonical Scriptures, they are also personal documents, invaluable to literature and life.

Consult: Clemen, 'Die Chronologie der paulinischen Briefe'; Conybeare and Howson, 'The Life and Epistles of Saint Paul'; Farrar, 'The Life and Work of Saint Paul'; Gloag, 'Introduction to the Pauline Epistles'; Harnack, 'Die Chronologie der altchristlichen Litteratur'; Knowling, 'The Witness of the Epistles'; Lightfoot, 'Biblical Essays'; McGiffert, 'The Apostolic Age'; Ramsay, 'The Church in the Roman Empire'; 'Paul the Traveler and Roman Citizen'; Shaw, 'The Pauline Epistles'; VanManen, 'Paulus.'

See ANTIOCH; CANON; CORINTH; EPHESUS; GALATIA; ROME; SAINT PAUL; SAINT PETER; THESSALONICA; TIMOTHY.

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**Paulinus**, pâ-lî'nūs, **Pontius Meropius Anicius, Saint**, ecclesiastical writer: b. Bordeaux 353; d. Nola 431. He was consul at Rome and later prefect of the province of Campania, but in 394 he retired from the world and lived as an ascetic at Nola, of which he was elected bishop in 409. He is best known as Paulinus of Nola. His festival is celebrated on 22 June. Many hymns and letters were left by him and have been collected by Muratori and Migne. Consult Buse, 'Paulin, Bischof von Nola, und seine Zeit' (1856).

**Paulinus of York, Saint**, an ecclesiastic of the 7th century, first archbishop of York: d. about 643. He was a native of Rome, was sent on his mission by Gregory in 601, and first labored under Augustine in the evangelization of Kent. By him he was consecrated bishop in 625, when he accompanied Ethelburga on her marriage to the heathen Edwin, king of Northumbria. For a long time he made no progress in his mission beyond baptizing the infant princess; but at length Edwin and his court submitted to baptism at York, in a wooden chapel dedicated to St. Peter, the foundation of the minster, Easter Sunday, 627. Paulinus now carried the Gospel over Northumbria, but after six years' constant labor the death of Edwin in battle at Hatfield put a sudden end to his work, and he was obliged to flee before the Northumbrians. He went back with the widowed queen to Kent. In the same year he received the "pallium" as archbishop of York from Rome, but he never returned, dying 10 Oct. 644. He was buried in the chapter house at Rochester, of which see he had been made bishop.

**Paulists**, or **Paulist Fathers**, the name familiarly given to the "Congregation of the Missionary Priests of Saint Paul the Apostle." This body of priests, the sole religious congregation of clerics which is of American origin, was founded in 1858. A short time prior to this date, five American converts to Catholicism had

joined the Redemptorist Order, and were actively engaged in preaching missions throughout the United States. These men were Isaac Hecker (q.v.), sprung of German Lutheran stock, and, a short time before his submission to the Catholic Church, a member of the Brook Farm community of "Transcendentalists"; Clarence Walworth, and Francis Baker, both former Episcopalian ministers; George Deshon, a classmate of General Grant at West Point, and Augustine Hewit, who, reared in New England Congregationalism, had afterward joined the Episcopalian Church. The experience of these men in their priestly work, and their intimate knowledge of American conditions, convinced them that the Redemptorist Order, to which they belonged, would not adequately meet its opportunities in this country, unless it attracted a greater number of American subjects, and became more at home in the language and national characteristics of the people. At that time nearly all the Redemptorists working in the United States were Germans. The five converts earnestly advocated the establishment of a house to serve as the headquarters of the English-speaking members, which, with English as the language in common use, might help to attract a larger number of American recruits, so much needed in the missionary field. Both Archbishop Hughes of New York and Bishop Bayley of Newark heartily supported this project. The German members of the order looked upon it with disfavor. According to the constitutions of the order, any member, if in conscience he deemed it necessary, enjoyed the right of personally laying any important question before the superior-general in Rome, without the permission of the local superiors. In 1855, a general chapter of the order had voted to abrogate this article of the constitutions. This decision, however, had not yet been approved by the Pope, and consequently was not yet definitively settled. The rector major, or superior-general, had, however, ventured to anticipate the action of the Holy See, so far as to issue a circular letter prohibiting, under pain of expulsion, any American Redemptorist from leaving America without express permission. The five American Fathers taking their stand upon their constitutional right, delegated Father Hecker to go to Rome to lay before the authorities the project of establishing an English-speaking house. Furnished with highly creditable testimonials as to his exemplary life from his Provincial superior, Father Hecker sailed from New York, and arrived in Rome on 26 Aug. 1857. He was met by his Superior with a decree of expulsion from the Redemptorist Order. Upheld by his confrères in America, whom he represented, Father Hecker appealed to the Propaganda; and, after some delay, he was at length vindicated by Pius IX., who gave to him and the other American Redemptorists advice and encouragement to found a new missionary community.

With an enthusiasm which has ever since characterized their congregation, the five priests entered upon their new vocation under the patronage of Saint Paul. Their twofold purpose — a purpose incorporated in their constitutions, and held before every Paulist as his ideal — was personal perfection and zeal for souls outside the Catholic faith. Lovers of America, and deeply penetrated with the national spirit, it was natural that they should lay special stress upon the cultivation of personal initiative, spiritual lib-



## PAULITES — PAULUS

erty, a high sense of honor and duty, and the virtues of fortitude and fidelity. Hence, it is a characteristic of the Paulists, the followers of Father Hecker, to aim at the highest possible legitimate development of the individual, interfering with him only to the extent dictated by the common good and the requirements of conventual discipline. It is in keeping with this spiritual scheme that, while the Paulists do not take the usual vows of religious orders, they live the life of the vows in strictness. This interior spirit of the congregation has been widely misunderstood; it must be appreciated correctly, if one is to form a just judgment of the institute, and of its founder. The absence of vows is not an indication that the Paulists wish to exempt themselves from any burden of the religious life; for, even had they solemn vows they would be no more devoted to the evangelical counsels than they are at present. But, without vows, to live as though solemnly vowed, implies a spirit of individual conviction, of enthusiasm, and of free consecration which best harmonizes with the interior and exterior vocation to which the Paulists devote themselves.

In carrying out their chosen work, the Paulists, though few in number, have left a clearly defined impress upon the course of the Catholic Church in America. It is chiefly due to them that a systematic and persistent endeavor to bring non-Catholics into the Church is now extensively organized among the diocesan clergy. Their example is stimulating other religious societies to fraternal emulation. In missionary work of this kind the Paulists are uncompromising in presenting the doctrines and claims of Catholicity, while, at the same time, they carefully avoid the polemical attitude which only arouses and exasperates religious prejudice. Another work in which they stand in the foremost rank is the promotion of temperance. Exhortation to total abstinence is a characteristic of their mission preaching; and their printing-house in New York is the headquarters of the Publication Bureau of the Catholic Total Abstinence Society. The propaganda of the press was an early ambition of the Paulists. In 1865, they founded 'The Catholic World,' a monthly magazine; in 1870, they established for young readers a bi-weekly, 'The Young Catholic,' which is now a monthly under the name of 'The Leader'; in 1896, they began to issue a quarterly, entitled, 'The Missionary,' which serves as the organ of the non-Catholic missions. Beside these periodicals, their presses turn out, annually, hundreds of thousands of pages of devotional, homiletic and apologetic literature. Another feature of Paulist endeavor has been the observance, in public worship, of strict ceremonial, including only Gregorian music. At present (1904) the Paulists number about 45 priests, with 35 students and postulants. They have missionary houses in New York, San Francisco, Winchester (Tenn.), Chicago; and a house of studies at the Catholic University, in Washington, D. C.

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**Paul'ites, or Hermits of Saint Paul**, an obscure religious order of men who take St. Paul, the first hermit, as their patron. The order was established in 1250 by uniting the Hermits of St. Augustine with those who lived under the rule of St. Eusebius. They now fol-

low the rule of St. Augustine. They are found in Italy, France, Spain, Germany, and other countries. They usually wear a short cloak and cowl and go barefooted. They also wear a beard.

**Paulo Affonso**, pow'lō äf-fōn'sō, **Falls of**. See SÃO FRANCISCO.

**Paulownia**, a genus of ornamental trees of the order *Scrophulariaceæ*. The species, of which three have been described, are natives of Japan and China. The best-known species (*P. imperialis*) is catalpa-like in habit of growth, having stout, spreading branches and flowers in terminal panicles. The flowers, however, are bell-shaped and the fruits two-celled capsules instead of pods. In favorable climates the trees become 40 feet in height; in cold localities they are often killed to the ground by frost, but send up numerous sprouts from the stump. At Montreal they are often planted for screens or specimens on lawns, their rapid growth, often amounting to more than 12 feet in a season, and their striking foliage (leaves frequently a foot wide and two feet long), making them very interesting. At New York city the tree is hardy but its blossom buds are frequently killed by the winter, and even south of Washington the flowers may fail to appear for several successive seasons. In this species the flowers resemble those of foxglove, are violet in color and fragrant. They appear in great profusion in April or May. An evergreen species has recently been discovered in southern China, and is said to be one of the grandest of floral spectacles when in blossom.

**Paulsen**, powl'sēn, **Friedrich**, German philosopher: b. Langenhorn, Schleswig, 16 July 1846. He was educated at Erlangen, Bonn, and Berlin, became a lecturer at the University of Berlin in 1875, and was made professor of philosophy and pedagogics there in 1873. Paulsen is a thorough Kantian, and finds in that philosophy the basis for the philosophic thought of the future. He holds that Kant has shown knowledge to be limited to the facts derived from the observation of the relations of phenomena in time and space. The power of values (or the good) is not demonstrable by science, but must be entrusted to faith. But science proves that there exists no scientific impossibility in belief in the indestructibility of that which possesses worth, of the freedom demanded by the will, and of a world beyond the reach of sense. Faith is in no danger of a real attack from science, but science may remove obstacles from the way of faith. The empirical view of the world remains incomplete and valid for only restricted human observation. Among Paulsen's more important works are: 'Entwicklungsgeschichte der Kantischen Erkenntnisstheorie' (1875); 'Einleitung in die Philosophie' (1892); 7th ed. 1900; Eng. trans. 1895), a work of high literary as well as philosophic value; 'Immanuel Kant' (1898); 'Kant, der Philosoph des Protestantismus' (1899); 'Schopenhauer, Hamlet, und Mephistopheles' (1900); and 'Philosophia Militans' (1900; 2d ed. 1901), containing a vigorous reply to the 'Welträtsel' of Ernst Haeckel.

**Paulus**, pow'loos, **Heinrich Eberhardt Gottlob**, German theologian: b. Leonburg, near Stuttgart, Württemberg, 1 Sept. 1761; d.



## PAULUS — PAUPERISM

Heidelberg, Germany, 10 Aug. 1851. He studied in Tübingen, Göttingen, London, and Paris, making a specialty of Oriental languages and theology. In 1789 he was called to the chair of Oriental languages at Jena and in 1793 took the chair of theology in that institution which he filled until 1803 when he accepted the same professorship at Würzburg. In 1808 he became director of the department of public worship at Bamberg, at Nuremberg in 1809, and in 1811 at Ansbach, accepting in that year the professorship of church history at Heidelberg. He was an earnest exponent of rationalistic theology, and among his best-known books are: 'Life of Jesus as the Foundation of an Original Work on Christianity' (1828); 'An Exegetical Handbook of the Three First Evangelists' (1830); etc.

**Paulus**, pâ'lūs, **Julius**, Roman jurist of the 3d century A.D. He was a legal assessor under the emperor Septimius Severus, was exiled by Elegabalus, and became prætorian prefect under Alexander Severus. He wrote much, but in a far less finished and skilful style than his contemporaries Ulpianus and Papinianus. Excerpts from his works hold the proportion of one sixth in the Pandects (q.v.). His 'Sententiæ,' a collection of settled principles on common legal points, exists in abbreviated shape.

**Paulus Ægineta**, ěj-ĩ-nē'ta, or **PAUL OF ÆGINA**, Greek medical writer, probably belonging to the latter part of the 7th century A.D. His encyclopædic work 'Artis Medicæ Principes,' translated into English in three volumes (1844-7), shows great erudition and good judgment, and is particularly famous for its information as to early surgery. Paul was in high repute with the Arabians, who called him Al-Kawâbeli, the Gynæcologist, and translated his 'Principes.'

**Paulus Diaconus**, dĩ-āk'ō-nūs, "Paul the Deacon," also called **Warnifridus**, and **Paulus Monachus**, "Paul the Monk," the earliest of mediæval historians: b. Friuli about 730. He was educated in the court of the Lombard kings at Pavia. On the capture of Desiderius, the last king of the Lombards, by Charlemagne, he retired to the monastery of Monte Casino, where he took the cowl. In 781 he was called to the court of Charlemagne. Paulus drew up a book of homilies from the Fathers, which was in general use throughout Europe during the Middle Ages. He also wrote a history of the bishops of Metz, 'Gesta Episcoporum Metensium,' which is to be found in the 2d volume of Pertz's 'Monumenta Germaniæ Historica.' In 787 he returned to his monastery at Monte Casino, and spent the rest of his life in religious and literary labors. Here he wrote his history of the Lombards, 'De Gestis Longobardorum Libri VI,' his principal work. It is written in a lucid and elegant style, and is prized for its general truthfulness; it contains a mass of information elsewhere unattainable. It commences with the migration of the Lombards from Scandinavia to the death of King Liutprand. The best edition is contained in Muratori's 'Rerum Italicarum Scriptores.'

**Paulus Hook**, formerly the name of the site of Jersey City, N. J., where fortifications were constructed by the Americans in 1776. The works were captured by the British in September of the same year, but on 19 Aug. 1779 a party

of American soldiers, not much above 200 in number, under Lieut.-Col. Henry Lee (q.v.), retook and partially destroyed them. The British garrison was surprised, and 159 prisoners were taken, with an American loss of two killed and three wounded. Paulus Hook was again reduced by the British, who held it until the end of the Revolution. The feat of Lee and his men was commemorated 21 Nov. 1903 by the dedication of a monument on the Paulus Hook battleground. The memorial, erected under the auspices of the Daughters of the American Revolution, is a rough-hewn granite shaft standing in the middle of a public square in Jersey City, and within the lines of the old fortification. An interesting feature of the dedication was the oration delivered by Gen. Fitzhugh Lee of Virginia, a grandson of "Light Horse Harry."

**Paumota**, pä-oo-mō'tä, or **Paumotu**, pä-oo-mō'too, native name for the Low Archipelago (q.v.).

**Pauncefote, Julian**, LORD, English diplomat: b. Munich, Germany, 13 Sept. 1828; d. Washington, D. C., 24 May 1902. He was educated at Marlborough College, and in Paris and Geneva. He began the practice of law in 1852, was, for a time, secretary to the colonial minister, Sir Samuel Molesworth, and in 1862 went to Hong-Kong where he practised law and became attorney-general in 1865. In 1872 he became chief justice of the Leeward Islands, in 1876 legal assistant under-secretary at the Foreign Office, and in 1882 permanent under-secretary of state for foreign affairs. In 1889 he was appointed minister to the United States, and 1893, when the office of ambassador was created, he was first to present his credentials as ambassador. His marked diplomatic ability and evident friendliness toward this country did much to bring about cordial relations between England and the United States. In 1890 he accepted the principle of arbitration for the Bering Sea dispute, and in 1892 signed the treaty; he managed the Venezuelan dispute skilfully, and negotiated a general arbitration treaty between Great Britain and the United States which was rejected by the Senate. He was most earnest in his efforts to abrogate the Clayton-Bulwer treaty, and negotiated and signed the treaty which supplanted it (see HAY-PAUNCEFOTE TREATY). He was British delegate to The Hague Peace Conference in 1899, and was raised to the peerage as Baron Pauncefote of Preston in recognition of his services there.

**Pauperism** (from Lat. *pauper*, poor). The word, strictly speaking, applies not to temporary destitution, not at all to "honest poverty," but to chronic willing dependency, whose roots are vices and careless charity. Destitution arising from such misfortunes as sickness or the death of the family bread-winner, is usually a curable condition, and does not often fossilize into pauperism except through the maladministration of relief, as when more is paid to the beggar than to the worker, so confirming the beggar in his degrading habit, and tempting his neighbors to give up their hard work and strike for the easier task and higher wages of beggary. The history of pauperism is, for the most part, the history of the successive mistakes in poor relief of those who loved their unfortunate fellows "not wisely, but too well."



## PAUPERISM

*Early History.*—Imperial Rome presents the first notable instance of pauperizing by undue aid. Ambitious politicians gave free grain, not to the wounded and helpless, as Athens had done, but to all men residing in the capital who could prove themselves Roman citizens. This began when votes could thus be bought under the Republic. Julius Cæsar found one third of a million of these able-bodied pensioners, and cut the number down one half; but Augustus allowed it to grow again. Marcus Aurelius, though a Stoic himself, gave these robust dependents bread and oil and meat. The strength of that world-conquering race was thus undermined, and the demand of the beggared populace, "Bread and games," is recognized as the death cry of once invincible Rome. With Constantine, the succession of misdirected charity passed over to the Church. While the Christian churches had been small in days of persecution they had shown, in intensified degree, the spirit of neighborly helpfulness that had existed among the Jews, whose Mosaic code is the most charitable of any ancient law. In the early Christian churches there was not much to give, and relief was seldom excessive or bestowed without due knowledge of the case. But with the patronage of the Emperor there came to the Church great charitable funds to be given in a general way to applicants whose circumstances in many cases would not be known. One fourth of the Church funds in Rome were thus devoted to the poor. Charlemagne was the first Christian ruler to take a strong hold of poverty as a civil problem. He required bishops and nobles to provide for their poor. In 779 he forbade begging and imposed a poor-tax. He also provided institutions for widows and orphans, which were not sufficiently grounded, however, to abide after his death. But religious benefactions of all sorts multiplied, many of them established as atonements for the sins of the rich donors. In the 15th century cities began to take up the problem of relief, but not of prevention or cure.

*Modern Pauperism.*—After the civil and social commotions in the 16th century consequent upon the Reformation efforts were made to cheapen necessities, to secure employment, to help the poor to help themselves. Public work-houses appeared before the end of the 17th century, and there grew up a literature on the subject of poverty. But in the opening years of the 19th century prolonged wars again increased poverty and beggary. Germany has shown of late how well she has learned the lessons of the past by wise administration of private and public relief, with friendly visitors, thorough investigation and discriminating aid, and especially by compulsory old age insurance, said to have put forty millions of her people beyond the fear of want in their last years. Austria cares for her poor by communes through the priests. Belgium has alms-houses and compulsory labor for able-bodied dependents. Holland has been much praised for her labor colonies and numerous organizations to relieve and remove poverty. In France the Church, save in the period of the Revolution, has had chief charge of the poor, and its best relief agencies have been the Sisters of Charity, and its numerous charitable institutions, many of them founded by Francis de Sales

and Vincent de Paul, and others of more recent origin to meet modern needs. It is instructive to recall England's mistakes in poor relief, which are representative of Scotland, Ireland and Wales also. In 1601 a great advance was made by the enactment of the poor law of Elizabeth. Begging had been forbidden in vain in previous centuries, but by that law all able-bodied paupers were required to work, under which requirement public work-houses developed. A serious backward step came in the Speenhamland law of 1795 by which a certain standard was set up as a "living wage" and all who fell short got an "allowance" from the public treasury. This of course encouraged employers to give low wages, and made workmen content to receive them. In about forty years the nation was startled to find its relief fund had quadrupled. Parliament investigated and found they had pauperized thousands by undue aid. In 1834 reforms were instituted by which "outdoor relief" was greatly limited and able-bodied persons were made ineligible for public aid outside the poor-houses, which were made less attractive, only the plain necessities of life being provided. Nearly all except the aged and infirm were removed to special institutions provided for the deaf and dumb and other defectives and for children.

*In America.*—In the United States, from early times, every town in New England, every county elsewhere, has had its poor-house, where at first all kinds of dependents and defectives and many delinquents were herded together. In recent years they have been sorted out leaving in the poor-houses, as stated above for England, few except aged and infirm adults. Some American cities have made the mistake of too generous outdoor relief, by which, at certain times, one tenth of the population of such rich cities as Chicago and Brooklyn have been tempted to become wholly or partially dependent. Charity organization societies by their teaching and the co-operation they have secured among the administrators of relief have largely reduced this evil and other abuses of charity.

*Statistics.*—The census of 1900 gave 73,046 as the number of persons in alms-houses of the United States. But this was generally regarded as too small a figure, and the poor-houses in any case contain less than half of the chronic dependents, since there is among the poor a great dread of the "poor-house," that inclines many who would in other days have gone there to become tramps instead, and live by doles of food and clothes and money and by petty thieving, while there are also in every community many drunken and vicious persons who live altogether on the easy benevolence of others, besides a great number of widows and children supported regularly by relatives and by churches, not a few of these weakened by too much help until they willingly receive and even expect and ask, if not demand, what they could by earnest effort get on without. A city officer of Cleveland, in 1903, estimated that one tenth of that prosperous city in that prosperous year received charitable aid.

*Tramps.*—The American poor-house, with its few old and infirm inmates, and street begging in American cities, which is everywhere forbidden, but almost everywhere tolerated to some



degree by public officers and private citizens, are the smallest part of the present American problem of pauperism, which is chiefly concerned with able-bodied "tramps," a term properly applied to those whose beggary is not localized but nationalized by constant travel from place to place. There are thousands who are tramps by choice, who tramp and beg rather than work even in the most prosperous times, especially in summer, when they can sleep out of doors without serious discomfort. Usually they ask for work, to evade the law against begging, knowing very well that most persons will give them food or clothes or money to get them out of the way in a hurry, lest they steal or do some act of violence or revenge. The tramps know also that town authorities will usually give them free lodging in station houses for a few nights each, and that even if they are arrested, rather than bear the expense of supporting them in jail for vagrancy, they will order them to "move on," sometimes even paying their fare to the next town. Stealing rides on freight trains is their common practice. They are gregarious and camp together in the outskirts of towns, going from these camps singly to their house to house begging.

*Causes.*—The chief causes of pauperism, other than careless alms-giving, are the vices that waste both the purse and the person. Prof. J. J. McCook, the highest American authority on tramps, said in 1895 ('Voice,' June 27): "Out of 1,314 tramps questioned by me, 825 admitted they were intemperate, that is, 62.8 per cent, nearly two thirds. Since more than half of them had trades, 57.4 per cent; and since 83.5 per cent, over four fifths, admitted their health was good; and since 90.06 per cent, over nine tenths, could read and write, and since the year when the inquiry was made was the high-water mark of our business boom, the conclusion seems a fair one that drink had something to do with their vagabondage." The number of drunkards among tramps is probably larger than among other paupers. The 26th report of the Massachusetts Bureau of Labor, 1896, shows that out of 3,230 paupers examined in the institutions of that State during twelve consecutive months 2,108, or 65.26 per cent, were known to be addicted to the use of intoxicating beverages, to which should be added a part of 7.93 per cent whose habits were not ascertained. It does not follow, of course, that drinking habits were in all these cases the only or chief cause of poverty. The "Committee of Fifty" name 34 per cent of the paupers as made so chiefly by their own drinking habits. A symposium of the opinions of 816 keepers of alms-houses ('New Voice,' 12 Aug. 1899) give 51 per cent as their average estimate of the percentage brought under their care directly or indirectly through drink, including cases where wives and children were pauperized by the drinking of the family breadwinner. These figures do not conflict with the tables of the Charity Organization Societies of the United States in which intemperance is recognized as a cause of poverty in only 28.1 per cent of the cases, because these societies deal not with pauperism, but with temporary destitution and outdoor relief. Dr. Howard Crosby names improvidence as the chief cause of dependency, but he straightway names the saloons as the causes of that condition. Although statistics

and experts of charity do not support the contention of Henry George that intemperance is more the result than the cause of poverty, the slum is recognized as a fruitful producer of pauperism, especially by its depressing and degrading influence upon the children of the poor, brought daily in contact not only with drink but other pauperizing vices, also.

Sensuality weakens mind and body and destroys self-respect, and thus leads straight to chronic dependency. Gambling also creates a distaste for regular employment, and so leads the strong to crime, the weak to pauperism. Not alone wickedness but weakness of mind and body tends to pauperism, especially when in times of financial depression there is not enough employment for all who wish it and in the survival of the fittest the unfit find the struggle too hard for them.

*Cures.*—The approved cures of pauperism, in distinction from wise administration of temporary charity (See CHARITY) are: 1. A strong public sentiment against giving to unknown beggars. 2. Enforcement of laws against begging. 3. Philanthropic work-yards and Pingree potato patches where every man out of work can be sent to earn the necessities of life temporarily while hunting a new job. 4. Self-supporting loan bureaus, managed by philanthropists, where goods can be safely pawned at moderate interest. 5. Farm colonies, to which the city poor can be sent to work in company with others, avoiding the dreaded loneliness of ordinary farm life. 6. Friendly visitors and Social Settlements, by which the strong can give themselves upliftingly to the weak, in recognition that "the lack of goods for the higher wants is not so sad as the lack of wants of the higher goods." 7. Tenement house reform. 8. Old age pensions (see NEW ZEALAND). 9. Public and private efforts to protect the children of the poor, by proper child labor laws and compulsory education laws, in their right to health, education, and a favorable environment.

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**Paur**, powr, **Emil**, German-American musical director: b. Czernowitz, Austria, 29 July 1855. He was graduated from the Vienna Conservatory, was first-violin at the Vienna Imperial Opera House, and in 1876-80 was court-conductor at Cassel, Hanover. From 1888-93 he directed the opera at Leipsic. He came to the United States in 1893 where his fame as a conductor had preceded him, and in 1893-8 conducted the Boston Symphony Orchestra. Since 1898 he has been leader of the New York Philharmonic Society, and in 1899-1900 conducted the "Paur Orchestra" in the Metropolitan Opera House, New York.

**Pausanias**, pâ-să'nî-ās, Spartan general: d. about 467 B.C. He was a nephew of Leonidas, a member of the royal line, and regent during the minority of Plistarchus, son of Leonidas. In 479 he commanded the 5,000 Spartans and the 35,000 helots from Lacedæmon, and all the allied Greek troops in the great victory over the Persians at Plataea. His autocratic temper was shown immediately afterward by his putting to death the Medizing leaders in Thebes entirely on his own responsibility. In spite of this his prestige won him the command of the allied fleet in 478, with which he occupied part of Cyprus and



captured Byzantium. He had now formed the plan of making himself king of Sparta, and then of all Greece; to this end he negotiated with the Persians. He was recalled to Sparta on the complaint of the allies, who urged that he was alienating the Ionians as well as playing Sparta false with Persia; but he was adjudged innocent. His negotiations with Persia were renewed, and he had begun to get help from Themistocles in Athens when his plot was discovered by the Spartan ephors. To escape punishment he fled to the temple of Athena; but the entry was walled up and he was left there to starve, his body being removed just before he died to avoid defiling the temple.

**Pausanias**, Greek topographical writer of the 2d century A.D. Nothing is known of him but from his writings. He came from Lydia and settled in Rome in the second half of the 2d century. His 'Hellados Periegesis' is an itinerary of his extensive travels. It is in 10 books and was not wholly written until as late as 175 A.D. Pausanias appears to have visited all the most important places in Greece. He describes Attica, Megaris, Corinthia, Sicyonia, Laconia, Messenia, Elis and Olympia, Achæa, Arcadia, Bœotia, Phocis, and Lacedæmon. His account of Greece describes temples, theatres, tombs, statues, pictures, monuments of every sort. It is valuable for the antiquarian and historian. He also mentions mountains, rivers, and fountains, and the mythological stories connected with them. He appears to have been a profound believer in mythology, and relates various legends belonging to it in all good faith. His observation is accurate, and his descriptions simple and practical, so that the fullest confidence may be put in him where he speaks as eye-witness, and this is well demonstrated by modern discovery. His style is obscure and uninteresting. His work has been edited by Siebolis (1822); L. Dindorf (1845); Spiro (1893). The edition by Clavier and others (1814-23) contains text, French translation, and notes. J. G. Frazer's is the standard English translation (1898). Consult the valuable partial commentary in Harrison and Verrall, 'Mythology and Monuments of Ancient Athens' (1890).

**Pausias**, pâ'shī-as, Greek painter: b. Sicyon. Together with Apelles he studied under Pamphilus, the inventor of encaustic or wax painting. He was successful in the representation of children and flowers, and he won great renown by his picture of his countrywoman 'Glycera,' of whom he was enamored. Lucullus bought a copy of this painting for two talents, something less than \$4,000. A large work of his, 'A Sacrifice of Oxen,' was brought to Rome and set up in Pompey's portico.

**Pausilippo**, pow-sē-lē'pō. See POSILIPPO.

**Pausinger**, pow'zīng'ēr, **Franz von**, Austrian painter: b. Salzburg, Austria, 10 Feb. 1839. He early studied landscape painting from nature, and proceeded to the Art Academy in Vienna; afterward he applied himself to painting animals and hunting scenes, under the instructions of J. W. Schirmer at Carlsruhe and of R. Koller at Zürich. Returning to Vienna he attracted notice by a series of landscapes with animal figures, and some studies of animals. He gained the patronage of the Crown Prince Rudolph of Austria by his hunting scenes. His

illustrations in 'Unser Vaterland' were much admired. In 1881 he traveled in the East with the Crown Prince of Austria and furnished the illustrations to the prince's account of his tour in the shape of 136 remarkable drawings of scenes in Egypt, Syria, and Palestine. Among his most recent oil paintings are 'Red Deer in Winter'; 'Evening Twilight in Autumn'; and 'Stag Attacked by Wolves.'

**Pauwells**, pow'ēls, **Ferdinand**, Belgian painter: b. near Antwerp 13 April 1830. He attended the academy at Antwerp (1842-50) and attained preeminent skill as a colorist under the instruction of Mapper, who represented the newest school of Belgian painters. His first picture of importance, 'Baldwin I. and His Daughter Johanna' (1851), was followed by 'Coriolanus of Rome,' which latter obtained for him the "Prix de Rome." After an absence of four years in Italy he exhibited 'Deborah, the Prophetess'; 'Rispah, Saul's Concubine, by the Corpse of her Son' (1856). His reputation reached its height during his residence at Antwerp, where he painted 'The Widow of Jacob van Artevelde' (1857), which is in the Brussels Museum; 'The Call of Saint Clara' (1861); and other striking works. He became professor in the Art Academy at Weimar in 1862 and had a large following among the students, meanwhile producing numerous historical pictures, among them 'Queen Philippina Ministering to the Poor in Ghent'; 'Louis XIV. Receiving the Deputation of the Genovese Republic'; and seven wall pictures illustrating the life of Luther. Dramatic energy and power of facial expression, grandeur of style, and brilliancy of coloring are the qualities of this artist—one of the most eminent of his class in Europe.

**Pav'ane**, an ancient Italian dance, popular during the 16th century. It was adopted in Spain, France, England, and Scotland and was a favorite pastime in court circles. It was a solemn, stately dance, sometimes accompanied by a song.

**Pavement Ant**, the small black ant (*Tetramorium caspium*) which has long been naturalized from Europe, and commonly makes its nests in galleries under the pavements of garden paths and village sidewalks. These galleries may be destroyed by kerosene oil or by boiling water. See ANT.

**Pavia**, pä-vē'ā, Italy, (1) a city of Lombardy, 19 miles by rail southwest of Milan, capital of a province of the same name, beautifully situated on the left bank of the Ticino, here crossed by a bridge of eight arches, about two miles above its confluence with the Po. The bridge, of stone and brick, is covered with a curious roof supported by 100 granite pillars. Until 1876, Pavia was surrounded by its mediæval walls, three miles in circuit, which have been replaced by handsome boulevards and public gardens. The Corso Vittorio Emanuele traverses the city centrally from south to north, and contains its most important edifices of which the chief are, the cathedral, a large, heavy, unfinished structure, begun in 1486, crowned with a lofty dome, and containing some good paintings, and a beautiful side chapel, with the tomb of St. Augustine; San Michele, a heavy marble edifice, in the Romanesque style, belonging to the latter part of the 11th century; Santa Maria



## PAVIA — PAVING

del Carmine, a fine brickwork Gothic church of imposing exterior, built in 1375, and possessed of good pictures; Santa Maria di Canepanova, in the *cinque-cento* style, by Bramante; and San Francesco, a 14th century building, with a mutilated façade of pure Italian Gothic. Other edifices deserving of notice are the Castello or Castle, erected by the Visconti, 1360-69, on the site of the old palace of the Lombard kings, now fitted up as a barrack; the municipal buildings; and several towers, once so numerous that Pavia was surnamed "the city of the hundred towers." The university, founded, it is said, by Charlemagne in 774, is one of the oldest in Italy, and about the beginning of the 16th century was attended by about 3,000 students (now only about 1,300); it has faculties of law, philosophy, science, and medicine. The buildings have several quadrangles surrounded by handsome arcades embellished with statues, busts, etc.; the library has about 136,000 volumes, and the collections include, among others, an excellent anatomical museum. There are also three colleges, a gymnasium, an ecclesiastical seminary, a school of painting, a school of design and sculpture, a municipal museum, an institute of fine arts, etc.; also a botanical garden. The public monuments include a statue of Italy, and a monument of Garibaldi (1884). The chief charitable endowments are a large general hospital and a military hospital. Pavia has numerous modern industrial establishments, including iron foundries, engineering works, electric supply works, chemical works, and cement factories. About four miles north of the city is the Certosa di Pavia, an old Carthusian monastery, now classed as a "national monument," with a magnificent Gothic church adorned with a splendid façade, among the finest decorative works of North Italy. Pavia was a place of considerable importance during the reign of Augustus. It afterward came into the possession of the Lombard kings, who made it their capital, and erected many edifices, more remarkable for magnitude than taste. Near it, on 24 Feb. 1525, the Imperialists defeated the French, and took their king, Francis I., prisoner. Pavia has given birth to many distinguished men, among whom were Pope John XIV., and Lanfranc. Pop. (1901) 35,372. (2) The province of Pavia, which extends on both sides of the Po, has an area of 1,288 square miles. The district of Bobbio is covered by the Apennines; those of Lomellina and Pavia form a fertile plain. Pop. (1901) 496,969.

**Pavia**, Philippines, pueblo, province of Iloílo, island of Panay; at the junction of the Tigón and Aganan rivers, eight miles northwest of Iloílo, the provincial capital. Pop. 10,230.

**Pavil'ion**, in architecture, a turret or small building, usually isolated, with a tent-like roof. The name is also applied to a projecting portion of any building having a tent roof. See **TENT**.

**Paving**, a covering, composed of some durable substance, laid on a street or road, to keep the surface uniform, and maintain it in a condition capable of sustaining traffic. Pavements have been a leading feature of civilization in all historic ages, and their absence is evidence of a low degree of culture, of indifference to progress, and of stagnancy, if not of decay.

The Roman empire depended almost as much on its pavements as on its armies for keeping its vast dominion knit together, and Roman roads are to-day among the most valued legacies of Roman occupation in Great Britain and on the Continent. The more important Roman roads had a paved width of 16 feet, and while their grades were not what a modern engineer would approve, they answered satisfactorily the requirements of the era in which they were constructed. The Dark Ages witnessed, among other signs of decline, the virtual disappearance of pavements, so far as public use was concerned, and it was not until a king of France was sickened to the point of vomiting by the odor of mud stirred by a passing vehicle, that pavements began to be laid in Paris. The spread of epidemics in the Middle Ages was doubtless due in large degree to the absence of pavements. The 18th century did not show much of an advance in this respect, and the records of New York prove that streets in the very heart of the city were in a condition that in these days would be most intolerable. Paving is expensive, and the cities and towns of the colonial period, and for many years after, were governed with great and often shortsighted economy. It was not until the 19th century that paving came to be regarded as otherwise than a luxury, to be indulged in only when the demands of traffic made it cheaper to pave the streets than to flounder through mud-holes and climb over refuse-heaps.

The necessity of street-paving is no longer a subject of discussion. It is regarded as much a requirement of settled communities as water and public lighting, and without it the enormous traffic of leading urban thoroughfares would be impossible. The only questions—and they are warmly discussed on account of the different interests involved—are as to which pavements are best. It may be said, without expressing any verdict on a subject so far from settlement, that a substantial foundation is necessary for any pavement intended to endure, and for this concrete may answer, or the hard surface of an old road. Wooden pavements have gone out of favor in American Atlantic cities, but are still considerably used in the West. For heavy traffic, such as on the streets adjoining the New York water-fronts, stone block pavement is found the most lasting, and requires comparatively little repair. It has its disadvantages in noise and in retaining surface liquids, but these are apparently more than offset in the public view by solidity and durability. Asphalt pavements are coming into more general use every year, especially on streets where traffic is not very heavy, and in the vicinity of public buildings and other structures where quiet is particularly desired. Its smoothness and noiselessness make it popular, and several rival companies are engaged in the business of laying it on public thoroughfares. Its disadvantages are the liability of horses to slip on its surface, its absorption of heat, and requirement of frequent repair. Brick pavement is in comparatively minor use, and chiefly in the West. It is claimed that the brick pavement is clean, not noisy, and makes traction easy. Statistics show stone to be far in the lead, with wood second, owing to its extensive use in Chicago, and asphalt third.

OLAF ALEXANDER MANN.



## PAVISE — PAWNEE INDIANS

**Pavise**, pāv'is, or **Pavisor**, in the Middle Ages, a large shield covering the entire body, and carried by a soldier for his own protection, as well as that of the archer before whom he stationed himself. They were often six feet in height.

**Pavo'nia**, a name formerly given to a part of eastern New Jersey, extending from Hudson County to Perth Amboy, opposite New York city and Staten Island. It is also the name of a hamlet in the western part of the State, a mile above the city of Camden.

**Pavy's Solution**, a modification of the well known Fehling's solution for the volumetric determination of glucose and other reducing sugars. An alkaline copper sulphate solution similar to a Fehling's solution is made to which a sufficient quantity of ammonia water is added to hold in solution all the copper when precipitated as cuprous oxide. The "end point" of the analysis is determined by the disappearance of the blue color of the solution. See FEHLING'S SOLUTION.

**Pawn.** See PLEDGE.

**Pawn-brokers**, a class of small shop-keepers whose business is the loaning of money on personal pledges. In the United States and in Great Britain the business has assumed large proportions especially in the crowded sections of metropolitan cities. The usury and other abuses to which the necessities of borrowers of this class are liable to give rise has led, on the Continent, to the establishment of charitable institutions (see MONT-DE-PIÉTÉ), where the business is conducted on benevolent principles. In Great Britain the same plan has been tried, but it has failed. The trade of a pawnbroker may be thus said, in a sense, to be peculiarly a British-American institution; but the object which has been aimed at by monts-de-piété has here been attempted to be accomplished by placing the trade under certain legal restrictions. In the Middle Ages lending upon pledges was a trade almost exclusively pursued by Jews and Lombards. In France, before the establishment of monts-de-piété, the trade was regulated by law. During the Revolution the monts-de-piété were at first abolished as a monopoly, but the abuses to which the restoration of private pledging gave rise soon led to their re-establishment and the prohibition of private pledging, which is still maintained.

The common law recognizes the property of the pawner in the goods he has pledged, which cannot be forfeited by, or taken in pledge for, the debts of the pawnee, who is responsible for their safe-keeping. On the other hand, the pawnee is recognized as having a qualified property in the goods, which cannot be put in execution by a creditor of the pawner till the debt for which they are pawned is satisfied. The property of goods of which the pawner is outlawed is in the king. Perishable goods are at the risk of the pawner, if he does not redeem them in time. Goods pawned without a fixed time of redemption may be redeemed at any time within the life of the pawner. A broker who refuses to deliver goods pawned on tender of payment may be indicted. Both in Great Britain and the United States the pawn-broking business is regulated by law, and in most States in

this country licenses must be taken out and renewed annually. The pawn-broker is to use books and schedules as provided by law. The name and surname of the broker, together with the words pawn-broker, are to be put in large characters over the outer door of his shop. The information to be printed on pawn-tickets must also be posted in a conspicuous part of his shop. Pawn-tickets are to be given for pledges. Profits and charges are fixed by a schedule, of which the following are the principal provisions: Rate of interest: On sums of \$100 and under 3 per cent per month or fraction of month for the first 6 months, and 2 per cent per month for the following 6 months. On sums over \$100, the rate is 2 per cent a month for the first 6 months, and 1 per cent a month for the second 6 months. The ticket is good for one year only, but can be renewed upon payment of interest. If a person offers an article in pawn without giving a satisfactory account of the way in which he became possessed of it, or attempts to redeem an article without title, he may be detained by the broker, and handed over to the police to be brought before a justice, and dealt with according to law. Goods entrusted to another by the owner for manufacture, repair, etc., cannot be pawned; and the owner may, on making oath that he believes a pawn-broker to have taken such goods, obtain a warrant to search his premises.

Under the law a poor person pawning a piece of jewelry valued at \$20 is compelled to pay interest to the pawn-broker at the rate of \$6 a year. In 4 years, if he requires the loan for such a length of time, he will have paid \$24 interest or \$4 more than the value of the loan. To relieve this condition of legal usury there was established in New York city in 1891, a Provident Loan Society, with a main office and numerous branch offices, where under a special charter loans could be made at a reduced rate of interest. The Provident Loan Society was organized by a number of New York philanthropists for the express purpose of relieving the poorer classes. The society has met with great popularity and while primarily a charitable enterprise, has been conducted at a small profit. The Provident Society rate of interest is one per cent a month or any fraction thereof. A loan of \$20 costs the borrower \$2 a year as against \$6 charged by the pawn-broker.

**Pawnee** (pâ-nē') **City**, Neb., city, county-seat of Pawnee County; on the Chicago, B. & Q., and the Chicago, R. I. & P. R.R.'s; about 60 miles in direct line southeast of Lincoln. It is in a productive agricultural region in which the chief productions are corn, wheat, and fruit. Considerable attention is given to stock-raising. Pop. (1890) 1,550; (1900) 1,969.

**Pawnee Indians**, an American tribe of the Caddoan family. They formerly resided in large numbers in the region now known as Nebraska, with branch tribes extending as far south as Texas. They were in constant warfare with every surrounding tribe, with the exception of the Omahas, Poncas and Otos. The Pawnees were known to the Spaniards as early as 1626. They are noted on Marquette's map of 1673. They surrendered their lands south of the Platte by treaty in 1833; suffered much thereafter at the hands of their hereditary enemies, the Sioux;



## PAWTUCKET — PAXTON

and in 1876 removed, only 2,026 strong, to a reservation of 283,020 acres in Indian Territory. In 1885 they numbered only 918. In 1903 their number had decreased to about 500.

**Pawtucket**, pâ-tûk'ët, R. I., city in Providence County; on both sides of the Blackstone River, at the head of deep-water navigation on the Pawtucket River, and on the New York, New Haven & Hartford railroad; 4 miles north of the business centre of Providence, and about 40 miles south by west of Boston. The city is connected by electric lines with many parts of Providence and with the nearby cities and towns. A fall of 50 feet in the Blackstone River at this place, together with the rapids, furnishes extensive water-power which has been instrumental in making Pawtucket an important manufacturing centre. The area is about nine square miles.

**History.**—It was settled about 1654. The part of the city on the east side of the river was originally in Bristol County, Mass. In 1862 it came into possession of Rhode Island. The west part of the city was a village in the town of North Providence. In 1874 this town was divided and the "East Side" and "West Side" were incorporated as a town, and chartered as a city in 1886. The factory system of Rhode Island began April 1790, when a copartnership was established in Pawtucket for carrying on the spinning of cotton. Samuel Slater (q.v.), one of the partners, constructed a complete set of machines on which was made the first cotton thread spun by water-power in the United States. The first cotton factory building, which was the first in the United States, is still standing.

**Manufacturing.**—The chief manufactories are cotton and woolen mills, silk factories, foundries, machine shops, electrical supply works, wire works, yarn mills, hosiery mills, knit-goods factories, textile dyeing and finishing establishments, meat-packing plants, lumber mills and lumber products factories, boot and shoe factories, jewelry works, and wagon and carriage factories. The city receives annually large quantities of lumber, shingles, and lath, cotton, coal, building-stone, brick, lime, and cement. The Federal census for 1900 gives for Pawtucket, 534 manufacturing establishments, having a combined capital of \$22,399,187; 12,776 employees; total annual wages for employees \$5,230,268; miscellaneous expenses for maintenance and operation, \$2,040,261; cost of materials used, \$12,933,104; and total value of the products, \$24,080,328. The increase from 1890 on the value of products was 47.7 per cent; increase of number of establishments, 43.9 per cent.

There are about 20 churches, and public and parish schools, a high school, English and Classic School (private), a public library, founded in 1876, and containing about 22,000 volumes, and several private business and industrial schools. Its proximity to Providence gives Pawtucket the advantage of the educational institutions of that city. It has one Home for the Aged Poor (R. C.), the Emergency State Hospital, and societies for the amelioration of the poor. Several fine bridges cross the rivers; it has a State armory, Dagget Park, and several other smaller parks or squares which beautify the city. A number of the business buildings

and blocks have considerable architectural merit.

The annual municipal expenditures for maintenance and operation are about \$710,000. The chief items of expense are, for schools, \$135,500; for waterworks, \$135,000; for police department, including truancy, etc., \$52,000; fire department, \$41,000; municipal lighting, \$39,200. The city owns and operates the waterworks, which were opened in 1878, and which cost originally \$1,333,000, and have since been enlarged at a cost of \$500,000. Pop. (1900) 39,231.

Consult: Davis (ed.), 'The New England States,' Vol. IV., pp. 2,533-34; Greene (ed.), 'The Providence Plantations.'

**Pax**, (1) in Roman mythology, the goddess of peace; (2) in ecclesiastics, a utensil in the Roman Catholic Church, formed usually of a plate of metal, chased, engraved, or inlaid with figures representing the Virgin and Child, the crucifixion, etc., which, having been kissed by the priest during the *Agnus Dei* of the high mass, is handed to the acolyte, who presents it to be kissed by each of the ecclesiastics officiating, saying to them *Pax tecum* (peace to thee). The decorations of the pax are frequently very rich.

**Paxo**, păk'sō (ancient **Paxos**, păk'sös), the smallest of the seven Ionian Islands (q.v.), lying 8 miles southeast of Corfu. The island is rocky, rises to a height of 800 feet, and has no fresh water supply, but is fertile, producing an excellent olive oil, citrons, oranges, and almonds. Facing it is the island of Antipaxos, which with it forms an eparchy in the administrative nome of Kerkyra, an island to which both Paxos and Antipaxos belonged in ancient times. Area, 7 square miles; pop. (1896) 3,814. Consult Ludwig Salvator, 'Paxos und Antipaxos im Ionischen Meere' (1887).

**Paxton**, păks'ton, **SIR Joseph**, English landscape-gardener and architect: b. Milton-Bryant, near Woburn, Bedfordshire, 3 Aug. 1801; d. Sydenham 8 June 1865. He became superintendent of the gardens of the Duke of Devonshire at Chatsworth, in Derbyshire, where he designed the great conservatories. He also designed the Crystal Palace for the London International Exhibition in 1851, and soon after was knighted. In 1853-4 he superintended the erection of the new Crystal Palace at Sydenham. He edited the 'Horticultural Register'; the 'Magazine of Botany'; the 'Cottage Calendar'; and was the author with Lindley of a 'Botanical Dictionary' (1840); and 'Paxton's Flower Garden' (1850-3), and independently of 'A Practical Treatise on the Cultivation of the Dahlia' (1838). He was a Liberal member of Parliament for Coventry from 1854 until his death.

**Paxton**, Ill., city, county-seat of Ford County on the Illinois C., and the Lake Erie & W. R.R.'s; 81 miles east of Peoria. It is in an agricultural region and is a shipping point for farm produce and live-stock; it contains flour mills, brick and tile works, carriage factories, etc. It is the seat of the Rice Collegiate Institute, a coeducational secondary school under the auspices of the Congregational Church. It has waterworks and an electric light plant, the former being owned by the city. Pop. (1890) 2,187; (1900) 3,036.



## PAY AND ALLOWANCES — PAYNE

**Pay and Allowances**, in the naval and military service a term used to denote the rate or schedule of pay and allowances granted officers and enlisted men. There are money allowances, food, tobacco, baggage, forage and various other allowances, all of which are made on a basis of requirement and rank. See also **ARMY OF THE UNITED STATES**; **NAVY OF THE UNITED STATES**.

**Payagua** (pǐ-yä-gwä') **Indians**, a South American tribe residing in Paraguay and in 1903 numbering less than 200 persons. They were formerly very numerous in the chaco region near Asuncion. They are a savage race, dark in color, of a low type, and live mostly in swamps subsisting on fish and alligators.

**Payer, pī'ēr, Julius von**, Austrian painter and Arctic explorer: b. Schönau (near Teplitz) 1 Sept. 1842. Educated at the military college of Wiener-Neustadt, he entered the Austrian army in 1859, and distinguished himself at Custozza. While stationed in northern Italy he explored several groups of mountains in the Alpine region; in 1869-70 took a prominent part in the second German north-pole expedition; and with Weyprecht directed an Austrian polar expedition which penetrated the sea between Nova Zembla and Spitzbergen and reached 79° north latitude (1871). In 1872 Payer and Weyprecht in a second expedition were hemmed in north of Nova Zembla in lat. 76° 30' N. They discovered the archipelago which they called Franz Josef Land (q.v.) in honor of the emperor, and Payer made a sledge journey through it almost to lat. 83° N. (24 March-26 April). After his return in 1874, Payer withdrew from the military service, studied art, and in 1884 exhibited his first important picture, 'The Bay of Death.' Others of his works are: 'The Death of Franklin'; 'Abandoning the Ship'; 'Religious Service'; and his best, 'Never to Return.' Among his writings is, 'Die Österreich-Ungarische Nordpolexpedition in den Jahren 1872-4' (1876).

**Pay'master**, in the army and navy, an officer, from whom the officers and men receive their wages, and who is entrusted with money for that purpose. In matters of general discipline the paymaster is subordinate to the commanding officer of his regiment; but in regard to the immediate duties of his office he is directly responsible to the war office. See **ARMY OF THE UNITED STATES**; **NAVY OF THE UNITED STATES**.

**Paymaster-General**. See **ARMY OF THE UNITED STATES**.

**Payment**, in law, the discharge of a legal obligation by the delivery of money, or whatever is accepted by a creditor in lieu of money. Payment should be made at the exact time and place agreed upon, or implied by law. Where no place of payment is designated the debtor must seek the creditor. If he fails to do this he may be considered in default. The effect of a valid payment is to discharge the debtor from his obligation. See **DEBTOR**.

**Payn, pān, James**, English novelist: b. Cheltenham 28 Feb. 1830; d. London 25 March 1898. He was educated at Eton and Cambridge and was editor of 'Chambers' Journal' 1859-71. In 1882 he succeeded Leslie Stephen (q.v.) as editor of the 'Cornhill Magazine,' retaining this

position till 1896, when failing health obliged him to relinquish it. For many years he wrote exclusively for 'Chambers' Journal,' and from 1888 the page of 'Weekly Notes' in the 'Illustrated London News' was from his pen. The long series of his books begins with 'Stories from Boccaccio' in 1852, and closes with 'The Backwater of Life,' which appeared in 1899, the 69th work of which he was the author. 'Lost Sir Massingberd' (1864) is the best known of his works, and its appearance in 'Chambers' Journal' raised the circulation of the periodical 20,000 copies, and permanently established his popularity. Though in no sense an imitator of Dickens, Payn was not a little influenced by the manner of the elder novelist. He possessed a lively, fluent style, an abundant fund of humor, and many popular writers of the present owe to him in his editorial capacity the first recognition of their talents. He was as much read in this country as in his own, and among the best of his books may be cited in addition to those already named: 'Carlyon's Year' (1868); 'Gwendoline's Harvest' (1870); 'At Her Mercy' (1874); 'The Burnt Million' (1890).

**Payne, pān, Henry B.**, American legislator: b. Hamilton, N. Y., 30 Nov. 1810; d. Cleveland, Ohio, 9 Sept. 1896. He was graduated from Hamilton College in 1832, studied law, and in 1834 removed to Cleveland where he was admitted to the bar and established a law practice. In 1846 he entered politics, was State senator in 1849, and in 1860 attended the Charleston Convention where he vainly endeavored to check secession sentiment. Throughout the war he was a strong Union man, and in 1872 was a member of the convention which nominated Horace Greeley for president. He was elected to Congress in 1874, in 1880 and 1884 was a candidate for the Democratic presidential nomination, and in 1885-91 was United States senator.

**Payne, Henry Clay**, American financier and politician: b. Ashfield, Mass., 23 Nov. 1843; d. Washington, D.C., 4 Oct. 1904. He was educated at Shelburne Falls Academy, Mass.; in 1863 went to Milwaukee, Wis., where he entered business as cashier in a dry goods store, and rose from this position to be one of the leading business men and financiers of the State. Since 1886 he has been president of the Wisconsin Telephone Co., and since 1889 president of the Milwaukee Electric Light and Railway Company; he was president of the American Street Railway Association in 1893-4, and was appointed receiver for the Northern Pacific Railroad in 1893. He has also been active in politics and has served as the secretary and chairman of the Republican county committee and of the State central committee; he has been a member of the Republican national committee since 1880, and vice-chairman of the executive committee. For several years he has attempted to have the representation of each State in the Republican national conventions based on the actual Republican vote, and not the representation of the State in Congress. From 1876-86 he was postmaster of Milwaukee, and in 1902 was appointed postmaster-general of the United States.

**Payne, John**, English poet and Oriental scholar: b. London 23 Aug. 1842. He studied for the bar, and became a solicitor. He was one



of a group of English verse-writers, including also O'Shaughnessy (q.v.) and Marziols (q.v.), that followed the leadership of the pre-Raphaelite poets. Among his original volumes are: 'A Masque of Shadows' (1871); 'Intaglios' (1871); 'Songs of Life and Death' (1872); 'Lautrec' (1878), and 'New Poems' (1880). He also made English renderings of Villon (1878), the 'Arabian Nights' (1882-4); 'Quatrains of Omar Khayyam' (1898), and 'Poems of Shemseddin Mohammed Hafiz of Shiraz' (1901). He was an excellent linguist, and his style was made interesting by a carefully sustained archaism.

**Payne, John Howard**, American actor and dramatist, author of 'Home, Sweet Home': b. 33 Pearl St., New York, 9 June 1791; d. Tunis, Africa, 10 April 1852. The date of his birth is commonly given as 1792, evidently because of an effort on some one's part to exaggerate his remarkable precocity, which was shown at 15, when, having left his boyhood home in East-hampton, Long Island, and having spent several years in Boston, where he was consumed with stage-fever, he became a clerk in a New York counting-house and spent his spare hours editing 'The Thespian Mirror.' After two years in Union College in 1809 he made his first appearance on the stage as Young Norval in the Park Theatre, New York. A tour to London 1812-13 followed, and there he wrote several dramas, usually adapted from the French. These are completely forgotten now with the exception of 'Clari, or the Maid of Milan,' in which appeared the song 'Home, Sweet Home.' Payne knew intimately many English literary persons, and corresponded with Coleridge and Lamb. In 1818 he brought out his very successful tragedy, 'Brutus,' in which he would have taken the title role but for the objections of his manager Kean, who became famous in the part. He renewed his labors as a critic of the stage, begun in 'The Thespian Mirror,' in London during 1826-7 as editor of 'The Opera Glass.' He returned to New York in 1832, and in spite of the handsome sums received for 'Brutus,' 'Vir-ginius,' and 'Charles the Second,' was continually in financial embarrassment. In 1841-5, and from 1851 to his death, he was U. S. consul at Tunis. His body was removed thence to Washington, D. C., in 1883. His homeless wandering life adds pathos to his great and well known song. Consult the 'Life' by Gabriel Harrison (1875), with an appendix containing Payne's juvenile poems and some of his dramatic criticisms.

**Payne, Will**, American journalist and novelist: b. Whiteside County, Ill., 9 Jan. 1865. He went to Chicago from Nebraska in 1890 and began his career on the *Daily News*; in 1896 was financial editor of the *Chronicle* and since 1897 has occupied the same position with the 'Economist.' He has published: 'Jerry the Dreamer' (1896); 'The Money Captain' (1898); 'On Fortune's Road' (1902); etc.

**Payne, William Harold**, American educator: b. Farmington, N. Y., 12 May 1836. He was educated in the New York Conference Seminary; in 1858-79 he was State superintendent of the public schools of Michigan and in 1879-88 was professor of science and the art of teaching at the University of Michigan. He was presi-

dent of Peabody Normal College in 1888-1901, when he was recalled to the University of Michigan. He has made translations of various pedagogical works, has published monographs, addresses, etc., on educational matters, and has written: 'School Supervision'; 'Education of Teachers' (1901); etc.

**Payne, William Morton**, American literary critic: b. Newburyport, Mass., 14 Feb. 1858. He was educated in the public schools, continuing his studies by himself; in 1874-6 was assistant librarian in the Chicago Public Library; since 1876 a teacher in the high schools of Chicago; in 1884-8 literary editor of the *Chicago Morning News*, and of the *Evening Journal* 1888-92. Since 1892 he has been associate editor of 'The Dial.' He was lecturer on literature in the University of Wisconsin in 1900 and has become known as a critic of the modern prose and poetry of different countries. He has published: 'The New Education' (1884); 'Little Leaders' (1895); 'Various Views' (1902); etc. He has also made translations from the Norwegian.

**Payne-Smith, Robert**, English theologian: b. Chipping Campden, Gloucestershire, November 1818; d. Canterbury 1 April 1895. He was educated at Oxford where he gained the Sanskrit scholarship in 1840 and a Hebrew scholarship in 1843. After taking orders in the English Church he spent a few years in parochial work, and in 1857 was appointed sub-librarian at the Bodleian library. He was regius professor of divinity at Oxford 1865-70, in the year last named becoming dean of Canterbury. He was a member of the Old Testament Revision committee and belonged to the evangelical party in the Establishment. His greatest work was the 'Thesaurus Syriacus' (1868 et seq.), and among his other publications are: 'The Authenticity and Messianic Interpretation of the Prophecies of Isaiah Vindicated' (1862); 'Prophecy: a Preparation for Christ' (1869).

**Paysandu**, pī-sān-doo', a department of Uruguay, and its capital. The city, situated on a hill above the juncture of the San Francisco and the Uruguay, lies 170 miles north of Buenos Ayres, with which, as well as with Montevideo, it has steamboat connections. A railroad runs to Montevideo and Salto. Founded in 1782 the city is well built and healthy, ranks all the Uruguayan cities except Montevideo in population, has a good educational system, is the seat of several consuls and an American commercial agent, and is one of the great slaughtering and packing centres of the region. Hence come the famous Paysandu ox-tongues. Pop. (1898) 26,000.

**Payson, pā'son, William Farquhar**, American novelist and journalist: b. New York 18 Feb. 1876. He was educated at Columbia University, was a member of the *New York Times* staff 1893-5, and has published 'The Copy-maker,' a novel of newspaper experience (1897); 'The Titlemongers' (1898); 'John Vytal' (1901); 'The Triumph of Life' (1903).

**Payta**, pī'tā, Peru, town and port of the northern part of the country, situated in a sort of amphitheatre about the bay. The city is little more than a port for Piura (q.v.), about 35 miles distant, with which a railroad nearly 60 miles long connects Payta. It is a poor dirty





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town of almost Oriental filth with few white inhabitants. The harbor is excellent and the exports of cotton, tobacco, hides, hats, and salt reach an annual value of about \$2,500,000. There is an American consul in the town. Payta was sacked by the pirate Anson in 1741 and was nearly wrecked in 1877 by a heavy fall of rain, reputed the first for 30 years. Pop. (estimated) 3,000; the province of the same name has a population of about 22,000.

**Paz, Enriquez de**, ěn-rĕ'kĕth dā pāth. See ENRIQUEZ, GOMEZ.

**Paz Soldan**, pās sōl-dān', **Marino Felipe**, Peruvian geographer and historian: b. Arequipa, Peru, August 1821; d. Lima, Peru, 31 Dec. 1886. He was graduated in law at Arequipa in 1847 and established himself at Lima where he was connected with various government offices, and was at one time secretary to the Peruvian legation at Colombia. He visited the United States in 1853 in order that he might inspect the prison systems, and afterward as director of public works succeeded in making reforms in Peruvian prisons. Under President Castilla he was minister of foreign affairs, and was minister of justice under Balta. He wrote: 'Geographical Atlas of Peru' (1861); 'History of Independent Peru' (1866); 'History of the War of the Pacific' (1884); etc.

**Pazzi**, pāt'sē, a wealthy and influential Florentine family which, led by one of its members, Jacopo Pazzi, was implicated in a conspiracy against Lorenzo and Guiliano de Medici in 1478. The plot failed and Jacopo Pazzi and his accomplices were executed.

**Pe-Chi-Li**, pĕ-chĕ-lĕ', or **Petchili**, China. See CHI-LI.

**Pea**, an annual vine (*Pisum sativum*) of the order *Leguminosæ*, commonly grown in gardens all over the world. Its botanical variety *arvense* is the field pea. Except in the color of the flowers — white in the garden sorts and various tints of blue in the field varieties — and in the seeds, the two are nearly alike in appearance, since both are climbing vines with pinnate leaves, the odd terminal leaflet being replaced by a branching tendril. From its home in western Asia and adjacent Europe, the pea has been taken by man to all civilized countries, but succeeds best in cool climates. It has been cultivated since very early times, its seeds being found in Egyptian tombs, and has developed a very large number of varieties, most of which, because of the plant's great tendency to vary, have disappeared, yet about 200 varieties of garden peas are offered annually by American seedsmen. These may be divided into early, medium, and late; dwarf, half-dwarf, and tall; smooth-seeded, and wrinkled-seeded; those with edible pods and those whose pods are not eaten by man. The wrinkled-seeded varieties are generally considered superior in flavor to the smooth-seeded, though the "marrowfat" varieties are highly prized by many people. The edible-podded sorts, which are prepared for the table like string-beans, are less popular in the United States than they deserve to be. In general the low-growing, quick-maturing varieties are most popular among market-gardeners. The so-called French peas (*petit pois*) are known to gardeners as the French canner or Turkey pea.

The garden varieties are grown mainly for their immature seeds which are used as a vegetable; the field sorts are more widely employed as "split" peas for soup-making, etc. They are also largely used ground for stock food, but for this purpose the meal is generally mixed with other meal to lessen its soddenness. The dried garden peas are also used for soups. The vines of both kinds make excellent fodder and hay, for which purposes peas are often grown with barley or oats. The dried mature vines are used mainly for bedding farm animals.

Peas thrive best upon fairly rich, well drained, loamy soils ranging in quality from heavy clay to light sandy loam, but not very well upon gravelly or sandy soils. They must not be over-supplied with nitrogenous plant-food, because this tends to rankness of vine at the expense of productivity. The fertilizers are preferably applied during the previous year, and the ground is plowed in late autumn and left rough until the spring, when, as soon as the ground can be worked, harrowing and seeding should be done. Spring plowing is also frequently practised. The seed should be sown an inch or two deep, in drills varying in distance apart with the height of the vines, the usual distance being equal to the height. The tall growing varieties are generally supported with "brush" or wire trellises. Except in keeping the surface clean and loose no cultivation should be given, since unnecessary disturbance of the soil injures the roots. Field-peas are generally broadcast, but when drilling machines which do not split the seed can be used they are preferable. The plants are hardy, being able to withstand light frosts without injury. They do not, however, succeed well in hot, dry weather, being subject to wilting and mildew, the tall kinds especially. The northern United States and Canada are the chief sources of dried peas in the markets, and these regions furnish practically all of the seed sold by American seedsmen.

Peas, either green or mature, are highly prized as food for man and animals. They are rich in protein and are readily digestible when cooked until they become soft. Immense quantities of green peas are canned, the chief localities of this industry being Maryland, Delaware, and New Jersey, where special machinery is used not only in their cultivation but in their preparation for canning. Perhaps the most remarkable machine is the "viner," into which the vines are fed as they come from the field, and in which revolving beaters and cylinders remove the green seeds as satisfactorily as a pea-thresher separates the dry ones from their pods and vines. The average percentage composition of dried peas is: Carbohydrates, 62.0; protein, 24.6; water, 9.5; ash, 2.9; fat, 1.0. Green peas average as follows: Water, 76.6; carbohydrates, 16.9; protein, 7.0; ash, 1.0; fat, 0.5. Edible-podded varieties average as follows: Water, 81.8; carbohydrates, 13.7; protein, 3.4; ash, 0.7; fat, 0.4.

Several more or less closely related plants of the order *Leguminosæ* are called peas, each, however, with a modifying adjective. The best known of these are the following: Everlasting pea (*Lathyrus latifolius*), a perennial, floriferous herb often planted in gardens for ornament, especially for concealing unsightly objects such as rubbish-heaps, stones, etc.; sweet pea (*Lathy-*



## PEA-CRAB — PEA-TREE

*rus odoratus*), a well known garden annual flowering herb described under its popular name; glory pea, glory vine, or parrot's bill (*Clianthus dampieri*), a tender sub-repent shrub with unique, showy flowers, for which it is cultivated somewhat in greenhouses but has not become widely popular because of its proneness to the attacks of red spider and its difficult management; hoary, pigeon, Toor, Kongo, or Dhal pea (*Cajanus indicus*), an Asiatic species widely cultivated in tropical countries for its seeds which are used for food; scurfy pea (*Psoralea spp.*), many herbs, shrubs, and sub-shrubs natives of various countries, where several are used as border plants in gardens; chick pea (*Cicer arietinum*), an annual herb of western Asia and the Mediterranean region where it is largely cultivated for its ripe seeds which are used as food; and sea or beach pea (*Pisum maritimum*), a native of seacoasts throughout the Northern hemisphere and valued in rocky and sandy gardens because of its ability to grow under very adverse conditions.

*Insect Pests.*—Of the score or more insects which feed upon the pea, the most troublesome is probably the green pea louse (*Nectarophora destructor*) of the order Hemiptera. Like other plant lice (q.v.) this insect multiplies very rapidly and in seasons favorable to it does prodigious damage, especially in regions which supply canning factories with peas. Before the middle of June in 1900 the damage was estimated at \$4,000,000, and that of the previous season at \$3,000,000. In one season it spread havoc from New Brunswick to Virginia, destroying approximately 50 per cent of the crop. Very early and very late planting have been suggested as preventive measures, as has also the avoidance of two successive leguminous crops upon the same land. As remedies, spraying with kerosene emulsion (see FUNGICIDE) has been tried with indifferent success, but brushing the insects with special machines is more satisfactory. The rows of plants are made far enough apart to permit of horse cultivation, which is given immediately after the brushing, so as to bury the insects before they can return to the vines.

The next most troublesome insect is the pea-weevil (*Bruchus pisorum*) which lays its eggs upon the young pods into which the larvæ burrow, finally transforming to pupæ in the mature seed from which the adults issue during late summer and autumn, although in the North they generally wait until the spring. The adults hibernate, lay their eggs and die; they do not reproduce in or feed upon stored peas. Fumigation with carbon bisulphide or hydrocyanic acid gas are often resorted to, the seed being enclosed in air-tight receptacles. Holding the seed over for a year in bins from which the beetles cannot escape is also recommended, as is also late planting, this last being thought to obviate egg laying, the insect not living until the peas come into flower.

Of the other insects which do serious injury the following are probably the commonest: Ash-gray blister beetle (*Macrobasis unicolor*) and several of its close relatives. These eat the leaves of peas, beans, and several other leguminous plants during early summer, though earlier in the year their larvæ may have helped to hold the grasshoppers in check by eating their eggs. Spraying with Paris green and driving

the insects to winrows of straw to be burned are recommended. Several cutworms often do serious injury (see CUTWORM), as does also the boll-worm (q.v.). The European pea-moth (*Semasia nigricana*), a dreaded pest of foreign fields, is known to be an arrival in Canada and pea growers are dreading the possible spread of the insect. There are also several general feeding insects such as leaf-hoppers and plant-bugs which are occasionally troublesome to the agriculturist.

**Pea-crab**, an English name for the oyster-crab (q.v.).

**Pea Ridge, Battle of**, a battle of the Civil War, fought 7–8 March 1862. Gen. S. R. Curtis had driven the Confederate troops out of Arkansas into Indian Territory, and made his headquarters at Fayetteville in the extreme northwest, when he heard that Van Dorn, with Price, McCulloch, Albert Pike, and some 25,000 men, was rapidly marching against him. The actual effective strength of the Confederates was, by the official records, 16,202 infantry and cavalry and about 50 cannon. According to Van Dorn's official report less than 14,000 were brought into the battle. Falling back to Sugar Creek, which half encircles a high plateau cut by ravines, called Pea Ridge, he strengthened his front. Van Dorn thereupon swung his army to the left and reached Pea Ridge in the rear of Curtis, to cut off his communications and reinforcements, thus making his elaborate frontal preparations worthless. Curtis at once faced his army to the rear, his left on the creek and his right on Elkhorn Tavern at the crest of the ridge, the Confederate left being at the latter. On the morning of the 7th the Confederates made a fierce assault, which for a time seemed to carry all before it; but it was in two unrelated divisions. McIntosh and McCulloch on the right ambushed and outflanked Osterhaus; Van Dorn and Price at Elkhorn Tavern decimated Col. Carr's forces. The latter carried on a seven hours' fight till near the last without reinforcements—which could not be spared him—so heroically that one fourth of his troops were killed or wounded. The Confederate right was making a final effort to break the Union line and join the left, when Curtis brought in his last reserves, and in a desperate combat in the woods both McCulloch and McIntosh were mortally wounded; whereupon their troops retreated, and Sigel reinforced Carr and stopped the progress of Price, who was badly wounded. The Federals lost some guns and some ground, being driven half a mile beyond Elkhorn Tavern, which was the headquarters of Van Dorn on the night of the 7th, as it had been of Carr in the morning. On the morning of the 8th the Federals renewed the fight, and Van Dorn, after a hard struggle, retreated. Van Dorn estimated the strength of the Union army at from 17,000 to 24,000. But the official records show their actual strength to have been 10,500 infantry and cavalry and 49 cannon. The Union troops lost 1,351, more than half of them from Carr's division; the Confederates probably lost as many, since Van Dorn says that his loss was between 800 and 1,000 killed and wounded, and 300 missing.

JOSEPH T. DERRY,  
*Author of 'History of Georgia.'*

**Pea-tree.** See PEPPER-TREE.



## PEA-WEEVIL — PEABODY

**Pea-weevil.** See BEAN-WEEVIL.

**Peabody, pē'bōd'ī, Andrew Preston,** American Unitarian clergyman: b. Beverly, Mass., 19 March 1811; d. Cambridge, Mass., 10 March 1893. He was graduated from Harvard in 1826, studied also at the divinity school, in 1833 became colleague of Nathan Parker at the South Parish Church of Portsmouth, N. H., and soon afterward sole pastor. In 1860 he was made Plummer professor of Christian morals and ethics at Harvard, and this post he held until his resignation in 1881, when he received an emeritus appointment, his attention being thenceforth given chiefly to literary work. In 1862 and 1868-9 he was acting president of Harvard. He was editor of the 'North American Review' in 1852-61, and besides more than 100 addresses and special sermons, published several volumes, including: 'Conversation: Its Faults and its Graces' (1856); 'Christianity the Religion of Nature' (1864); 'Reminiscences of European Travel' (1868); 'Christian Belief and Life' (1875); 'Harvard Graduates Whom I Have Known' (1890).

**Peabody, Cecil Hobart,** American mechanical engineer: b. Burlington, Vt., 9 Aug. 1855. He was graduated from the Massachusetts Institute of Technology in 1877 and in 1878 was appointed professor of mathematics in the Imperial Agricultural College, Sapporo, Japan. In 1881 he was assistant-professor of mechanical engineering and in 1883 professor of steam engineering at the Massachusetts Institute of Technology, where he has been professor of naval architecture and marine engineering since 1893. He has published: 'Thermo-dynamics of the Steam Engine' (1889); 'Valve Gear for Steam Engines' (1892); 'Manual of Steam Engine Indicator' (1900); etc.

**Peabody, Elizabeth Palmer,** American writer and educator: b. Billerica, Mass., 16 May 1804; d. Jamaica Plain, Mass., 4 Jan. 1894. She engaged in teaching at 16 and later studied Greek under Emerson. She taught under Amos Bronson Alcott (q.v.), was for a time secretary to William Ellery Channing, and subsequently was largely instrumental in introducing the Froebel kindergarten system into the United States. Among her publications, which are chiefly of an educational character, are: 'First Steps in History' (1833); 'Crimes of the House of Austria against Mankind' (1852); 'Kindergarten in Italy' (1872); 'Reminiscences of William Ellery Channing' (1880); 'Education in the Home the Kindergarten' (1887); etc.

**Peabody, Francis Greenwood,** American Unitarian clergyman and educator: b. Boston, Mass., 1847. He was graduated from Harvard in 1869, from the Harvard Divinity School in 1872, and in 1874-80 was pastor of the First Parish Church at Cambridge, Mass. In 1880-6 he was professor of theology in the Harvard Divinity School, and since 1893 has occupied the Plummer chair of Christian morals at Harvard University. He has published: 'Short Addresses to Young Men on Personal Religion' (1896); 'Afternoons in the College Chapel' (1898); 'Jesus Christ and the Social Question' (1900); etc.

**Peabody, George,** American merchant and philanthropist: b. Danvers (now Peabody), Mass., 18 Feb. 1795; d. London, England, 4 Nov. 1869. His parents were poor, and after a common school education he became clerk in a grocery store at the age of 11. In 1812 he went to Georgetown, D. C., as clerk in his uncle's grocery; but a few years later entered into partnership with Elisha Riggs in the wholesale dry goods business, at Baltimore. Largely through his untiring industry the firm became prosperous and influential, and his partner retiring in 1829, he was left at the head of the business. In behalf of his firm he had several times visited London, and decided to make that his permanent residence; he consequently severed his connection with his American firm, established in London a banking and mercantile business under the firm name of George Peabody & Co.; and owing to his business ability and strict integrity amassed a large fortune. This wealth he devoted largely to promoting education, giving most generously to several institutions. He gave \$200,000 to found an institute with a free library and lecture course in his native town of Danvers; and to the city of Baltimore gave \$1,400,000 for an institute combining free library and lectures with an academy of music and an art gallery; in 1866 this institute was opened and he was present at the dedication ceremonies. He further gave \$150,000 to Yale for a museum of natural history, the same amount to Harvard for a Museum of Archæology and Ethnology; \$140,000 to Salem, Mass., to found the Peabody Academy of Science; and an endowment of \$13,000 to the Newburyport public library. In 1862 he placed in the hands of trustees in the city of London \$750,000 for the building of model tenement houses for the poor to be let at moderate rents; this plan proved so successful and the houses were so well patronized that he later increased the fund to \$2,500,000, it being known as the London Peabody fund. In 1851 he contributed \$15,000 for the improvement of the United States exhibit at the London World's Fair; and in 1852 gave \$10,000 to the second expedition under Dr. Kane in the search for Sir John Franklin; hence a part of the region discovered by this expedition was named in his honor Peabody Land. His last and perhaps most important gift was that of \$3,500,000 for the promotion of education in the Southern States, under the control of a special board of trustees, and known as the Peabody Educational Fund (q.v.). The total amount of his gifts was between \$8,000,000 and \$9,000,000. His benefactions were so eminently wise and helpful to the community that he was greatly respected and beloved in both England and America. In 1866 he was given the freedom of the city of London, an unusual honor; and the queen sent him an autograph letter and a miniature portrait of herself, both of which are at the Institute in Peabody, Mass. A public funeral was given him in Westminster Abbey; and his remains were brought to the United States by the British ship-of-war *Monarch*, and buried with fitting honors at Danvers (now Peabody), Mass. Consult: The 'Life' by Hanaford (1870); Bolton, 'Poor Boys who became Famous' (1888); Curry, 'Brief Sketch of George Peabody' (1898).



## PEABODY—PEABODY EDUCATIONAL FUND

**Peabody, Henry Oliver**, American inventor: b. Boxford, Mass., 13 May 1826; d. Point Allerton, Mass., 28 July 1903. At the outbreak of the Civil War he was employed in an arms factory in Boston, and there invented the breech-loading gun known as the Peabody rifle. It was manufactured in large quantities by a Providence establishment for the Turkish Government. Its pattern was copied extensively in Europe, where it was not patented.

**Peabody, James Hamilton**, American banker: b. Topsham, Vt., 21 Aug. 1852. He was educated in the public schools of his native town, and going to Colorado engaged in business first as a bookkeeper and then as a merchant in Cañon City. In 1885 when the First National Bank of Cañon City was organized he was chosen vice-president, and later became president. He has also been active in public life, has been city clerk, member of the school board, city treasurer, and member of the city council; in 1885 he was elected county clerk on the Republican ticket. In 1902 he was nominated and elected governor of Colorado for a two years' term. He has been a prominent member of the Masonic fraternity.

**Peabody, Josephine Preston**, American poet: b. New York 1874. She was educated at Radcliffe College and was instructor in English literature at Wellesley College, 1901-3. She is the author of 'Old Greek Folk Stories' (1897); 'The Wayfarers: a Book of Verse' (1898); 'Fortune and Men's Eyes: New Poems with a Play' (1900); 'Marlowe,' a drama infused with the Elizabethan spirit, and containing several beautiful lyrics (1901); 'The Singing Leaves' (1903).

**Peabody, Selim Hobart**, American educator: b. Rockingham, Vt., 20 Aug. 1829; d. Saint Louis, Mo., 27 May 1903. He was graduated from the University of Vermont in 1852, appointed professor of mathematics and engineering at the Polytechnic College at Philadelphia, Pa., where he remained from 1854-7 and was later connected with various educational institutions in the West. He was professor of physics and engineering at the Massachusetts Agricultural College in 1871 and in 1878 accepted the chair of mechanical engineering at the Illinois Industrial Academy at Champaign, Ill. He was elected president of that institution in 1880 and under his administration it became the University of Illinois. He resigned the presidency in 1891 to become chief of the department of liberal arts at the World's Columbian Exposition.

**Peabody**, Mass., town, Essex County; on the Boston & M. railroad, two miles west of Salem. It includes the villages of Peabody, North Peabody, South Peabody, West Peabody, and others. The town was incorporated in 1855 as South Danvers, and, in 1868, the name was changed in honor of George Peabody (q.v.), who was born there. The most important of its manufactures is leather, plain and morocco; others are shoes, electrical supplies, thermometers, and glue. It contains the Peabody Institute, founded in 1852 by George Peabody, and the Eben Dale Sutton Reference Library. The Institute is under the management of a board of trustees who report annually to the town government; it contains a library of 38,883 volumes (1903) and a lecture

hall in which free lectures are given. The Sutton Library is under the control of the same trustees. In 1902 the Peabody Historical Society presented the Institute with a small safe containing pictures of the town, articles by leading citizens, and newspapers, which is "to be opened by the citizens of Peabody on or after June 16, 2002." Pop. (1890) 10,158; (1900) 11,523.

**Peabody-bird**, the white-throated sparrow (q.v.), so called in northern New England.

**Peabody College for Teachers**, founded in Nashville, Tenn., in 1875, by means of the Peabody Educational Fund (q.v.). The need of special training for the work of teaching the young was recognized by Dr. Barnas Sears, president of Brown University, who was trying to place the fund to do the most good for the greatest number. Nashville was selected as the place to found a college for the training of teachers, and the University of Nashville was offered and accepted as a foundation. The school opened with 13 pupils, and in 1902 there were in attendance 813 pupils. The same year (1902) there were 33 professors and instructors; over 20,000 volumes in the library; the buildings and grounds were valued at \$202,500. The total income from public money and productive fund was nearly \$80,000. The college receives its support from the Peabody Fund, the State, and the University. Scholarships bestowed by the Peabody Fund are given to a certain number of worthy students of the college. The degree of licentiate of instruction is conferred by the college, and the student holding this degree is by law eligible, without any further examination, for any teaching position in the public schools of Tennessee. The University confers other degrees,—master and bachelor of arts, letters, and sciences. The building is well equipped for laboratory work, professional training, and observation. See SCHOOLS, NORMAL.

**Peabody Educational Fund**, founded in 1867 by George Peabody (q.v.), for educational purposes in the South. In the articles of endowment the words are that the money shall be used for promoting "intellectual, moral, and industrial education in the most destitute portion of the Southern States." The first gift was securities amounting to \$2,100,000, of which \$1,000,000 were Mississippi State bonds. The Mississippi bonds were afterward repudiated. Mr. Peabody gave \$1,000,000 additional in 1869. Of this amount \$384,000 were Florida bonds issued while that section was a territory, and for certain reasons such bonds had never been recognized as legal by the State. The fund was placed in charge of 15 trustees, men prominent in the United States,—Robert C. Winthrop of Massachusetts was chairman.

The trustees held meetings annually, generally in New York city. They filled vacancies caused by the death or resignation and transacted such business as was necessary. The trustees had authority to spend the interest and 40 per cent of the principal the first two years; after that time the principal was to remain intact for 30 years, when the whole amount might be divided and distributed for educational purposes, as might be deemed best by the trustees. The rules governing the use of the fund were broad, and precautions were taken not to interfere with





GEORGE PEABODY.







## PEACE — PEACE SOCIETY

established schools. Efforts were to be made to work with existing schools, to strengthen weak schools, and to promote in general elementary education. No school should receive aid unless it had in attendance at least 100 students and maintained a school 10 months in the year. The district desiring a share of the fund should contribute twice the amount granted by the trustees. A school having an attendance of 100 pupils and complying with other conditions, might have \$300; if 200 pupils were in attendance, it might have \$600; and a school with 300 in attendance might have \$1,000. Normal and training schools for teachers received special attention. Scholarships were granted to many worthy pupils,—at first \$200 each, later \$100. From the establishment of the fund to the end of the 30 years, the total amount paid out was about \$2,600,000. The greater part of this sum was used in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Texas, Tennessee, Virginia, and West Virginia. Consult: Curry, 'History of Peabody Educational Fund' (1898); Reports of United States Commissioner of Education, in which will be found an account of the foundation and distribution of the fund.

**Peace** (in law). See BREACH.

**Peace Conference.** See HAGUE CONFERENCE.

**Peace Convention**, in American history, a term used at the beginning of the Civil War. After the secession of several of the Southern States, Virginia on 1 Jan. 1861 invited the other secession States to send delegates to a conference in Washington, D. C., with the object of devising a plan whereby all differences between the North and the South might be peaceably settled. The conference met 4 February and delegates were present from 14 free States and 7 slave States. Ex-President John Tyler was made presiding officer. A committee of one from each State was appointed to draw up a report of "what they may deem right, necessary, and proper, to restore harmony and preserve the Union." Several minority reports were presented, but the majority report was adopted. It recommended a number of amendments to the Constitution, the substance of which was as follows:

1. In the territories north of lat. 36° 30' slavery was to be prohibited. In territories south of that line the institution was to remain as it then was, and no law was to be passed abridging the right of a man to take his slave thither. The status of new States was to be determined by the constitution adopted by them.

2. No new territory was to be acquired except by discovery or for naval and commercial stations or depots, without the concurrence of a majority of the Senators from the free States and a majority of the Senators from the slave States.

3. Neither the Constitution nor any amendment thereof was to be construed as giving Congress power to interfere with slavery in any State; nor to abolish it in the District of Columbia without the consent of the State of Maryland and of the owners, nor without compensation to the latter; nor to prohibit representatives and others from taking their slaves to the District and bringing them away again; nor to prohibit slavery in any place under the jurisdiction of the United States, if within a slave State; nor to prohibit the inland slave trade between slave States, but not in or through free States. The slave trade in the District was prohibited.

Section 4 provided for the delivery of fugitive slaves, section 5 for the prohibition of the foreign slave trade, section 7 for the payment to owners by the United States of the value of slaves that might escape by reason of the interference of mobs with Federal officers, and for

"securing to the citizens of each State the privileges and immunities of citizens in the several States," while section 6 ordained that sections 1, 3, and 5 and Article 1, section 2, clause 3, and Article 4, section 2, clause 3, of the Constitution were to be amended or abolished only by the unanimous consent of the States. This report was offered to the Senate, which refused to act upon it, and it met a similar fate in the House, neither party being satisfied with it.

**Peace of God**, a universal cessation from private warfare which the Church of France in the 10th and 11th centuries tried to impose upon the nobles of that country. The ecclesiastical authorities in several synods recommended that all differences should be settled by the ordinary civil tribunals. But these efforts were all in vain and a compromise was arrived at which resulted in the establishment of what was known as the Truce of God (q.v.).

**Peace of the Pyrenees.** See PYRENEES, PEACE OF THE.

**Peace, Religious** (German, *Religionsfriede*), a series of treaties by which, after the Reformation, the Protestant states were granted their religious liberty. There are two treaties which especially bear this name, that of Nuremberg, signed by the Protestants on 23 July, and confirmed by the emperor Charles V. at Ratisbon 2 Aug. 1532, and that of Augsburg, 26 Sept. 1555. By the Treaty of Nuremberg the emperor pledged himself to summon a council to settle all religious differences, and both sides agreed to suspend hostilities until the council should be convoked. The Protestants gained by this peace only a temporary security. The Peace of Nuremberg was consequently six times renewed between 1534 and 1545. The victory of Charles over the Schmalkaldic League placed the whole of Germany at his mercy, when the declaration of war by the Elector Maurice compelled him to accept the Peace of Passau, 31 July 1552, by which the right of the evangelical states to the free exercise of their religion was acknowledged by the emperor who promised to convene a diet to settle the rights of the two religious parties, and the rights of the imperial authorities. Several circumstances delayed the meeting of the diet, which took place at Augsburg in 1555, presided over by the Archduke Ferdinand, and concluded the treaty known as the Religious Peace of Augsburg, which provided that no state was to be disturbed on account of its religion; subjects were not forbidden to leave a state where their religion was persecuted, and the Protestants were to retain all the ecclesiastical benefices in their possession after the Peace of Passau. The Calvinists were not included in the provisions of this treaty, but by the Peace of Westphalia (1648), which placed the Calvinists on the same footing with the Lutherans, a permanent peace was established.

**Peace River**, Canada, an important affluent of the Mackenzie (q.v.).

**Peace Society**, an organization founded in 1816 for the purpose of promoting universal peace on a permanent basis among the nations. It is more or less a religious movement and asks the support of all denominations, as well as of persons who oppose war on any grounds. The society has always advocated a gradual disarmament by all the nations of Europe, but



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its main contention is the necessity for adopting the principle of arbitration in international disputes. That method of settling such questions as for centuries have been solved by a campaign, has become frequent in recent years, largely owing to the efforts of the Peace Society. During the period of its existence over 140 instances of pacific settlements of international misunderstandings have occurred.

**Peace Treaties.** Although comparatively few peace treaties were negotiated prior to the Middle Ages, the making of such agreements, as well as the observance of treaties in general between the great nations of the world, was one of the first phenomena to indicate the spread of civilization. In the history of international law there were few subjects that received earlier attention. The Greek and Roman historians devote much space to the subject, while the fact that nations had given thought to this method of settling grievances ages before these chronicles were written is indicated by the references to such agreements which appear in the Old Testament writings as well as by the records discovered upon the ancient monuments of Egypt and Assyria. Even the movement for universal arbitration, the principle which attained its culmination in the Hague tribunal, is almost as old as the records of history. It is true that the first instances of arbitration, especially those of Greece, were intermunicipal, rather than between the different races. During the Middle Ages the popes were frequently appealed to, and it was in response to such demands that Innocent III. became the mediator between King John and his barons; Boniface VIII. arbitrated the difficulties between Edward I. and Philippe le Bel; Leo X. arranged affairs for Maximilian and the Doge of Venice, just as, in more modern times, Leo XIII. adjusted the dispute of Germany and Spain in relation to the Caroline Islands. It was as early as 1603 that Sully suggested his plan for a "Concert" of the 15 states, by which all international differences were to be decided. A century later the Abbe St. Pierre proposed the organization of his "General League of Christendom," but, although his international peace court was based upon a less ulterior motive than that of Sully, it had little effect except to inspire a hundred or more similar schemes which helped to prepare the world for the organization of the 19th century tribunal of arbitration at the Hague.

The most important treaty to which the United States has been a party was the Peace of Paris, the preliminaries of which were signed in that city 13 Nov. 1782. In announcing the settlement of these preliminaries John Adams wrote: "We have been very industrious, having been at it forenoon, afternoon, and evening, ever since my arrival," while Benjamin Franklin, who was also a member of the commission, added: "We hope the terms we have secured will be satisfactory, though to secure our main points we may have yielded too much in favor of the royalists."

Despite the fact that the treaty was so favorable to his interests, George III. did not see fit to ratify it until 6 Aug. 1783. On the 3rd of the next September the definite treaty of peace, which formally acknowledged the ex-

istence of the new republic as a nation, was signed, also at Paris, and 14 July 1784, it was duly confirmed by Congress.

The following list includes the most important peace treaties negotiated by the various nations of the world:

*Aarau.*—At the conclusion of the religious war in Switzerland, which ended in a victory for the Protestants, 25 July 1712, the treaty of Aarau was signed, 15 Aug. 1712. By its provisions the two religions were equalized throughout the Swiss provinces.

*Abo.*—A treaty signed by Russia and Sweden, 18 Aug. 1743. By its provisions Russia acquired the southern territory of Finland as far as the river Kymen, and the privilege of electing an ally as Prince Royal of Sweden.

*Adrianople.*—This important treaty between Russia and Turkey was signed at Adrianople, 14 Sept. 1829. By its provisions Turkey not only recognized the independence of Greece, but gave to Russia nearly all the rights she demanded, including the control of a part of the left bank of the lower Danube, as well as the Sulina mouth of that river; several districts on the northeastern coast of the Black Sea, with their important fortresses; the confirmation of the protectorate of the Czar over the Danubian principalities, and the confirmation to Russian subjects of the rights of trade in Turkey, and the freedom of navigation in the Black Sea, the Danube, and the Dardanelles. See ADRIANOPLE.

*Aix-la-Chapelle.*—The first peace treaty of Aix-la-Chapelle was signed 2 May 1668, when France, in accordance with the demands of the Triple Alliance (then composed of England, the Netherlands, and Sweden), returned France-Comte to Spain in consideration of the cession of 12 fortified towns on the border of Spanish Netherlands. The second peace treaty of Aix-la-Chapelle put an end to the famous war of the Austrian Succession. It was signed 18 Oct. 1748, and provided for the mutual restitution of conquests, except in the case of Austria, which was compelled to cede Parma, Guastalla, and Piacenza, to Don Philip of Spain, and to confirm the rights that Prussia had acquired in Silesia. See AIX-LA-CHAPELLE, TREATIES OF PEACE.

*Alais.*—The last of the religious wars in France was ended by the peace treaty of Alais, which was signed in 1629. By its provisions the Huguenots ceased to exist as a political party.

*Alkmaar.*—It was in accordance with the provisions of the Convention of Alkmaar, signed Oct. 1799, that the Anglo-Russian forces under the command of the Duke of York, evacuated the Netherlands.

*Altradstadt.*—The treaty of peace, dictated by Charles XII. of Sweden, and which cost Augustus II. of Saxony his possession of Poland, was signed 24 Sept. 1706.

*America.*—See *Paris*.

*Amiens.*—The peace of Amiens was concluded 27 March 1802. By the provisions of the treaty, which was between Great Britain on one side and France, the Batavian Republic, and Spain on the other, the former agreed to recognize the Ionian Republic and to restore all conquests with the exception of Ceylon and Trinidad, on condition that France should abandon Rome and Naples and should restore Malta to the Knights of Saint John.

*Ancon.*—A treaty by the provisions of which Peru ceded important territories to Chile, was signed 20 Oct. 1883.

*Antalcidas.*—This treaty, which was signed by Antalcidas the Lacedemonian with Artaxerxes, King of Persia, in 387 B.C., was made on behalf of Greece and in favor of Sparta. By its provisions the cities of Ionia passed to the Persians.

*Antanarivo.*—This treaty, signed 1 Oct. 1895, marked the conclusion of the troubles between France and the Hovas. By its provisions the French protectorate over Madagascar was established.

*Anthony and Octavius.*—In B.C. 40, Anthony and Octavius were compelled by their own soldiers to make a treaty of peace. It was signed at Brundisium, and was the means of postponing for fully 10 years the final struggle between the two chief Triumvirs.

*Augsburg.*—While, in one sense of the word, a religious peace treaty, the agreement which was concluded between the Lutheran and Catholic state of Germany at Augsburg, 25 Sept. 1555, exerted an important political influence at that time. By the provisions of the treaty each state was permitted to prescribe the form of worship to be followed within its limits. This triumph of the Reformation, however, did not extend so far as to include the Calvinists.

*Baden.*—A treaty signed by the German Empire



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and France, 7 Sept. 1714. This, with the treaties of Utrecht and Rastadt, concluded that war of the Spanish Succession. By its provisions the Peace of Ryswick was ratified; the electors of Bavaria and Cologne were fully reinstated, and Landau was ceded to France.

*Basel.*—5 April and 22 July 1795. See BASEL, TREATIES OF PEACE AT.

*Belgrade.*—By this treaty signed between Turkey, Austria, and Russia in Sept. 1739, Russia returned to Turkey her conquests in Moldavia and Bessarabia, and relinquished her naval rights in the Black Sea, while Austria renounced her territory in Wallachia, Bosnia, and Servia. See BELGRADE.

*Bergerac.*—A treaty of peace, establishing liberty of conscience, was signed between the Catholics and Protestants at Bergerac, France, 17 Sept. 1577.

*Berlin.*—Treaty of 1742. See *Breslau*.

*Berlin.*—On 21 Oct. 1866, Saxony signed a treaty of peace with Prussia by the provisions of which she agreed to pay 10 millions of thalers as indemnity to Prussia for the part her forces had played in the struggle known as the Seven Weeks War.

*Biac-na-bato.*—This treaty was signed by Aguinaldo, as leader of the Philippine insurgents, and Spain, 14 Dec. 1897. By its provisions he agreed that the insurgents would evacuate all positions and would maintain a three years' armistice in return for a stated cash consideration. The latter condition was never fulfilled.

*Bordeaux.*—A treaty of peace signed by Bouillon and his allies and Mazarine, after the siege of Bordeaux, in July 1650.

*Breda.*—By the treaty of Breda, signed between England, Holland, France, and Denmark, 31 July 1667, the rights of England in New York and New Jersey, of France in Arcadia, and of Holland in Surinam, were confirmed by the Powers.

*Breslau.*—The treaty signed at Berlin by Lord Hyndford, as representative of Maria Theresa, Queen of Hungary, with Podewilz, Minister of Prussia, 28 July 1742, is known as the Peace of Breslau, owing to the fact that the preliminary convention was signed at that place on 11 June. By the provisions of this treaty Silesia was ceded to Prussia by Austria.

*Bretigny.*—This treaty, known as "The Great Peace," was signed by Edward III. of England and John II. of France, 8 May 1360. See BRETIGNY.

*Bromsebro.*—By the provisions of the treaty of peace signed at Bromsebro, between Sweden and Denmark, in Aug. 1645, the latter nation renounced its rights to rule over Jemtland, the island of Gothland, etc.

*Bucharest.*—This treaty, concluded 8 May 1812, ended the war which had been waged between Russia and Turkey since 1806. By its provisions the Pruth and the Lower Danube became the established boundary between these countries. See BUCHAREST, PEACE OF.

*Callias.*—A treaty concluded at Sparta, June 371 B.C., in which Athens and Sparta and all their allies participated. Callias, from whose name the treaty derived its title, was one of the most prominent Athenian envoys.

*Cambray.*—A treaty signed between Francis I. of France and Charles V., 5 Aug. 1559, by which France not only permitted Italy to revert to the Emperor, but also relinquished all claims over Artois and Flanders, her rights to the duchy of Burgundy alone being recognized. This treaty is sometimes called the "Ladies' Peace," because of the fact that the preliminary negotiations were undertaken by Louise, the mother of Francis, and Margaret, aunt of Charles.

*Campo-Formio.*—A treaty signed between France and Austria, 17 Oct. 1797. It provided that Austria should cede the Belgian Provinces and recognize the Cisalpine Republic, retaining, on the other hand, a large proportion of the Venetian territories, while France retained the Ionian islands.

*Carlowitz.*—The Peace of Carlowitz will always be known as one of the most memorable treaties in history: (1) because of the magnitude of the territorial changes involved; (2) because it marked the beginning of the downfall of the Ottoman Empire as an aggressive power, and (3) because by taking part in a General Congress for the first time the Sultan admitted the principle of intervention of the Powers for the general good. This treaty, which was for 25 years, was concluded 26 Jan. 1699, between Russia, Austria, Poland, Venice, and Turkey, by the mediation of England and The Netherlands. By its provisions Austria received that portion of Hungary lying between the Danube and Theiss, as well as Transylvania; Russia obtained Azoff; Venice retained the Morea, while Poland regained Podolia and Ukraine.

*Cateau-Cambresis.*—A treaty between England, France, and Spain, signed 3 April 1559, by which the two latter countries restored many of their conquests.

*Cherasco.*—This treaty, signed 6 April 1631, con-

firmed the treaty of Ratisbon (q.v.) which had been concluded between Richelieu and Ferdinand II., thus ending the War of the Mantuan Succession.

*China and Japan.*—The treaty signed between China and Japan, 16 April 1895, not only compelled China to pay a heavy indemnity, but required the cession of Formosa, the recognition of the independence of Corea, and other concessions.

*Cimon.*—The Peace of Callias is sometimes known as the Peace of Cimon.

*Clair-on-Epte.*—A treaty signed about A.D. 911, between King Charles, Duke Robert of Paris and Rolf. By its provisions a definite district was ceded to Rolf, upon condition that he would become the King's vassal. After having been admitted to baptism the King's natural daughter was given him in marriage.

*Conflans.*—It was this treaty, signed in Oct. 1465, between Louis XI. of France and the dukes of Burgundy, Bourbon, and Brittany, which marked the conclusion of the War of the Public Good. By its provisions Normandy was ceded to the Duke of Berry.

*Constance.*—The peace treaty concluded by Frederick Barbarossa and the Lombard League in 1183, by which the cities of the League acknowledged the overlordship of the Emperor upon his renouncement of the regalian rights which he had previously claimed.

*Constantinople.*—See *Pruth* 1711.

*Constantinople.*—By this treaty signed between Russia and Turkey, 8 Feb. 1879, the provisions of the treaty of San Stefano (q.v.) were materially modified, and the Sultan was compelled to pay a heavy war indemnity.

*Constantinople.*—The treaty of peace, signed between Turkey and Greece in Dec. 1897, officially concluded the Greek War.

*Crepy-en-Laonnais.*—By this treaty, signed between Francis I. of France and Charles V., the Emperor renounced all claims to Burgundy, while Francis renounced all rights in Lombardy, Naples, Flanders, and Artois.

*Dennikon.*—The peace treaty that was signed at Dennikon in 1531, established the principle of each canton's independence.

*Dresden.*—The Peace of Dresden concluded the second Silesian War. It was signed between Austria, Saxony, and Prussia, 25 Dec. 1745, and its provisions confirmed Frederick the Great in his contention for the possession of Silesia.

*Dyrrachium.*—The first Macedonian War, which began in 214 B.C., was concluded by the Peace of Dyrrachium, signed 205 B.C. This peace was of five years' duration.

*El Zanjón.*—Peace was declared between the Spanish forces and the Cuban revolutionists in 1878, when the treaty of El Zanjón was signed. According to the provisions of the treaty Gen. Gomez disbanded his army and retired to San Domingo, but the reforms which Spain had promised in return never materialized. As the result the standard of revolt was once more raised in 1895.

*Evora Monte.*—The treaty of Evora Monte concluded the attempt of Dom Miguel to capture the throne of Portugal. By its provisions he abandoned his claim to the crown in consideration of a pension of \$60,000 per annum.

*Falaise.*—The engagement of fealty to Henry II. taken by William the Lion, King of Scotland, in 1175, is generally known as the Treaty of Falaise.

*Fleix.*—This treaty of peace which was concluded between Henry III. of France and the Huguenots, 26 Nov. 1580, was little more than a renewal of the Treaty of Bergerac (q.v.)

*Foligno.*—By the truce of Foligno, concluded between Napoleon and the King of Naples, Feb. 1801, the latter ceded part of the island of Elba and abandoned all rights in Tuscany.

*Fommanah.*—A treaty of perpetual peace was concluded between Great Britain and the Ashantees, 13 Feb. 1874. By its provisions an indemnity of 50,000 ounces of gold was paid, supremacy over Adansi and other tribes was renounced; free trade was guaranteed, and human sacrifices were prohibited.

*Fontainebleau.*—The preliminary convention of peace between Great Britain, France, Spain, and Portugal, was signed at Fontainebleau, in 1762.

*Fontainebleau.*—The Peace between the Emperor and the Dutch was concluded 8 Nov. 1785. By its provisions the Emperor, in lieu of 10,000,000 guilders, renounced his claims to the free navigation of the Schelde outside of his own domain, and all pretensions to Maestricht, etc.

*Friburg.*—A perpetual peace was negotiated between France and the Swiss Cantons at Friburg, 29 Nov. 1516.

*Fuessen.*—By this peace treaty, concluded between



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**Queen Maria Theresa of Hungary**, and the elector of Bavaria, 22 April 1745, the latter renounced all claim to the imperial crown in return for his lost territories.

**Ghent.**—The treaty of peace between the United States and Great Britain, which concluded the War of 1812, was signed at Ghent, 24 Dec. 1814. Its provisions included the mutual restitution of conquered territory, and the appointment of a commission to settle the boundary dispute, and matters relating to islands in Passamaquoddy Bay. See GHENT, TREATY OF.

**Greenville.**—The Peace concluded between "Mad Anthony" Wayne and the Northwestern Indians, 3 Aug. 1795. The treaty, which made cession of an extensive territory to the Union, also guaranteed the safety of all settlers. See GREENVILLE, TREATY OF.

**Guadalupe-Hidalgo.**—The treaty of peace which concluded the war between the United States and Mexico, was signed 2 Feb. 1848. It fixed the boundary line between the two republics, and, by its provisions, the United States paid to Mexico \$15,000,000 for the territory which it gained by the new boundary, and also relieved Mexico from all claims of citizens of the United States for damage, agreeing to pay the same to the amount of \$3,250,000. See GUADALUPE-HIDALGO, TREATY OF.

**Guerande.**—The civil war which established Montfort as Duke of Brittany was concluded by the Peace of Guerande, signed in 1365.

**Guines.**—The war between Henry VIII. and Francis I. of France was terminated by the treaty of Guines, signed in 1547. By its provisions Boulogne, which had been taken by the English, was restored to the French upon receipt of an indemnity of 2,000,000 gold crowns.

**Hague.**—The treaty of peace between Spain, Savoy, and Austria was concluded at The Hague, 17 Feb. 1717.

**Hamburg.**—The treaty of Hamburg was concluded between Russia and Prussia, 5 May 1762.

**Hodeiba.**—The truce of Hodeiba was extorted from the Koreish by Mahomet in 628. As the result of its provisions hostilities were suspended for 10 years.

**Hubertsburg.**—The Peace of Hubertsburg, which terminated the Seven Years' War, was signed by Prussia, Austria, and Saxony at the Castle of Hubertsburg, 15 Feb. 1763. By its provisions Prussia retained Silesia.

**Jassy.**—The treaty of Jassy, concluded between Russia and Turkey, in 1792, extended the Russian borders to Dniester and gave to her the coast on which the city of Odessa soon arose.

**Kainardji.**—See *Kutschuk Kainardji*.

**Karlowitz.** See *Carlowitz*.

**Kiel.**—By the treaty of peace signed at Kiel, 14 Jan. 1814, Denmark ceded Helgoland to Great Britain and Norway to Sweden, receiving Swedish Pomerania and Rugen as exchange from the latter.

**Kimon.**—See *Callias* and *Cimon*.

**Kutayah.**—By the treaty of peace signed here in May, 1833, Turkey ceded Syria and the Province of Adana to Ibrahim Pasha.

**Kutschuk Kainardji.**—By this treaty of peace signed between Russia and Turkey, 21 July 1774, the Sultan renounced his sovereignty over the Tartars in Southern Russia and granted other territories and strategetical points in the Crimea and on the Black Sea.

**Ladies' Peace.**—See *Cambray*.

**La Rochelle.**—The treaty by which Charles IX. granted partial toleration to the Protestants, 6 July 1573, is known as the Peace of La Rochelle.

**Leoben.**—A provisional treaty of peace concluded between Napoleon I. and the Austrians, 18 April 1797. By secret provisions Napoleon promised to exchange the greater part of the mainland territory of Venice for the Netherlands. Its terms were modified by the treaty of Campo Formio (q.v.).

**Lisbon.**—The successful revolution of Portugal against Spain was officially terminated by the conclusion of the treaty of Lisbon, 13 Feb. 1668. Although this treaty recognized the independence of Portugal, it provided for the cession of Ceuta to Spain.

**Lodi.**—The war of Milan and Florence with Venice, Naples, and other States ended with the signing of the treaty of peace at Lodi, 9 April 1454.

**Longjumeau.**—A treaty of peace between the Catholics and Protestants was signed at this town in France, 23 Mar. 1568. Peace was of brief duration, however, as war was under way again within six months.

**Lubeck.**—A peace signed between Wallenstein, for Germany, and the Danes, Jan. 1629. In accordance with its provisions the Danes recovered all their former possessions, without the payment of indemnity. They were merely compelled to pledge themselves never again to interfere with the affairs of the Empire.

**Lund.**—The treaty between Denmark and Sweden, adjusting the difficulties that had led them to partici-

pate in the War of 1672 between France and Holland, was negotiated at Lund, 26 Sept. 1679.

**Luneville.**—Historians have always held that the Peace of Luneville was especially distinguished in that it marked the beginning of the end of the Holy Roman Empire. It was a treaty concluded between the Emperor and the French, 9 Feb. 1801. By its provisions the Batavian, Cisalpine, Helvetic, and Ligurian republics were recognized; the left bank of the Rhine was bestowed upon France; Tuscany was ceded to Parma, and the arrangements made with Austria by the treaty of Campo-Formio were confirmed.

**Mangalore.**—The treaty of peace by which the British and Tippu Saib agreed to a restitution of conquests was signed at Mangalore, India, in 1784.

**Mersen-Rastadt.**—See *Rastadt*.

**Milan.**—The treaty of peace between Austria and Sardinia was concluded at Milan, 6 Aug. 1849.

**Monsieur.**—The treaty forced upon Henry III. of France by a powerful combination of Huguenots and "Monsieur," the Duc d'Alencon, and whereby great concessions were made to the Huguenots, has since been known as the Peace of Monsieur. It was signed in 1576.

**Montpellier.**—A treaty of peace which was extremely unfavorable to the Huguenots was signed at the close of the siege of Montpellier, in 1622.

**Montpellier.**—The second treaty of Montpellier, which offered more tolerable terms to the reformers, was signed in 1626.

**Monzon.**—A treaty of peace between France and Spain was signed at Monzon in May, 1626. The negotiations were conducted so quietly that the interested parties, (Savoy, the Grisons, the Venetians, etc.) knew nothing about the matter until their fate had been settled by the treacherous cardinal, Richelieu.

**Munster.**—The general peace which ended the Thirty Years' War was signed at Munster, 24 Oct. 1648. See also *Westphalia*.

**Nanking.**—Great Britain and China concluded a treaty of peace which terminated the so-called "Opium war," in 1842. By its provisions China was not only compelled to pay an indemnity, but was forced to cede Hong-Kong to Great Britain, and to open the ports of Canton, Amoy, Fuchow, Ningpo, and Shanghai to British commerce.

**Nantes.**—The Edict of Nantes, issued by Henry IV. of France, 13 April, 1598, is also known as the Peace of Nantes, owing to the fact that it put an end to the religious wars in France. See EDICT OF NANTES.

**Naupactus.**—The conflict known as the "Social War," waged between the Achæan League, in alliance with Philip of Macedonia, and the Aetolian League, in combination with Sparta, was terminated by the Peace of Naupactus, B.C. 217.

**Nice.**—A truce famous in history was concluded at Nice between Charles V. and Francis I. of France, in 1538.

**Nicias.**—The famous truce negotiated by Nicias during the Peloponnesian War, between the Athenians and Sparta, B.C. 421, has since been known as the Peace of Nicias.

**Nikolsburg.**—The preliminary peace terms, which were afterwards confirmed by the Peace of Prague (q.v.), were negotiated at Nikolsburg, a town in Moravia, 26 July 1866. These terms acted as a truce in the war between Prussia and Austria.

**Nimeguen.**—See *Nimwegen*.

**Nimwegen.**—A number of treaties were concluded at Nimwegen, Netherlands, during 1678 and 1679. With subsequent treaties, including that of Westminster (1674); Fontainebleau (1679); Lund (1679); St. Germaine-en-Laye (1679), etc., they succeeded in terminating the war between France and Holland, and their allies, which had been in progress since the attack of Louis XIV. upon Holland, in 1672. The treaties signed at Nimwegen were as follows: Between France and Holland, 10 Aug. 1678; between France and Spain, 17 Sept. 1678; between the Emperor, and France and Sweden, 5 Feb. 1679; between Holland and Sweden, 12 Oct. 1679. By the provisions of the treaty all territories taken were restored to Holland upon her pledge of future neutrality; France and Spain exchanged some extensive territories; the Emperor ceded Frieburg-im-Breisgau to France, and Charles IV., Duke of Lorraine, was restored to his duchy upon conditions to which he refused to give his assent. See NIMWEGEN.

**Northampton.**—The treaty of peace by the provisions of which Edward III. of England renounced all claims of dominion which had been assumed over the kingdom of Scotland, was concluded with King Robert I., 4 May 1328.

**Noyon.**—The wars that arose from the League of



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Cambray were terminated by the treaty of peace signed by Francis I. of France, Charles of Spain, Maximilian, the Emperor, etc., 3 Dec. 1516.

*Nuremberg.*—The religious truce concluded between Emperor Charles V. and the Protestants, 2 Aug. 1532, is known as the Peace of Nuremberg.

*Nystad.*—The Northern War between Russia and Sweden was terminated by the Peace of Nystad, concluded 30 Aug. 1721. By its terms Russia restored Finland, but received, in place of it, extensive territories, including Esthonia, Livonia, Ingria, part of Karelia, etc.

*Oliva.*—Sweden, Poland, the Empire, and Brandenburg participated in the peace treaty which was concluded at Oliva, Prussia, in 1660. By renouncing Courland, Sweden obtained important concessions from Poland.

*Olmütz.*—The Olmütz Conference between Prussia, Austria, and Russia, 29 Nov. 1850, put an end to the revolts in Hesse and Schleswig-Holstein. The elector of Hesse was reinstated and Schleswig-Holstein was restored to Denmark.

*Osnabrück.*—See *Westphalia*.

*Paris.*—There have been many so-called treaties of Paris. See PARIS, TREATIES OF. The following are the most important Peace treaties:

1763.—A peace treaty was signed at Paris, 10 Feb. 1763, between Great Britain on one side and France, Portugal, and Spain on the other. By its provisions Great Britain received Canada, Prince Edward Island, Cape Breton, Dominica, Tobago, St. Vincent, Grenada, Mobile, and all the territory east of the Mississippi from France, restoring to her in return Guadalupe, Miquelon, Martinique, Pondicherry, and St. Pierre, and ceding to her St. Lucia. In return for Florida Great Britain restored Havana and ceded Louisiana to Spain.

1783.—The Peace of Paris, which terminated the Revolutionary War, was signed between Great Britain on one side and the United States, Spain, and France on the other, 3 Sept. 1783. In addition to the acknowledgment of the independence of the United States, the treaty provided that the navigation of the Mississippi should be made free to all parties to the agreement; that Florida and Minorca should be restored to Spain; that France should control the region of the Senegal, etc.

1814.—The treaty popularly known as the "First Peace of Paris," was concluded between France and one side and Great Britain, Austria, Prussia, and Russia on the other, 30 May 1814. In addition to acknowledging the independence of the Netherlands, Switzerland, and the German and Italian States, many territorial changes were made, both by the treaty and at the Congress which met later at Vienna.

1815.—This treaty, known as the "Second Peace of Paris," was concluded between the same parties as the treaty of 1814, having been signed 20 Nov. 1815. By its terms France was reduced practically to the limits of 1790; the sum of \$1,400,000,000 was assigned as proper recompense to the allies for the expenses of the war, and, among other things, it was agreed that the fortresses of the northern frontier should not only be occupied by the allies for a term of 5 years, but that such garrisons should be paid by France.

1856.—By the Peace of Paris, concluded between Russia on one side and Turkey, Great Britain, France, and Sardinia on the other, 30 Mar. 1856, Russia abandoned her claim to a protectorate over the Christians in Turkey, the neutralization of the Black Sea was proclaimed, and several important territorial changes were made.

1898.—The most recent Peace of Paris was concluded between the United States and Spain, 10 Dec. 1898. According to its terms Spain relinquished her sovereignty over Cuba, and ceded Porto Rico, Guam, and the Philippine Islands to the United States in return for the payment of \$20,000,000.

*Passarowitz.*—By the treaty of Passarowitz, concluded 21 July 1718, between Turkey and Austria and Venice, Venice ceded the Morea to Turkey, while Turkey ceded a large tract of territory, including Bosnia and part of Serbia, to Austria.

*Passau.*—A treaty concluded between the Elector Maurice of Saxony and King Ferdinand in behalf of Emperor Charles V. This agreement, granting freedom of religion to the Lutherans, was signed 16 July 1552.

*Peace of Monsieur.*—See *Monsieur*.

*Pekin.*—The Peace of Peking, concluded between China and Great Britain and France, Oct. 1860, provided for the ratification of the Treaty of Tientsin (q.v.), and arranged the payment of indemnities and other concessions on behalf of China.

*Perpetual Peace, The.*—See *Friburg*.

*Persia.*—The treaty of peace between Great Britain

and Persia, at the conclusion of the war over the taking of Herat, was signed at Teheran, 14 April 1857.

*Petersburg, Saint.*—See *Saint Petersburg*.

*Pinerolo.*—An agreement reached between the English Commonwealth and France, 1655, by which further persecution of the Waldenses by the Duke of Savoy were permitted.

*Pleswitz.*—Although finally signed at Poischwitz, the armistice between Napoleon and the Russian and Prussian sovereigns, concluded 1 June 1813, is usually known as that of Pleswitz, owing to the fact that the negotiations were chiefly conducted at that place.

*Portsmouth.*—The treaty of peace between Japan and Russia, conducted through the mediations of the United States, was concluded 5 Sept. 1905, at Portsmouth, N. H. See PORTSMOUTH, TREATY OF.

*Prague.*—The first treaty of Prague was concluded between Ferdinand II., Emperor, and the Elector of Saxony, in 1635. By its terms the latter assumed control over Lusatia.

*Prague.*—By the second treaty of Prague, concluded between Prussia and Austria, 23 Aug. 1866, the Lombardo-Venetian kingdom was annexed to Italy and the Germanic Confederation was dissolved.

*Presburg.*—The Peace of Presburg was concluded between France and Austria, 26 Dec. 1805. By its terms Austria ceded her Venetian territories to Italy; Tyrol, Passau, etc., to Bavaria, and her Swabian territories to the South German States. Bavaria and Wurtemberg were also made kingdoms.

*Pretoria.*—The treaty of peace that put an end to the South African War was concluded at Pretoria, 31 May, 1902. By its terms Great Britain took possession of the Transvaal Republic, the Orange Free State, etc.

*Pruth.*—The Peace of Pruth, which is also known as the treaty of Falczi, was concluded at Hush, between Russia and Turkey, 23 July 1711. By its provisions Peter the Great and his army were released from the blockade; and Charles XII. of Sweden was permitted to return home without being molested, in return for territorial cessions made by Russia to Turkey.

*Pyrenees.*—The treaty of peace concluded between France and Spain, Nov. 1659, not only arranged for the cession of considerable Spanish territory to France, but also provided for a marriage between Maria Theresa, Infanta of Spain, daughter of Philip IV., and Louis XIV. of France.

*Rastadt.*—The agreement for the termination of the war between Austria and France was reached at the Congress of Rastadt, in 1714.

*Rastadt.*—The treaty known as the Peace of Rastadt was the agreement which preceded the treaty of Baden (q.v.). It was concluded between France and Austria, 6 Mar. 1714.

*Reuil.*—The treaty of peace between the French parliament and the Court, at the conclusion of the "First Fronde," was signed at Reuil in 1649.

*Roeskilde.*—By the treaty of Roeskilde, concluded 28 Feb. 1658, Denmark ceded Schonen, Halland, Bornholm, and Drontheim to Sweden.

*Ryswick.*—The treaty of Ryswick, concluded between France on one side and England, the Netherlands, and Spain on the other, 21 Sept. 1697, marked the end of French support of the Stuarts by the recognition of William III. as King of England. Many conquests were restored and several territorial exchanges were made.

*Saint Germain-en-Laye.*—The peace treaty of Germain-en-Laye was concluded in 1679 between France and Brandenburg. By its terms Brandenburg was compelled to cede the greater part of its Pomeranian conquests to Sweden.

*Saint Petersburg.*—The peace treaty between Russia and Prussia by the terms of which the former restored all her conquests to the latter, was concluded 5 May 1762.

*San Ildefonso.*—The treaty of peace which concluded the revolution of La Granja was signed at the Castle of Ildefonso in Aug. 1836. By its terms Queen Maria Christina of Spain was compelled to restore the Constitution of 1812.

*San Stefano.*—A treaty of peace concluded between Russia and Turkey, 3 Mar. 1878. By the terms of this agreement, which terminated the Russo-Turkish War, the independence of Roumania, Serbia, and Montenegro were recognized; the principality of Bulgaria was created, while Russia was to receive important territorial cessions as well as a war indemnity of 300,000,000 rubles. This treaty was much altered by the Congress of Berlin which met in the following June. See ADRIANOPLE; SAN STEFANO, TREATY OF.

*Sardinian.*—The agreement by which Sardinia consented to assist Great Britain and France by providing a military contingent to serve against Russia in the Crimean War is known as the Sardinian Convention.



## PEACE TREATIES

*Schonbrunn*.—A treaty concluded between Napoleon I. and Prussia, by which the latter ceded Cleves, Ansbach, and Neuchatel to France. It was signed 15 Dec. 1805.

*Schonbrunn*.—The second treaty signed at Schonbrunn is also known as the Treaty of Vienna. It was concluded 14 Oct. 1809, between Napoleon I. and Francis I. of Austria, and its terms provided that Austria should not only join the Continental system and pay a war indemnity, but that she should cede territories to Bavaria, Warsaw, Russia, and France. Those ceded to France were formed under one government, the Illyrian Provinces, by Napoleon.

*Serpul*.—The peace of Serpul, between the Russians and the Bokhariots, was concluded in 1858. By its terms the Emir pledged himself to remain a firm ally of Russia. Valuable territorial concessions were also made.

*Seville*.—A peace between Great Britain, Spain, and France, concluded in 1729. It was this treaty that left Great Britain in possession of Gibraltar.

*Shimonoseki*.—The treaty of peace concluded between China and Japan, 17 April, 1895, and by the terms of which China agreed to recognize the independence of Corea, ceded to Japan the southern portion of the Province of Shingking, the island of Formosa, and the Pescadores; pay a war indemnity of about \$175,000,000, and open the ports of Shashih, Chungking, Hangchow, and Suchow.

*Sistova*.—A treaty of peace concluded between Turkey and Austria, 4 Aug. 1791. The boundaries which were adopted under the provisions of this treaty were very similar to those of the treaty of Belgrade.

*Spain with America*.—See *Paris*, 1898.

*Stockholm*.—A treaty concluded between Great Britain and Sweden by the terms of which the duchies of Bremen and Verden were ceded to George I. as Elector of Hanover, in consideration of the payment of one million rix-dollars.

*Szathmar*.—By the terms of the Peace of Szathmar, concluded between Karoly and Hungary, in 1711, the Emperor agreed to redress all grievances, both civil and religious, besides promising amnesty to all adherents of Rakoczy's, and the restitution of many of the confiscated properties.

*Szegeddin*.—The treaty of peace which Hunyades extorted from the Sultan of Turkey rescued a large Christian territory from the Moslem yoke. It was concluded 12 July 1444.

*Tafna*.—The peace signed between Gen. Eugeaud, for France, and Abd-el-Kader, 30 May 1837, is known as the Treaty of Tafna.

*Teschen*.—The peace which ended the War of the Bavarian Succession was concluded at Teschen, between Austria and Prussia, 13 May 1779.

*Thorn*.—Two peace treaties have been concluded at Thorn between Poland and the Teutonic Order. The first treaty was signed in 1411; the second, in 1466. By these treaties the Order made important cessions to Poland.

*Tien-Tsin*.—A treaty concluded between China on one side and the United States, Great Britain, France, and Russia on the other, 26 June 1858.

*Tilsit*.—The peace between France on one side and Russia and Prussia on the other was concluded at Tilsit in 1807. The treaty between France and Russia was signed 7 July, that between France and Prussia on 9 July of that year. By the terms of the Peace a portion of Prussia was set aside as the grand duchy of Warsaw, another portion of Prussia was ceded to Russia, and a smaller portion to Saxony; Dantzic was made free; Prussian harbors were closed to the trade of Great Britain; the Prussian army was reduced to 42,000 men, and the Confederation of the Rhine and Joseph, Louis, and Jerome Bonaparte were recognized. Russia, on her part, entered into a secret alliance with France.

*Tolentino*.—By this treaty concluded between Pope Pius IV. and Napoleon, the Pontiff ceded Avignon, Bologna, Ferrara, the Comtat-Venaissin, the Romagna, and Ancona to France. The agreement was signed in Feb. 1797.

*Turin*.—A peace between France and Savoy was concluded at Turin in 1696.

*Turin*.—The armistice negotiated between Bonaparte and Sardinia in 1796 is known as that of Turin.

*Turkmauchay*.—By the terms of the peace treaty concluded between Russia and Persia in 1828, Russia acquired, among other cessions, control over Persian Armenia.

*Ulm*.—The armistice concluded in 1647 between the French and Swedish forces on one side and the Bavarians on the other has since been known as the "Truce of Ulm."

*Unfortunate Peace*.—This title is frequently applied to the treaty of Cateau-Cambresis (q.v.).

*Utrecht*.—The Peace of Utrecht, which consisted of several separate treaties, was concluded in 1713 between France on one side and Great Britain, Holland, Portugal, Prussia, and Savoy on the other. With the treaties signed later at Rastadt and Baden it terminated the War of the Spanish Succession, for, by its provisions, it stipulated that the crown of Spain, which should never be united to that of France, should revert to Philip V. of Bourbon. The Protestant succession in England and Prussia's rights as a kingdom were also recognized. Among the several territorial changes, Great Britain received Newfoundland, Nova Scotia, etc., with the right to send African slaves to America; the Spanish Netherlands, Sardinia, Milan, and Naples were ceded to Austria; Sicily was given to Savoy by Spain; Portugal received additional territories in South America, while Prussia took Neuchatel and Gelderland upon the renouncement of its claims upon Orange. See *UTRECHT, PEACE OF*.

*Verdun*.—The conflict between the sons of Louis the Pius, immediately succeeding his death, was the first great dynastic quarrel of modern Europe. By the treaty of Verdun, the agreement of partition which followed the battle of Fontenay, in 843, the Teutonic principle of equal division among heirs triumphed over the old Roman principle which provided for the transmission of the individual empire.

*Vergara*.—The treaty between the Carlists and the Cristinos, in Spain, was terminated by a treaty concluded at Vergara 1 Aug. 1839.

*Versailles*.—The preliminary agreement which preceded the Peace of Frankfort (q.v.) was concluded between France and Germany at Versailles, 26 Feb. 1871. See *VERSAILLES*.

*Versailles*.—See *Paris*, 1783.

*Vienna*.—Several treaties have been concluded at Vienna. Those of the greatest importance are as follows:

1725.—A treaty between Germany and Spain, concluded 30 April, 1725. By its terms the two sovereigns confirmed to each other such portions of the Spanish dominions as were then in their possession, while Spain guaranteed the Pragmatic Sanction. By a secret treaty signed at the same time Germany agreed to endeavor to restore Gibraltar to Spain, and to use effort to place the pretender on the throne of Great Britain.

1738.—A treaty between Charles VI. of Germany and Louis XV. of France, concluded 18 Nov. 1738. By its terms Austria ceded the Two Sicilies to Don Carlos of Spain, receiving the duchies of Parma and Piacenza in return; Lorraine was ceded to France, and the Duke of Lorraine received Tuscany. It was this agreement that terminated the War of the Polish Succession.

1864.—The treaty which ended the Schleswig-Holstein War was concluded between Austria and Prussia on one side and Denmark on the other, 30 Oct. 1864. By its terms the King of Denmark renounced all rights over Schleswig-Holstein and Lauenburg.

1866.—The treaty of peace between Austria and Italy by the terms of which the former gave up Venetia to Italy, was concluded 3 Oct. 1866.

*Villafranca*.—The war of 1859 between France and Austria was brought to an end by the treaty signed at Villafranca by Francis-Joseph and Napoleon III., 11 July 1859. This treaty was preliminary to that of Zurich (q.v.).

*Westminster*.—By the treaty of Westminster, signed 19 Feb. 1674, the United Provinces relinquished their conquests of the New Netherlands to the King of England.

*Wedmore*.—A treaty of peace concluded between King Alfred and the Danes (about 860) by which the latter bound themselves to remain peacefully on that side of England which lay north and east of "Watling Street."

*Werela*.—A treaty of peace was concluded between Sweden and Russia, at Werela, Finland, in 1790.

*Westphalia*.—The Peace of Westphalia, which terminated the Thirty Years' War, consisted of treaties signed at Munster and Osnabruk, the general peace being signed at Munster, 24 Oct. 1648. By its provisions Switzerland and Holland were declared independent of the German Empire; Sweden obtained Hither Pomerania, Wismar, etc., with three votes in the Diet and a cash indemnity; France received most of Alsace, and was confirmed in the possession of other territories; Brandenburg received Further Pomerania, etc.; Lusatia went to Saxony; the Upper Palatinate to Bavaria; the Rhine Palatinate reverted to the electoral house of the Palatinate, a new electorate being created for it; the Peace of Augsburg was confirmed (its provisions being also extended to the Calvinists) and autonomy was secured to the German States. See *WESTPHALIA, PEACE OF*.



## PEACH

*Znaim*.—The truce between France and Austria which followed the battle of Wagram 12 July 1809, has since been known as the "Armistice of Znaim."

*Zurich*.—The Peace of Zurich was concluded between France and Sardinia on one side and Austria on the other, 10 Nov. 1850. Based on the preliminary treaty signed at Villafrance (q.v.), its terms provided that Austria should cede Lombardy (except Mantua and Peschiera) to France, she ceding them to Sardinia. In return Sardinia assumed responsibility for three fifths of the debt.

**Peach**, a small tree (*Prunus persica*) of the order *Rosaceæ*. It is supposed to be a native of China, whence it has been carried by man, by way of southwestern Asia and the Mediterranean region, to all warm temperate climates throughout the civilized world. It has been cultivated since prehistoric times and to-day it ranks among the twelve most important fruits of the world. The original species is not identifiable, and many botanists suppose that originally the peach and the almond were identical. The two trees are much alike in habit and appearance, and many intermediate grades of their fruit are known. The peach attains heights of 15 to 20 feet, bears lanceolate leaves singly, in pairs or threes, in the last case two of the buds usually being flower-buds with a leaf-bud between them. Flower-buds are also borne upon short spurs which live only two or three years. Since the flower-buds open in very early spring, before the leaves appear, they are frequently injured by frosts. The fruits (drupes) vary greatly in size, downiness, color, adherence to or separation from the stone, and color of flesh.

About 300 varieties are cultivated in the United States, popularly classed as clingstone and freestone, white-fleshed and yellow-fleshed. Price, a Texas horticulturist, has given a systematic classification as follows: (1) Peen-to race, flat, greenish-white, medium-sized, early varieties, suitable for cultivation only in the Gulf States; (2) South China race, flattened-oval, rather small fruits with curved apex; (3) Indian or Spanish race, hairy, yellow, late, often streaked, firm fruits; (4) North China race, large, mostly cling or semi-cling fruits with slightly curved beaks; (5) Persian race, the common peaches, white or yellow fleshed, cling or free, of the northern and central States, also cultivated extensively in Georgia, California, and other great peach producing districts. There are also smooth-skinned peaches, nectarines, which may originate from peach seeds, or from sport-buds upon peach trees, and are propagated and cultivated in the same way as peaches, but to only a small extent commercially.

Peaches are always propagated by means of seeds, which are usually stratified in sand during the autumn, and allowed to freeze during the winter in order to crack the shells and thus hasten germination. The seeds are planted in light soil six or eight inches asunder in rows  $2\frac{1}{2}$  or 3 feet apart. The young plants are cultivated like other inter-tilled crops until they are large enough to be budded with the desired varieties. This is usually in June in the South, and from early August to mid September in the North. In the South the trees may be ready for setting in the orchard during the autumn; in the North the buds do not grow until the following spring and the trees are not ready for planting until the succeeding autumn. In the operation of budding the buds are set as close

to the ground as the operator can place them, and when they start to grow the original top is removed so as to force all the food into the young sprout. When set in the orchard the young tree is buried at least as deeply as the point of union of stock and scion. Peach trees more than one year old from the bud are rarely planted because they are less satisfactory than yearling trees.

The peach will succeed upon almost any soil if not too wet; it thrives best, however, upon light, sandy, gravelly or shaly soils, where the fruits are superior in color and flavor to those produced on heavier soils, though these latter may yield more succulent fruits. Heavy lands have a further disadvantage since they generally induce late and rank growths, which are not only at the expense of productivity but are very prone to be winter-killed. The inferior color of fruits on such land can be partially corrected by distant planting, and by admitting light and sun to the trees by open pruning. More important than soil is situation. Since the blossom-buds open very early, the peach orchard should be situated on a northern slope, preferably on high ground where the coldness of the air will counteract the sun's warmth on thawing winter days and in early spring. The later they can be made to open, the better. For this purpose many growers spray their trees in early winter with whitewash so that the twigs will reflect rather than absorb the sun's rays. Nearness to large bodies of water is always desirable if the prevailing wind during winter and spring comes from that direction. The most successful peach areas in the North are on the eastern shore of Lake Michigan and the southern shores of Lakes Erie and Ontario.

In the orchard the trees are planted about 20 feet apart, though upon very light soils, and when given special care as to pruning and tilling they may be set even 12 feet apart. Usually in such cases, however, each alternate tree is removed when the branches commence to interfere with one another. The land is deeply plowed and harrowed either in early spring or autumn, and the trees set in rectangles or hexagons, the latter being preferred in California because a larger number of trees can be planted on a given area and the land can be kept cleaner, since it may be cultivated in three directions instead of two. In arid and semi-arid regions the orchards are irrigated. In regions where there is danger of late growth, they are sown with crimson clover, rye or some other cover crop, to check growth and thus ripen up the branches already formed. In the following spring this crop is plowed under. Care must be taken, however, to prevent the undue accumulation, by this practice, of nitrogenous plant-food in the soil, and for this reason also nitrogenous fertilizers must usually be withheld, since such tend to produce rank growth of tender wood. Potash and phosphoric acid fertilizers may be applied without stint. At planting time the trees must be severely cut back, only a small part of the main stem and one or two buds upon the best placed twigs being allowed to remain. In subsequent seasons the twigs must be severely pruned back, usually less than half of the wood produced being allowed to remain and often two thirds being removed. Pruning should occur in the spring just as the buds are swelling,



## PEACH

since at this time those that are living can be easily distinguished and the pruning done most judiciously. Summer pruning is rarely done, but thinning the fruit is a general practice. This operation is performed after the "June drop," when the imperfectly set fruits fall off. Many growers remove more than half the fruits set; others insist that the remaining fruits be from 5 to 10 inches apart. This practice results in a saving of plant-food and consequent annual productivity. It also increases the size and quality of the specimens. Even under the best of management the trees will seldom live much longer than 25 years, and in commercial orchards they rarely exceed 10 years of profitable service, having come into profitable bearing when three or four years old.

With perhaps no other fruit did methods of marketing change so radically during the closing half of the 19th century as with the peach. In the fifties the fruit was generally sent to market in large baskets or even piled loosely in wagons. In 1900, though half bushel baskets were still used to a small extent, small packages were the rule, a favorite package being a crate containing six veneer baskets each holding two or four quarts. Another popular package is the climax basket holding from five to ten pounds, provided with a handle, and covered with netting or a thin board. The fruit is gathered while still firm but when full grown and well colored. Enormous quantities of peaches are used as dessert and still larger amounts are canned or dried. In some sections peach brandy is also made upon a small commercial scale.

The peach is the victim of several insidious and inexplicable so-called diseases, as well as of several whose origin, life-history and control have been fairly well worked out. Probably the most widely dreaded of the first group is yellows. This malady attacks all varieties of peaches, of all ages, and on all kinds of soils. It appears on the tree, first as a tip growth late in autumn or before general growth in spring, the tips of twigs and especially of water-sprouts and suckers when present being most often attacked. The small, stiff, narrow leaves of these growths stand approximately at right angles to the short stem. The second symptom is slender, the appearance of wiry shoots with stiff leaves developed on the trunk and main branches. Often these form tufts. Finally, slender growths of new wood bearing small, narrow yellow or reddish leaves, appear often in great abundance in the centre of the tree. An infallible sign after the trees are in fruit is the red splotched fruit, the flesh of which is usually mottled red. Premature ripening of the fruit is common and decrease of size and increased fuzziness mark the second year's crop. Since no remedy has been discovered, and since the disease is considered contagious, the trees should be dug out and burned as soon as possible. New trees may be planted where the old ones have stood. The disease is purely American, and has been known for about a century. Trees rarely live more than five years after being attacked. It is more prevalent in northern than in southern orchards.

In the South, a similarly insidious malady called rosette takes the place of yellows as an orchard devastator, and demands similar treatment. The most characteristic symptom is the

appearance of dense rosettes of leaves on the twigs.

During the closing decade of the 19th century a new inexplicable disease called "little peach" appeared in the peach belt of Michigan and in western New York. The fruits continue small and hard, the trees decline in vigor and die in a few years. No remedy has been discovered, and since the affection is considered contagious, grubbing and burning are urged.

Of the controllable diseases the following are the more common and destructive if unchecked. Fruit-rot or twig-blight (*Monilia fructigena*) destroys the young twigs and foliage, especially in the centre of the tree. It is most commonly recognized by the rotting of the fruits, which may hang as "mummy" peaches for a year or more after they have destroyed the specimen. Since these mummies are sources of infection they should be gathered and burned. Further treatment consists in spraying the dormant trees in very early spring with a copper-sulphate solution (1 pound to 25 gallons of water). When the buds commence to swell, an application of Bordeaux mixture diluted to 75 gallons should be given and another when the buds open. Other sprayings should be given as the fruit approaches maturity, a clear fungicide being used. Thinning of the fruit and the admission of light and air by open pruning are helpful preventive measures. Leaf-curl (*Exoascus deformans*) seems to have a pronounced liking for some varieties, especially soft, dark-leaved ones. The leaves become wrinkled, yellowish or reddish, and contorted, but are at first only somewhat blistered. It appears in spring, particularly in moist weather and may defoliate the trees by midsummer, though slight attacks seem to do no marked injury. Spraying before the blossoms open, as recommended above, and once after they fall, has been found effective. If the weather is dry and clear the last mentioned application may be omitted. Black spot (*Cladosporium carpophilum*) appears as dusky dots upon the fruit, especially in damp atmosphere. Their confluence often checks the development of the part attacked and the fruit may crack open or be lop-sided. Spraying as for fruit rot has been found satisfactory. See FUNGICIDE.

Among the numerous insects which feed upon the peach the following are often troublesome: Peach twig borer, the larva of a European moth (*Anarsia lineatella*). It passes the winter as a larva, and in the spring burrows into the growing shoots, which fail to develop. It has become a scourge in the Pacific Coast orchards, but is little known in the Eastern States. The fruit-tree bark-beetle (*Scolytus rugulosus*), a general borer, often attacks the peach. Since it prefers ailing trees the girdling of unprofitable specimens is recommended, these trees serving as decoys for the females to lay their eggs in. The trees are to be cut and burned. The peach-tree aphid (*Myzus persicae*) and the black peach aphid (*Aphis persicae niger*) are often troublesome but may be controlled with kerosene emulsion. Several leaf chewing insects often cause damage; for instance, the peach-tree leaf-roller (*Pytholoma persicana*), and the New York weevil (*Ichthycerys novaboracensis*), all of which are more or less perfectly controlled by arsenites, lime being added





A TYPICAL PEACH BRANCH.







## PEACH ORCHARD—PEACH TREE CREEK

to prevent injury to the foliage. Several scale insects and bark-lice are often serious enemies.

The most troublesome insects, however, are the curculio (see PLUM) and the peach-tree borer (*Ægeria exitiosa*). This latter is the caterpillar of a clear-winged, day-flying, wasp-like moth, which lays its eggs usually near the ground on the trunks from midsummer until autumn. The larvæ bore beneath the bark to the cambium layer, feed on the young wood, pass the winter in the larval form in little shelters made of peach gum, castings, etc., and after eating actively for several weeks in the spring, pupate for about three weeks. The adults emerge in the north during midsummer, in the South in late spring. The trunks of peach-trees should be examined during October and April, and the larvæ grubbed out and destroyed. They are easily discovered by the castings and gum. Most frequently they are within six inches below or above the surface of the ground.

Consult: Bailey, 'Cyclopedia of American Horticulture' (1900-02); Wilcox, 'Peach Culture' (1886); Rutter, 'The Culture and Diseases of the Peach' (1880); Fulton, 'Peach Culture' (1899); Fitz, 'Southern Apple and Peach Culturist'; Black, 'Cultivation of the Peach and Pear on the Delaware and Chesapeake Peninsula'; 'The Peach' (Kansas State Horticultural Society, Topeka, 1889); Smith, 'Peach Growing for Market'; United States Department of Agriculture Farmers' Bulletin No. 33, and numerous bulletins of the State experiment stations, especially, No. 39 of Texas; 82 of West Virginia; 103 of Michigan; 62 of Florida; 72 of Maryland; and 54 of Delaware.

M. G. KAINS,  
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### **Peach Orchard, or Allen's Farm, Battle of.**

The battle of Gaines' Mill (q.v.) was fought on 27 June 1862, and that night Gen. McClellan put his army in motion for James River. Porter and the troops supporting him were withdrawn at midnight from the north bank of the Chickahominy, and the bridges were destroyed; the immense trains of the army were put on the road, and at 1 A.M. of the 28th Keyes' corps took up the march, followed by Porter. Slocum's division of Franklin's corps marched for Savage's Station, which it reached on the morning of the 29th. Heintzelman's and Sumner's corps and Smith's division of Franklin's remained in position on the 28th at and near Fair Oaks, confronting Huger's and Magruder's Confederate commands, and covering and screening the movement of the rest of the army. At daybreak of the 29th Heintzelman drew out of his works on the left and fell back to near Savage's Station. Smith on the right fell back to join Slocum. Sumner, abandoning his works at Fair Oaks, retired to Orchard Station on the York River Railroad, destroyed the vast amount of stores accumulated for the use of the army, and then marched to the Peach Orchard, or Allen's Farm, and formed line across the railroad, fronting Richmond, Richardson's division on the right and Sedgwick's on the left. Heintzelman's corps was on the left of Sedgwick. Lee did not divine McClellan's movement until the night of the 28th. He gave no orders for pursuit until the morning of the 29th, when Longstreet and A. P. Hill were directed to recross

the Chickahominy and move to the Long Bridge road to strike McClellan in flank, Jackson was ordered to move down the south side of the Chickahominy, and Magruder, who had discovered by sunrise that the works in his front had been abandoned, was ordered in pursuit by the Williamsburg road, and Huger by the Charles City road. Magruder advanced on both sides of and perpendicular to the York River Railroad, his own division in the centre, McLaw's division on his right, between the railroad and the Williamsburg road, and D. R. Jones' division on the left of the line. Jones, who was in advance, came up to Sumner at 9 o'clock and attacked his right and centre with artillery and infantry. Sumner got three batteries in position and silenced Jones' guns, but Jones kept up a persistent and determined fire upon an advanced position held by Col. John R. Brookes' 53d Pennsylvania, supported by the 71st Pennsylvania. At this point the action was very sharp, and continued until 11 o'clock, when Jones, finding that Jackson had not crossed the Chickahominy on his left, as expected, and that Magruder had not come up to his support, ceased the attack. Sumner waited until noon, and then continued his movement to Savage's Station (q.v.), where a concentration of his corps with those of Heintzelman and Franklin had been ordered. Consult: 'Official Records,' Vol. XI.; Webb, 'The Peninsula'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. II.

E. A. CARMAN.

### **Peach Tree Creek (Atlanta), Battle of.**

After the engagement at Smyrna Camp Ground (q.v.), 4 July 1864, Gen. Sherman secured three good crossings of the Chattahoochee River above Gen. J. E. Johnston's position, with good roads leading to Atlanta, whereupon Johnston, on the night of the 9th crossed to the east side of the river. On the 17th Sherman ordered a general advance on Atlanta, and by night the entire army formed a general line along the old Peach Tree road. On the night of the 17th Gen. Johnston was relieved from command of the army confronting Sherman, and was succeeded by Gen. J. B. Hood. His army numbered about 51,000 men, strongly posted about four miles in front of Atlanta, on the south bank of Peach Tree Creek, holding the line of that stream and the Chattahoochee for some distance below the mouth of the creek. On the 18th and 19th Sherman's army, with Gen. Thomas' Army of the Cumberland on the right as a pivot, swung to the right and, all advancing, closed in on Atlanta. Gen. Schofield's Army of the Ohio occupied Decatur and then moved toward Atlanta. The Army of the Tennessee, under Gen. J. B. McPherson, destroyed several miles of the Augusta Railroad east of Decatur, and then closed in on that place. Thomas, after some sharp skirmishing, put his heads of columns across Peach Tree Creek by several bridges, but there was a gap of two miles between him and Schofield, which he partially closed on the 20th by two divisions of the Fourth corps, Newton's division of the same corps being left on the Buckhead road, on the left of Hooker's Twentieth corps. When Hood, on the 19th, knew that Thomas was crossing Peach Tree Creek, he determined to crush him before he could intrench, and then turn on Schofield and



## PEACOCK — PEA FOWL

McPherson. Gen. Cheatham's corps was Hood's right, Hardee's his centre, and Stewart's his left. Cheatham was to hold his left on the creek to separate Thomas from Schofield and face Schofield and McPherson, while Hardee and Stewart, moving by division in echelon from the right, went against the flank and front of Thomas to drive him back to the creek and then down it toward the Chattahoochee into the narrow space formed by the river and the creek, into a sort of pocket. The order was given to advance at 4 P.M. of the 20th and sweep the field. Bate's division, on Hardee's right, passing by Newton's left, found no enemy in its immediate front, and failed in an effort to reach Newton's flank. Walker's division, in Hardee's centre, struck Newton's division, bent back both flanks and, after a severe struggle, was driven back with great loss. A part of Hooker's corps assisted Newton. Hardee was about to renew the attack on Newton, with Maney's and Cleburne's divisions, when Cleburne was withdrawn to go to the extreme right, and Hardee gave up further attack. On Hardee's left Stewart made a furious attack upon Hooker, whose troops had not fully taken position. Geary's division had crossed the creek more than a half mile above Howell's Mill, and was on high timbered ground, with its right thrown forward, and the 33d New Jersey was thrown to a bare hill some distance in advance. Williams' division was moving up to connect with Geary on the left and Palmer's division of the Fourteenth corps on the right. Ward's division was near Collier's Mill, on Geary's left and rear, near the banks of the creek to the rear and right of Newton's division, from which position its brigade commanders led their men against the flank of Walker's division, engaging Newton. Stewart, moving by division in echelon, first struck the 33d New Jersey, almost enveloping it, driving it back, and taking many prisoners, then fell upon Geary, Ward, and Williams, in quick succession, making a series of determined assaults, continuing until night, when he was finally repulsed and withdrew to the works from which he had advanced, with a loss of about 2,000 men. The Union troops engaged numbered about 20,000, the Confederates about 19,000. The Union loss, killed and wounded, was about 1,600, of which nearly 1,500 fell upon Hooker's corps; the Confederate loss, killed and wounded, was about 2,500. Consult: 'Official Records,' Vol. XXXVIII.; Cox, 'Atlanta'; Van Horne, 'History of the Army of the Cumberland,' Vol. II.; Sherman, 'Personal Memoirs,' Vol. II.; Johnston, 'Narrative of Military Operations'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

E. A. CARMAN.

**Pea'cock, Thomas Love**, English novelist: b. Weymouth, Dorset, 18 Oct. 1785; d. Halliford 23 Jan. 1866. He was at first in mercantile life in London, in 1808-9, was secretary to Sir H. R. Popham, in 1819 was appointed to the East India House, and in 1836-56 was chief examiner to the company. He wrote some ambitious but artificial poems, such as 'Rhododaphne, or the Thessalian Spell' (1818); but found his true field in the satirical novel—'Headlong Hall' (1816), 'Melincourt' (1817), 'Nightmare Abbey' (1818), 'Crotchet Castle' (1831), and 'Gryll Grange' (Fraser, 1860).

These maintain real humor, and the later ones, if they lack for invention, are nevertheless interesting from the frank expression of prejudice with which they abound. The lyrics interspersed through these volumes are Peacock's best verse. His works were edited by Garnett in 1891.

**Peacock.** See PEA FOWL.

**Peacock-butterfly**, a butterfly (*Vanessa io*), so called from the "eyes" on their wings, which resemble those on peacocks' feathers. The forewings are of a reddish-brown color, with black, white, and yellow markings and an outer margin of a browner hue. The hind-wings are somewhat similar in general color, but more brown than red. The caterpillar is black with some white markings and red hinder legs; it is to be seen on the nettle about the beginning of July.

**Peacock-fish**, a European wrasse (*Ctenilabrus pavo*), named from its gaudy colors.

**Peacock-flower.** See POINCIANA.

**Peacock-pheasant**, a pheasant of the gorgeously ocellated genus *Polyplectron*, species of which inhabit the forests of the foothills of the Himalayas. The males have two spurs on each heel.

**Peafowl**, birds of the genus *Pavo*; the type of the sub-family *Pavoninae* of the pheasant family (*Phasianidae*). The genus comprises but two species, both of the Indo-China region and neighboring islands of southern Asia, one of which has been extensively domesticated as an ornamental bird in Europe and America. The common peafowl (*Pavo cristatus*) is sufficiently familiar to require no description beyond the rectification of a very common error. The splendid plumes which are the chief glory of the peacock are not the tail quills, but the tail coverts. When these are erected and spread the true tail quills are exposed at their base, and are quite plain and ordinary.

The wooded hill-country of India and Ceylon is the native home of the peafowl and here they are common in a wild state. When courting, the male struts like a turkey-cock, and usually secures three or four hens. They commonly live in small flocks. The wild pea-hen lays from six to eight eggs, and produces only a single brood in each year. The nest is of rude construction, and is placed on the ground, or rarely on low branches or in ruined buildings. The period of incubation extends over 25 or 30 days. The young birds of both sexes are feathered alike for the first two years; and in the third year the tail coverts of the male begin to be developed.

In Bengal, Java, Sumatra, etc., shooting the wild peafowl forms a favorite amusement, and large flocks of these birds are occasionally met with by sportsmen. In India peacocks are held sacred to certain castes and various superstitions are connected with them; in Greek mythology it was the favorite bird of Juno. The peacock was domesticated at a very remote period and some uncertainty exists concerning the exact time of its introduction into Europe. From India it was probably brought to Persia and Media. Aristophanes speaks of "Persian Peacocks." Suidas terms it the "Median Bird." The fleets of Solomon brought these birds to Judea. Alexander the Great brought them to Europe; and they were first seen in Rome about



## PEAK — PEANUT

the end of the republic, and speedily became objects of interest to the sybaritic tastes of the day. Pliny says that the orator Hortensius was the first who made a table delicacy of these birds, this worthy presenting them at a feast given to the College of Augurs. Vitellius and Heliogabalus introduced at their feasts dishes composed of the brains and tongues only of peacocks. In the Middle Ages in Europe peacocks were still deemed meet dishes for the tables of the great, although in modern times the flesh is accounted coarse and tough. In ancient Greece, in the time of Pericles, those birds brought high prices. From India they were also brought to Asia Minor, and thence into the Isle of Samos, where they were bred and consecrated to Juno, who was alleged in mythological legends to have adorned their tails with the eyes of her favorite Argus. From Europe they were in turn introduced into Africa and America.

In domestication the food consists of grain of various kinds, but at times may be quite varied. The young in temperate climates usually require some attention in rearing. They also lay more numerous eggs than in the wild state. The cry of these birds is popularly said to be repeated before the fall of rain. The peafowls are said occasionally to live to a great age; but from twenty to thirty years appears to be the average limit of their existence. The black-shouldered or jappanned peacock is generally regarded as a variety of the common species, but, as it breeds true, it has been described as a separate species. A somewhat similar form, however, sometimes appears as a sport from the common species. The Javan peafowl is certainly a distinct species (*P. muticus*) found in Indo-China and Java. It has a neck of golden-green and a crest of a different form from the common species.

Consult: Elliot, 'Monograph of the Phasianidæ' (London, 1872); Blanford, 'Fauna of British India Birds' (London, 1898).

**Peak**, or **High Peak**, England, a district forming the northwest angle of Derbyshire, consisting of a wild and romantic tract, full of hills, valleys, and moors, the hills mostly bare or covered with a thin mossy verdure; the valleys often richly wooded, and very picturesque. The district is celebrated for its limestone caverns and grottoes containing many remarkable natural curiosities; chief of these are the extensive Peak Cavern or Devil's Cave, Elden Hole, both near Castleton, and the Bagshaw Grottoes. Other objects of interest are the Mam Tor, or Shivering Mountain, with traces of a Roman encampment on the top; the ancient lead mines of Odin, at the foot of Mam Tor; and the Peak Castle, founded by William Peveril, natural son of the Conqueror, and the hero of Sir Walter Scott's novel, 'Peveril of the Peak.'

**Peake, Elmore Elliott**, American novelist: b. Decatur, Ohio, 25 March 1871. He has published: 'The Darlings' (1900); 'The Pride of Tellfair' (1903); 'The House of Hawley' (1904).

**Peale, pēl, Charles Willson**, American artist: b. Chestertown, Md., 16 April 1741; d. Philadelphia, Pa., 22 Feb. 1827. He turned from saddlery to portrait painting, received some instruction from J. S. Copley at Boston, and in 1770 became a pupil of Benjamin West in London. In addition to portraiture, he studied mez-

zotinto engraving, modeling in wax, and casting and molding in plaster. In 1774 he opened a studio at Annapolis, Md., and in 1776 at Philadelphia. He was elected to the Pennsylvania legislature in 1779. In 1802 he opened at Philadelphia Peale's Museum, including collections of portraits and objects of natural history. Peale was not only a collector of natural curiosities and a lecturer on natural history, but turned his hand to a half dozen or more means of livelihood. It is said that he himself sawed the ivory on which his miniatures were painted, molded the glass that covered them, and made the shagreen cases that enclosed them. His considerable fame in the United States is due less to genius than to two fortunate circumstances; one, that for many years he was the only portrait painter of worth in the colonies, and widely in demand,—the other that he associated his art with the name of Washington, who granted him 14 sittings, and whom he portrayed in all guises, from colonel of Virginia militia onward. Among his other subjects were: Robert Morris, Hancock, Gates, Baron de Steuben, Comte de Rochambeau, Franklin, Nathanael Greene, Jefferson, Hamilton, Monroe, Jackson, J. Q. Adams, Calhoun, and Clay. Consult: Dunlap, 'History of the Arts of Design in the United States' (1834).

**Peale, Patrick**, a pseudonym of Gustav Anton von Seckendorff (q.v.), a German poet and novelist.

**Peale, Rembrandt**, American artist: b. Bucks County, Pa., 22 Feb. 1778; d. Philadelphia 3 Oct. 1860. He was second son of C. W. Peale (q.v.). In 1796 he established a studio at Charleston, S. C., where he remained until 1801. He then became one of West's pupils in London, and for some time thereafter was occupied at Paris in painting portraits of celebrities for Peale's Museum at Philadelphia. In 1810 he began painting in Philadelphia. Two of his great exhibition pictures, 'The Roman Daughter' and 'The Court of Death,' attracted much attention. The latter was a canvas 24 x 13 feet, and contained 23 figures. The most of his time, however, was devoted to portraiture. He several times painted Washington, the portrait of 1823 being justly famous. The original was purchased by Congress for \$2,000 in 1832, and many copies were ordered from the artist. This work, whose authenticity is sufficiently indicated by the fact that Chief Justice Marshall called it "more Washington himself than any portrait I have ever seen," is a truly impressive delineation, and has remained as favorite among the general public. Among Peale's writings were: 'An Account of the Skeleton of the Mammoth' (1802); 'Notes on Italy' (1831); 'Graphics' (1841); 'Reminiscences of Art and Artists' (1845).

**Peanut**, a spreading, hairy, annual herb (*Arachis hypogæa*) of the order *Leguminosæ*. It grows about 18 inches tall, bears light green leaves, and whitish flowers, after the fading of which the stems bury themselves in the ground, where the one to three-seeded yellowish pods mature. The plant is considered to be a native of Brazil, whence it was introduced into Europe shortly after the discovery of South America, and whence it has been carried by man to nearly all warm climates throughout the world. Since



## PEANUT INDUSTRY — PEAR

the Civil War it has been an important agricultural crop in the South, especially from Virginia to Georgia, and in Tennessee, where the plant is known locally as "goober-pindar," "ground-pea," etc. The crop averages about 4,000,000 bushels annually, three quarters of which is recleaned for roasting and sale as a luxury, either alone or in confectionery, etc. This use is distinctly American; in the Old World the "nuts" are used mainly for making oil and for stock-feeding. Peanut butter, soups, cakes, etc., are manufactured, but have not become widely popular. From 25 to 50 per cent of oil may be expressed from the shelled nuts, and this, if carefully prepared, is useful for cooking and in the arts. The "hay" is fed to stock, as also is the cake left after the oil is expressed. Pigs are often profitably turned upon the fields after the harvesting of the crop, and still more profitably upon unharvested fields. The cost of digging is thus saved, and the peanuts make a good quality of pork, which, however, is somewhat soft and should be hardened by feeding corn to the animals.

Peanuts thrive best upon very light, sandy loam, well supplied with lime. They are also favored by an early warm spring and a hot, humid summer. The soil should be deeply plowed and finely harrowed, and the unshelled seeds at the rate of about two bushels to the acre, planted about an inch deep, at intervals of a foot in rows about 30 inches apart, as soon as the weather has become settled in the spring. Until the plants shade the ground the surface must be kept loose and open and free from weeds, especially turf-forming grasses, and similar weeds. Before danger of frost the plants are harvested with special implements, dried in loose shocks for two or three weeks, the pods removed and sent to "recleaning" establishments, where they are finished for market. Under ordinarily good management 50 bushels of "nuts" and two tons of straw should be obtained from an acre. In Europe the peanut is perhaps best known as ground nut and earth nut.

**Peanut Industry, The.** The people of the United States consume upward of \$10,000,000 worth of peanuts annually, while during each year the country produces 4,000,000 bushels of peanuts, or 88,000,000 pounds. This is not a very large fraction of the total world's supply, which amounts to about 600,000,000 pounds. The exportation from Africa and India to Europe during 1900 amounted to nearly 400,000,000 pounds. Of this vast quantity 222,000,000 pounds were delivered at the port of Marseilles, France, the bulk of it being pressed for oil. The peanut is employed mainly as an adulterant of or as a substitute for olive oil, and it is so excellent in quality that most people cannot detect the difference. Nearly all the olive oil that comes to the United States is at least mixed with part of the peanut. Peanuts furnish from 30 to 50 per cent of the weight of their kernels in oil. The latter is somewhat more limpid than olive oil. It serves excellently for lighting, though it does not give so clear an illumination as some other seed oils. Furthermore, it is utilized to advantage in the making of soaps and as a lubricant in machine shops.

During the years between 1861 and 1865 peanut oil was manufactured by at least four mills

in the Southern States, and used as a lubricant by railroads for locomotives, by wool and cotton spinners for their spindles, and by housewives instead of lard as shortening in bread and pastry. Though the American peanut is finer, larger and better flavored than any other, it does not contain so much oil as the African nut, and the oil is not of so fine a quality. The oil of the peanut is utilized medicinally to some extent, and fullers of cloth get another employment for it in their business. The "cake" which is left after the oil has been expressed makes an excellent feed for cattle, and is used as such to a great extent, particularly in Germany, where its market value is from \$30 to \$33 per ton.

It is said that peanuts were introduced to the United States by the negroes imported from African slavery. Between 1865 and 1870 the cultivation in this country spread with great rapidity, owing largely to the knowledge of plants gained by individual members of the various armies which at one time or another occupied the eastern section of Virginia. Each year doubled and at times increased threefold its crop over that of the preceding year, so that this country, from being a large importer of West African nuts, was soon able to supply the domestic demand with the home-raised article. Wasteful methods of cultivation and the consequent impoverishment of the land have diminished the yield of the peanut producing territory in Virginia, North Carolina, and Tennessee very seriously, so that now instead of an average yield of 50 bushels per acre, with frequent yields of over 100 bushels, the average in the peanut section is not over 20 bushels.

Norfolk, Va., is regarded as the centre of the peanut trade, and Virginia produces a larger quantity than any other State. In 1900 over 120,000 acres were planted to this crop, and 3,713,347 bushels, valued at \$2,261,148, were credited to Virginia. Peanuts were grown by 11,572 farmers, or 6.9 per cent of the total number in the State. Increases of 98.3 per cent in acreage and 216.9 per cent in production are shown for the decade between 1890 and 1900. The leading peanut counties are Southampton, Nansemond, Isle of Wight, Sussex, and Prince George, ranking in the order named, and reporting, in the aggregate, 76.3 per cent of the total acreage.

The Southern farmers do not prepare their peanuts for market. The crop is delivered to "factories," where the nuts undergo a process of cleaning and sorting. The peanuts are hoisted to the top of the factory building, where they are poured into hoppers, passing downward through chutes and being separated roughly into four grades by the mere action of gravity. The best ones are necessarily the heaviest, being the largest, having the biggest kernels, and being most free from "pops." The first, second, and third grades are sold to venders of roasted peanuts, either directly or through jobbing houses. The fourth grade goes into the hands of confectioners, to be used in the making of "burnt almonds" of a cheap sort, peanut candy, and common chocolates. Peanuts of the lowest grades are shipped mostly to New York city.

**Pear**, a tree (*Pyrus communis*) of the natural order *Rosaceæ*. It is probably a native of western Asia and adjacent Europe, whence it has



## PEAR

been introduced by man into all temperate climates of the civilized world. The chief producing countries are France and the United States, and in the latter the principal regions are New England, New York, Michigan, and the Pacific Coast States, particularly California. Among the fruits of the United States the pear ranks fourth in commercial importance. It is distinctly a cool climate tree, but except certain inferior Russian varieties, does not thrive on the cold western plains. Some of its hybrids with the Chinese sand pear (*P. sinensis*) do well in the South, but their inferior quality is against them. The Kieffer, Leconte, Garber, and Smith varieties are most often planted; the first not only in the South, but very generally throughout the Eastern States. This is a chance hybrid between the original species, which was grown for ornament by Kieffer, a Philadelphia nurseryman, and was introduced as an acquisition. It is famous for poor quality, but is extensively used as a substitute for the Bartlett, especially in canning. The Bartlett, a European variety known as Bonchretien, is the most widely cultivated pear in the United States, being popular in all the pear-growing regions. The most noted variety in point of quality is the Seckel, an American sort, which though of small size is considered the acme of the thousands of varieties cultivated throughout the world.

The pear is generally propagated by means of root-grafting, the scions for which are imported from France. These form what are called standard trees, which are usually planted 20 to 25 feet asunder in the orchard. Dwarf trees are produced by grafting the pear upon quince stocks, which are also imported from France. They should not be planted closer than 12 feet, and a rod asunder is even better. The usual methods of planting are in rectangles, in "quincunx" form, and in hexagons. The first two are popular in the East, the last on the Pacific coast. The last is generally best because, where distances are adequate, the ground can be more economically employed and cultivation may be given in three directions.

The pear will grow upon almost any soil, but thrives best on well drained heavy loams, except the Chinese hybrids which do best upon lighter soils. Air drainage is as important as water-drainage; therefore, the orchard should be on high ground. The field should be deeply plowed and thoroughly harrowed before the trees are set, and throughout the season the land should be kept loose, open, and free from weeds by frequent cultivation. About mid-summer a cover-crop should be planted to conserve the plant-food that might be wasted by leaching during the winter, and also to check the growth of wood and assist in the maturing of that already produced. If leguminous crops are employed for this purpose, they should obviate the necessity of fertilizing heavily, if at all, with nitrogenous fertilizers, such as stable manure and nitrate of soda. (See LEGUME; CLOVER; etc.) Applications of phosphoric acid and potash may be given liberally.

After the trees are set the tops should be pretty severely pruned, only two or three buds being left upon from three to five well placed twigs, preferably near the ground. The ideal form for training the pear resembles that of a vase, because when attacked by pear-blight or

fire-blight (see below) the tree can then often be saved, whereas if trained with only one trunk it usually can not. Each main limb should be made to divide and re-divide, thus forming a spreading tree with a somewhat hollow centre. Though the work during the first five years of the orchard's life may seem excessive, its value will be appreciated in after years. Dwarf pears should also be trained in this form; but since they must be kept dwarfed (below 12 feet) and since they have a tendency to develop into standards, especially if the scion takes root above the quince stock, they must be severely cut back late each winter. Many growers advocate removing fully two thirds of the annual growth of the previous season. Care must be taken in pruning all pear-trees to save the gnarly twigs, which are generally of irregular thickness and direction. These are the fruit-bearing spurs. They do not appear upon young trees.

The pear is more noted for self-sterility than most other perfect flowered fruits; the pollen of certain varieties is impotent upon the pistils of the same variety. Failure to set fruit may also result from a variety of causes, such as cold or rainy weather at blossoming time, difference in time of opening of the flowers of adjacent varieties, impotent pollen or pistils due to over-feeding of the orchard, etc. To obviate self-sterility, two or more varieties should be chosen which blossom simultaneously, and these should be planted in adjacent rows, not more than three rows of a kind together — preferably two.

Pears should be gathered when they will readily separate from the twigs without breaking the fruit-stalks. If allowed to hang upon the tree until fully ripe they usually lose flavor and become more gritty. When gathered they are usually hard and imperfectly colored, but if stored in a cool room and still air, preferably in boxes or drawers, they will acquire both good color and flavor, besides obviating grittiness and decay at the core to a great extent. Freely circulating air, especially if warm, tends to shrivel the fruit, make it decay and impair the flavor. Winter pears may be left upon the trees until danger of frost is feared; then they should be carefully gathered and stored in cold well ventilated cellars, being removed for ripening to warmer quarters as needed.

Several of the diseases which attack the pear have been treated under the title APPLE. The two most dreaded maladies are pear-blight and leaf-spot. The former is attributed to a species of bacterium which may gain entrance to the tissues at any "naked" point such as a wound, tips of growing twigs, or, especially, through the nectaries and pistils of the flowers, to which it is conveyed by insects. The disease manifests itself by the blackening of the foliage which hangs on the tree. As the organism works its way down the limbs toward the trunk, it discolors the young tissues upon which it subsists just beneath the bark. In early spring there may be a somewhat saccharine exudation from affected parts of the trunk and limbs. Insects carry infection from these places. Hence the advisability of examining the trees and removing diseased parts in late winter. Whenever the operation is performed the affected branch should be removed several inches below the point of discoloration. Many orchardists recommend sterilizing the tools after each operation, using



## PEAR — PEARL

a solution of bichloride of mercury. The disease is believed to be more prevalent upon light, rich and low soils upon which the growth is usually sappy. Some varieties, such as Duchesse d'Angoulême and Kieffer, are considered fairly immune.

Pear-leaf blight (*Entomosporium maculatum*) is distinct from the previous disorder, being of fungus origin. It appears upon the twigs as black spots; upon the leaves as more or less coalescent reddish brown spots; upon the fruit as upon the leaf, the underlying tissues being hard and cork-like, badly attacked specimens often becoming lopsided and cracked. The trees are frequently defoliated from the falling of the leaves. Bordeaux mixture is considered a specific; many varieties formerly failures now being grown successfully where sprayed. Applications should be given at intervals of two weeks from the time the buds commence to swell until early summer, or, in wet seasons, later and more frequently.

Among the numerous other insects that feed upon the pear the following are probably best known and most easily controlled: Fall web-worm, Cecropia moth, eye-spotted bud-moth, white marked tussock-moth, red humped apple-tree caterpillar, codlin-moth, all of which may be combated by spraying with arsenites. The San Jose scale and the oyster-shell bark-louse, like several of the above, attack pear and apple (q.v.) indiscriminately. (See INSECTICIDE.) Several borers are often troublesome, for instance, the sinuate pear-borer (*Agrilus sinuatus*), a European species which tunnels irregularly in the trunk; and the borers mentioned under APPLE. Digging the insects out is the most satisfactory remedy. The larvæ of the pear-blight beetle (*Xyleborus pyri*) burrow in and cause the twigs to wilt. When discovered the withered twigs should be gathered and burned. The pear-slug (*Eriocompoides limacina*) is the larva of a saw-fly probably introduced from Europe. The slugs, which feed upon the leaves, are covered with a slimy secretion to which powdered lime will adhere; hence its use, and also that of road dust, as a remedy. Arsenites, hellebore, kerosene emulsion, etc., are also used effectively. Indeed, forcible spraying with water or a heavy rain is often curative. Unless checked this blight frequently skeletonizes the leaves of even large trees.

Probably the most troublesome pear-pest is the pear-tree psylla (*Psylla pyricola*), a flea-louse which seems to be confined to this tree. It is most abundant from Michigan to Virginia and northward, into which region it was probably introduced from Europe about 1832. The orange-colored eggs are laid upon the leaves upon which the red-eyed yellow larvæ feed by sucking the juices. Four or more generations appear before frost, at the approach of which the adults hide for hibernation in crevices of the bark. Among the remedies recommended, scraping the trunks, spraying in winter with crude kerosene, and with kerosene emulsion when the buds expand, with a second application just before blossoming, are probably the most favored. The psylla has numerous natural enemies; especially the larvæ of lady-bird beetles and of lace-wing flies.

Consult: Field, 'Pear Culture' (1858); Quinn, 'Pear Culture for Profit' (1869, 1883);

Bailey, 'Cyclopedia of American Horticulture' (1900-2); Jordan, 'Pear Growing in New Jersey,' N. J. Experiment Station Bulletin No. 142; Saunders, 'Insects Injurious to Fruits' (1889); Smith, 'Economic Entomology' (1896).

M. G. KAINS,  
*Crop Expert.*

**Pear, Balsam**, an annual, climbing herb (*Momordica charantia*) of the order *Cucurbitaceæ*. It is a native of southern Asia and tropical Africa, and has become naturalized in the West Indies. The plants attain heights of about 10 feet, climbing by means of tendrils; bear dull green, roundish leaves, yellow flowers, and oblong, yellowish, pointed fruits, for which, as well as for ornamental purposes, the plants are cultivated. They can be grown wherever the cucumber will succeed, and with about the same treatment. The fruits are usually gathered before maturity for boiling. Under the name *la-kwa* the plants are grown by Chinese gardeners near large cities.

**Pearce, pērs, Charles Sprague**, American artist: b. Boston 13 Oct. 1851. He was a pupil of Bonnat at Paris, and in 1885 established his residence at Auvers-sur-Oise, near Paris. His first exhibited picture was shown at the Paris salon in 1876, and since then his works have appeared in most of the international exhibitions of America and Europe. He was a member of the jury of selection for the World's Columbian Exposition in 1893. Among his works are: 'Decapitation of St. John Baptist' (1881); 'Prelude' (1883); 'Toilers of the Sea' (1884); 'Return of the Flock'; 'Meditation'; several portraits; and decorations for the north hall of the Congressional Library (1896).

**Peard, Frances Mary**, English novelist: b. Exminster, Devonshire, 1835. She is the author of numerous novels and historical romances which have attained popularity both in Great Britain and United States. Among them are: 'Unawares' (1870); 'Schloss and Town' (1882); 'Prentice Hugh' (1887); 'The Blue Dragon'; 'To Horse and Away' (1888); etc.

**Pearl**, the substance forming the inner layers of the shells of nacreous mollusks, as pearl-oysters, abalones, and others. In the mass, it constitutes "mother-of-pearl"; when in the form of a detached lustrous concretion it is called "a pearl," and regarded as a gem. In order to make clear the nature of a pearl it is necessary to explain briefly the mode of formation of the molluscan shell. The shell ordinarily consists of two distinct portions of different composition. The superficial epidermis, outer layers, and margin of the shell are largely horny; while the inner part is composed of numerous layers of a chrystalline carbonate of lime with relatively little animal matter. Both are secretions of the outer surface of the "mantle" (see MOLLUSCA), which lines the shell, and by the free outer margin of which the shell grows in concentric additions to its margins.

The remainder or attached portion of the mantle is continually secreting calcium carbonate, which is added layer by layer to the inner surface of the shell, which thus increases in thickness. The iridescence is due to the fine irregular striations upon the surface. Now, if any foreign body like a grain of sand, an unde-



## PEARL

veloped egg, a parasite, or an image artificially placed there, find lodgment between the mantle and the shell it seems clear that the shelly deposit must envelop it. It is probable also that it will act as an irritant and stimulate secretion at that point, and that it may be rolled about by slight contractions of the mantle, thus remaining free from adhesions to the shell and gaining symmetry. Such detached portions of the shell, developed as concretions about foreign particles serving as nuclei, are found in many mollusks. Their character naturally partakes of the character of the shell in which they are formed; if that be opaque and dull so also will the pearls; if it have the iridescence and translucency of mother-of-pearl, they will possess these same elements of beauty. It is vain, therefore, to expect to find pearls of value in common edible oysters, as people often do. Comparatively few mollusks have a well developed nacreous lining to the shells, and only a few of these are adapted to the production of pearls of the texture and lustre which is most prized. They belong chiefly to the *Aviculidæ*, or pearl-oyster family, and to the *Unionidæ*, or family of the fresh-water mussels (q.v.).

The *Aviculidæ* differ from the edible oysters in having a small foot and anterior adductor muscle, a well developed byssus gland, which secretes a bunch of fibres, by which the animal is attached, and a thick mother-of-pearl layer to the shell. The true pearl oyster (*Meleagrina margaritifera*) has a very wide distribution, being found in nearly all parts of the Indian Ocean, the Red Sea, the warmer parts of the South Pacific, the Gulf of California, Caribbean Sea, etc. There is, however, a very great difference in the color, size, thickness, and texture of the shells, and the quality of the pearls produced in the different localities. Pearls have been gathered commercially in many parts of the world, but most of the fisheries have had periods of prosperity and decline, the latter usually resulting from wasteful overfishing. The oldest fisheries are those of Ceylon on banks covering an extensive area off the north coast. These have been fished at intervals from the beginning of the Christian era, and since the British occupation have been under the control of the government, which derives rich revenues therefrom. This fishery is conducted by means of small boats, each with a crew of 10 divers divided into two gangs, an equal number of helpers, and two or three sailors. The diver is lowered to the bottom by a rope weighted with a heavy stone and carrying a basket. Arrived at the bottom, in from 30 to 50 feet of water, he works as rapidly as possible for from 30 to 90 seconds, gathering the oysters and placing them in the basket, when he is raised to the surface to rest. The oysters are carried ashore at the close of the day and placed in bins on the ground to decompose, when they are thoroughly washed and picked over for the pearls. So extensively has this fishery been prosecuted that the shores for miles are said to be covered with oyster shells to an average depth of four feet. The government inspection is very rigid and the time of beginning and ending the day's fishing, as well as the duration of the season, is determined by officials.

In America the most important fishing ground is in the Gulf of California, centring about La Paz, but extending to the mouth of the

Colorado River. These fisheries were operated by the Indians at the time of the conquest by Cortes, who exploited them for the benefit of the Spanish throne. The fishing season lasts for about six months, from June to December. Formerly expert Indian and Mexican divers were employed. Several of these went together in one canoe, acting alternately as diver and helper. The water is so clear that oysters could be seen on the bottom in 50 or 60 feet. The diver, carried down by a large stone, would remain for about a minute and a half, and bring the oysters to the surface in his hands after cutting them loose with a knife carried for that purpose. In order to have the greatest possible lung expansion the divers always worked with empty stomachs, eating nothing until after the conclusion of the day's fishing. If abundant a basket would be lowered and filled. Working in this manner each diver would secure from 125 to 150 oysters daily and the total product for the season of 450 divers would be about 2,000 tons of oysters, yielding pearls and shell valued at about \$400,000. At the present time the chief concessions are controlled by San Francisco firms, and the fishing is conducted by more modern methods. Suitable boats are each provided with apparatus for submarine diving, and a crew of six men consisting of one diver, one rope-tender to raise and lower the diver and baskets for the oysters, and four pump-men who work the air-pump. Each diving-crew secures about 300 oysters per day, which are collected by a schooner and carried ashore, where they are opened with knives and the pearls removed. Other American fisheries exist on the coasts of Guatemala and Panama and the Island of Margarita. The Red Sea, many of the South Sea islands, and the north coast of Australia also support valuable fisheries. The latter is one of the most recently developed and has grown rapidly in importance. It is conducted by means of diving suits and is very productive, especially of mother-of-pearl, for the shells become here larger and thicker than elsewhere in the world.

Fresh-water mussels (*Unionidæ*) are found in many streams and lakes of Asia, Europe, and America. In the United States these mollusks are exceedingly numerous in the Mississippi Valley, both in species and individuals, and are chiefly utilized in the States of Iowa, Wisconsin, Arkansas, Tennessee, and Kentucky, but spasmodic periods of excited pearl-hunting in other States have occurred several times, and have been productive. Although an important fresh-water pearl-button industry has grown up in the past few years, the gathering of pearls from fresh-water mussels has never been taken up seriously and consistently, but has been prosecuted chiefly by farmers and others in their spare hours. The methods have naturally been very wasteful. The mussels are secured by rakes, tongs, drags, or simply by the hands; even a steam dredge is operated in connection with the Iowa button-factories. Generally mussels of all sizes were killed, examined for pearls and thrown away until the beds became exhausted. In Europe the supply is better conserved by carefully opening the mussels for examination, by means of specially devised tools which do them no injury, and then replacing them in the water. Fresh-water pearls are especially valued because of the great variety and beauty of their



## PEARL ASH—PEARSON

colors and are, like the marine pearls, most likely to be found in shells which are distorted or otherwise imperfect in form and growth.

For further information concerning marine pearl-fisheries consult: Simmonds, 'Commercial Products of the Sea' (New York, 1879); Thurston, 'Notes on the Pearl and Chank Fisheries' (Madras, 1890); Kunz, 'Gems and Precious Stones of America' (New York, 1890); Herdman, 'Report on the Ceylon Pearl Fisheries in 1903' (Indian Office, 1903); and for freshwater pearls, various papers by Kunz, Smith, Simpson, and others in 'Bulletins' of the United States Fish Commission, especially since 1897.

**Pearl Ash**, crude carbonate of potassium, as obtained by the lixiviation of wood ashes, and the subsequent evaporation of the solution. The immediate product thus obtained is very impure, and is chiefly used in the manufacture of soap. It is also known as "potashes." See POTASSIUM.

**Pearl Barley**, a preparation of barley-grain. See BARLEY.

**Pearl Harbor**, an inlet on the southern coast of the Island of Oahu, Hawaii. It is landlocked and has a depth of from 50 to 60 feet, but there is a bar at the entrance with only 10 feet of water, thus making the harbor useless for large vessels. In 1884 the United States obtained from the Hawaiian king the exclusive right to establish a coaling and repair station at this harbor. Surveys were made in 1887 and 1897, and the removal of the obstructing bar and the entrance proposed; but the improvements were never made, owing to the United States taking possession of the islands in 1898 and the acquisition of the harbor of Honolulu.

**Pearl Millet**. See GRASSES OF UNITED STATES.

**Pearl Oysters**. See PEARLS.

**Pearl River**, a river of the State of Mississippi, formed by the junction of several streams in Neshoba County, flows southwest and then south, and empties into the Gulf of Mexico; length about 300 miles. In the latter part of its course it forms the boundary between Louisiana and Mississippi. The navigation is obstructed by sand-bars and snags, but it is navigable for flatboats as far as Jackson.

**Pearl Wedding**. See WEDDING ANNIVERSARIES.

**Pearl of the Antilles**, a name given to the Island of Cuba on account of its fertility and beauty.

**Pearl of Orr's Island, The**, a novel by Harriet Beecher Stowe, published in 1862. This story gives a truthful and entertaining picture of the people in a Maine fishing hamlet. The descriptions of the picturesque scenery of the island are graphic and accurate; and the Pennel house, now known as the "Pearl House," and the "grotto," are still objects of interest to visitors.

**Pearly Nautilus**. See NAUTILUS.

**Pearse**, pērs, **Mark Guy**, English Wesleyan clergyman: b. Camborne, Cornwall, England, 1842. He was educated at Wesley College in Sheffield, studied medicine at St. Bartholomew's Hospital, London, and in 1863 entered the Wesleyan ministry. He held pastorates in Leeds, Ipswich, Bristol, and other places, and

in 1889 became missionary at St. James Hall in connection with the West London mission, which position he filled for 14 years. He has devoted much time to literature of a religious character and has published: 'Daniel Quorm and His Religious Notions' (2 series); 'The Christianity of Jesus Christ—Is it Ours?'; 'The Gentleness of Jesus' (1898); 'West Country Songs' (1902); etc.

**Pearson**, pēr'son, **Charles Henry**, English historian: b. Islington 7 Sept. 1830; d. London 29 May 1894. He was educated at King's College, London, and Exeter College, Oxford, was elected fellow of Oriel, in 1855 was made lecturer in English literature at King's, and shortly thereafter professor of modern history. In 1862-3 he edited the 'National Review,' in 1865 withdrew from his chair at King's, and in 1869-71 was lecturer on modern history at Trinity College, Cambridge. After an experience (1871-4) as a sheep-farmer in South Australia, he was appointed by the minister of education to prepare a report on the condition of education in Victoria (1877), and presented a document of much value, recommending many changes since introduced. In 1878 and 1880 he was elected to the legislative assembly for Castlemaine, and in 1883-92 sat for the East Bourke boroughs. From 1886 to 1890 he was minister of education, in which capacity he worked effectively toward reorganization and reform, and in 1893 was made permanent secretary to the agent general. His chief publication is 'National Life and Character' (1893; 2d ed. 1894), a work prophesying the decay of European civilization through the disappearance of independent character and genius, due to the increase of democracy in the highly civilized nations of the West; and the growing importance of Chinese and negroes in world-politics and trade. Others of his works are: 'The History of England during the Early and Middle Ages' (1867); 'Historic Maps of England during the First Thirteen Centuries' (1870); and 'English History in the 14th Century' (1873). Consult the biography by Stebbing (1900).

**Pearson**, **Charles William**, American Unitarian clergyman: b. Selby, Yorkshire, England, 7 Aug. 1846; d. Quincy, Ill., 13 July 1905. He was employed by a firm of ship-owners in whose service he went to Calcutta and South America, teaching for a time in a mission school in Buenos Ayres. He came to the United States and in 1866 entered the Northwestern University, Watertown, Wis., where he was graduated in 1871. He was tutor in German and history there in 1871-6 and occupied the chair of English literature in 1881-1902. In 1876-7 he was pastor of Methodist Episcopal churches in Bangor and Breedsville, Mich., and from 1902-5 occupied the pulpit of the Unitarian Church, Quincy, Ill. He published: 'Methodism, a Retrospect and an Outlook' (1891); 'The Carpenter Prophet' (1902); etc.

**Pearson**, **Cyril Arthur**, English publisher: b. Wookey, near Wells, England, 24 Feb. 1866. He was educated at Winchester College and joined the staff of Sir George Newnes and became manager of the latter's publications. He founded 'Pearson's Weekly' which met with success and subsequently started 'Home Notes,' 'Pearson's Magazine,' 'Short Stories,' 'Royal



## PEARSON—PEARY

Magazine,' 'Lady's Magazine,' 'M. A. P.,' and in 1900 his most important publication, the *Daily Express*, a halfpenny London paper. He has since established newspapers in various cities in Great Britain and is the principal owner of the *St. James Gazette*.

**Pearson, John**, English bishop and theologian: b. Snoring, Norfolk, 28 Feb. 1613; d. Chester 16 July 1686. He was educated at Eton and Cambridge and took holy orders in 1639. His first pastoral charge was Thorington in Suffolk, to which Lord-keeper Finch had presented him, but he was subsequently appointed to Saint Clement's Eastcheap. On the Restoration he was made prebendary of Ely, archdeacon of Surrey, and master of Jesus College, Cambridge. In 1661 he was appointed Margaret Professor of Divinity, the following year master of Trinity College and bishop of Chester in 1673. He was a man of prodigious learning, and his 'Exposition of the Creed' is still the best manual of textual and patristic theology in the English language. He also wrote a vindication of the authenticity of the Ignatian Epistles, 'Vindiciæ Ignatianæ.'

**Pearson, John Loughborough**, English architect: b. Brussels, Belgium, 15 July 1817; d. London 11 Dec. 1897. He was trained in his profession by Ignatius Bonomi of Durham and by Salvin and Hardwick in London; early displayed much skill in mediæval design; was employed in several important restorations; and in St. Peter's, Vauxhall, produced his first (1861) distinctive work. He continued to devote himself to the development of Gothic, giving his attention to no special phase—though he favored early pointed. His name is largely associated with certain London churches by him. The following are conspicuous: Holy Trinity, Bessborough Gardens; St. John, Red Lion Square; and St. Augustine's, Kilburn. But he is perhaps equally well known for his cathedral restorations. He became architect to Lincoln cathedral in 1870, to Bristol cathedral in 1880; was also architect to Rochester, Chichester, and Wakefield cathedrals; was consulting architect to those of Exeter and Gloucester; and restored the upper part of the north transept front and the south aisles of choir and nave in Westminster Abbey. In 1879 he received "the greatest ecclesiastical opportunity which has been offered to any modern architect" in his appointment as architect for the new cathedral of Truro, which has been described as the only Gothic work of modern times worthy of the name cathedral. The building was consecrated 3 Nov. 1887, and the completed part opened for service. Pearson's labors were not wholly ecclesiastical, as he also designed country-seats, mansions, and other structures. But these works, though excellent in their kinds, added little to his reputation. He was the real founder of the school of modern Gothic, which aims not to copy mediæval precedent but to design anew in the mediæval spirit, but wrote nothing relative to his art.

**Pearson, Karl**, English mathematician: b. England 1857. He was educated at King's College, Cambridge, and in Germany, admitted to the bar in 1882, and in that year was appointed professor of geometry at University College, London. In 1885 he was promoted to the chair of applied mathematics and mechanics, which he

has since occupied. He has published: 'The New Werther' (1880); 'The Ethic of Free-thought' (1888); 'The Chances of Death, and Other Studies in Evolution' (1897); 'Enlarged Grammar of Science' (1899); 'History of the Theory of Elasticity and Strength of Materials' with Todhunter (1886-93); etc.

**Pearsons, pēr'sónz, Daniel Kimball**, American capitalist and philanthropist: b. Bradford, Vt., 14 April 1820. He was graduated from the Medical College at Woodstock, Vt., and practised medicine in Chicopee, Mass., until 1857. He subsequently entered the real estate business in Chicago in which he continued with great success until 1887 when he retired, but retained the office of director in the Chicago City Railway Company. He has devoted much attention to philanthropic work, and his benefactions from 1890-1900 amounted to more than \$2,500,000, much of which was given to colleges. He has since continued his gifts, the Chicago Theological Seminary and Beloit College in particular receiving a large share of his benefactions.

**Peary, Robert Edwin**, American naval officer and Arctic explorer: b. Cresson, Pa., 6 May 1856. He was graduated from Bowdoin College, and in 1881 entered the United States navy as a civil engineer with the rank of lieutenant. From 1884-5 he was assistant engineer in connection with the surveys for the Nicaragua Canal, and later engineer in charge of these surveys. In 1886 he made his first trip to the North, reconnoitering the Greenland ice cap, east of Disco Bay. In 1891-2 as chief of the Arctic expedition of the Academy of Natural Sciences of Philadelphia, he made further explorations, traversing Greenland from McCormick Bay to Independence Bay, in the northeast angle, a trip of 1,300 miles, considered one of the most remarkable polar sledge journeys ever made. He discovered and named Melville Land and Heilprin Land, proved the convergence of the east and west coast of Greenland and determined its insularity. In 1893-5 he again visited Greenland, made a thorough study of the tribes known as the Arctic Highlanders, and discovered the so-called Iron Mountain, a group of three large meteorites. In the summers of 1896 and 1897 he made short voyages and in the latter year brought to the United States the meteorites of Cape York. In 1898-1902, he made his most important expedition in search of the North Pole, under the direction of the Peary Arctic Club of New York city. In August 1898 his ship the *Windward* had reached the northern side of Princess Marie Bay, where her progress was stopped by the ice. In December he left the ship, and by sledge reached Fort Conger. He returned to the Fort again in April 1899, explored the region of Lady Franklin Bay, and rescued the instruments and records left by Greeley at the Fort in 1883. From June to July he explored the Princess Marie Bay region, crossed the Ellsmere ice cap, and established a line of caches from Cape Sabine to Fort Conger. In 1900 he again visited Fort Conger, and from there sledging over the ice along the northwest coast, reached Cape Washington, lat. 83° 39', but finding further progress barred by an impassable sheet of water, turned and explored the east coast to within a degree of In-



## PEARY ARCTIC EXPEDITION — PEAT

dependence Bay. In March 1902 he made another start from Payer harbor, and traveling over the frozen Polar Sea, reached Crozier Island, but after that finding every day's march more difficult, and encountering open leads and floes, he had to abandon his hope of reaching the Pole. He had gone as far as latitude  $84^{\circ} 19'$ . In August he sailed on his return voyage in the new *Windward*, which had been sent north by the club for him. Careful surveys were made at all stages, and much useful information gained; he determined conclusively the northern limit of Greenland, proved the non-existence of land for a considerable distance to the northward and northeastward, and determined the origin of the floe bergs and palæocrystic ice. In 1906 he reached  $87^{\circ} 6'$  in the *Roosevelt*, within about 203 miles of the Pole. He has written 'Northward over the Great Ice' (1898), an account of his earlier voyages.

**Peary Arctic Expedition.** See PEARY, ROBERT EDWIN; POLAR RESEARCH.

**Pearyland**, northeastern coast of Greenland, between Independence Bay and the 80th degree of latitude; so called in honor of its discoverer, Robert E. Peary (q.v.).

**Peasants' War, or The Great Peasants' War**, a name given to the general rising of the German peasantry in 1524-5 and originally correlated with the "Nobles' War," a term applied to the attempt of the nobles to break free from the power of the princes. The Peasants' War was not an isolated incident, as is clearly shown by the second name given it above. It was an almost inevitable result of the increasing exactions laid upon the peasantry by their masters in a declining feudal system; and it was not the first rising of its sort, for in 1502 and 1514 there had been great revolts called respectively the "Bundschuh" and the "League of Poor Conrad," and in 1515 an uprising in Carinthia and Styria had maintained itself for several months only to be put down by the Emperor after great slaughter. Hence it is evident that the true cause of the Peasants' War was something antecedent in time and deeper-seated than the effects of the doctrines of Reformation, though the latter were prominent among the immediate causes. Luther, who, had he sided with the peasants would have carried with him the great middle class and so assured the success of the cause, attempted compromise, urged upon the princes the justice of certain demands, suggested to the peasants the withdrawal of others, and after a short interval threw the weight of his influence against the insurgents by the publication of his pamphlet 'Against the Robbing Murdering Troops of the Peasants.' The revolt by this time had spread from the southern Black Forest through Austria, the Tyrol, Alsace and the lower Rhine; its different bands in different places and with Metzler, Geier, Hippeler and Rohrbach as leaders, had met with little success save in a few cities where they had worked from the inside, notably Heilbronn, Wimpfen, Dinkelsbühl, Mainz and Trier; a trained soldier, Goetz von Berlichingen (q.v.), had, however, been impressed as general, and while he was moving on Frauenberg the nobles had joined forces, practically at Luther's suggestion. Philip of Hesse, the Elector John, and Dukes Henry and George of Saxony met the fanatic Münzer, one of the foremost of

the preachers of the revolt, at Frankenhäusen, killed 5,000 of his men and took him prisoner, 15 May 1525, executing him soon afterward. In southern Germany repression was equally swift and terrible; the work was done in Alsace by Anton of Lorraine, and in Swabia by Georg Truchsess who destroyed Weinsberg, and then joined forces (10,000 men) with the Electors of the Palatine and of Trier, marched to Frauenberg, and, when the peasants had been deserted by Goetz von Berlichingen, defeated and practically annihilated the army of 2,000 men under Metzler at Königshofen. The atrocities committed by the victors were in the way of a sanguinary warning: 60 burghers were executed at Würzburg, and at Kitzingen 57 were blinded. Schweinfurt, Bamberg and other cities were heavily mulcted in money. The peasants of the mid-Rhine district had been defeated in the meantime by the forces of the Palatine. The general result of the great rising was reactionary; the burdens of the peasants were made all the heavier; and the cause of the Reformation had suffered a terrible blow, losing prestige among the nobles, who laid to it the rising, and among the peasants, who saw their battle lost, perhaps, by the defection of Luther. On the preliminaries of the uprising consult the works entitled 'Zur Vorgeschichte des Bauernkriegs' by Zollner (1872) and Stolze (1900); and on the war itself Cornelius, 'Studien zur Geschichte des Bauernkriegs' (1862); Bebel's study (1876), a partisan Socialist pamphlet; and Zimmermann, 'Allgemeine Geschichte des grossen Bauernkriegs' (last edition 1891).

**Peat**, the partially decayed and compacted remains of mosses and other marsh plants which have become covered with water during the process. Generally the plants grow luxuriantly at the surface but die below and are submerged. The rate of growth is estimated to vary from one to four inches a year and the depth of beds has been found often to exceed 20 feet, but 10 feet or less is more common. The deposits are confined to temperate regions, in both Northern and Southern hemispheres, but especially in the north, where the plants most frequently found in such places are species of sphagnum moss. In the Southern hemisphere a rush (*Astelia pumila*) is said to be most common. Peat bogs do not occur in the warm tropics because the decay of vegetable matter is too rapid to permit of their formation. In the cool North Temperate zone the areas covered by peat bogs are enormous. In Ireland estimates place the area of upland bogs at about a million and a quarter acres; that of lowland bogs at more than a million and a half. There are thousands of acres in Germany, Sweden, Norway, England, Scotland, Holland, France, and Denmark; and in Russia the area is estimated at 6,700 square miles. In Canada and the United States there are also enormous deposits which have been little used except in the former country, where compressed peat is a product of the closing decade of the 19th century.

The chief use of peat is for fuel, for which purpose it is most largely employed in Ireland where under the name of turf it is the principal fuel. At a short distance below the surface the peat is brown and somewhat loose in texture; at greater depths it becomes more dense and nearly black; and in many cases



## PEAT-BOG—PEBRINE

it becomes lignite. Owing to the presence of tannin, organic acids, various salts and iron in various forms, which make the substance antiseptic, the plants are so well preserved as to be readily identified and in some cases their perfect condition has led to experiments in their use for the manufacture of textiles from the fibre. Trees, fruit leaves and animal bodies are not infrequently found in as good condition as they might be expected to be after long immersion in a tanning vat. This characteristic is, however, a decided disadvantage when the land is to be used for agricultural purposes, since the reclamation is slow even under the best of management; and as a fertilizer the pulverized peat must be allowed to weather for a considerable time before it can be profitably spread upon other land as a manure. As a manure it is often best applied after being used as an absorbent in stables, where its deodorizing qualities specially recommend it. It also readily gathers and holds the easily-lost nitrogenous salts voided by animals.

In the conversion of a peat bog into arable land drainage is the first requisite. Then applications of lime, marl, and other soil amendments must be combined with frequent turning of the surface to the weather, especially to the action of frost during winter. During the first years under crop the yields will probably be light if there is any yield at all. Hence it is often advisable to plant only coarse-feeding crops, such as corn and potatoes, which will require the frequent stirring of the soil. Mineral fertilizers must be given liberally because peat is usually very deficient in such ingredients. And since stable manure seems to accelerate fermentation of the peat it should be applied liberally. Owing to their generally low situation and the consequent settling of cold air upon such areas, reclaimed peat bogs are often unsuitable for many crops which are likely to be injured by cold. They are, however, often admirable for such crops as celery and onions, their fine texture and easy preparation, after once being reclaimed, being decidedly in their favor. They are not, however, enormously rich in plant-food, etc., popular belief to the contrary notwithstanding. American peat contains only about 0.13 per cent of potash, 0.21 phosphoric acid and 0.67 of nitrogen, the last usually in a slowly available form.

In the digging of peat for fuel the bog is partly drained by open ditches, and when the excess of water has disappeared the loose surface is removed and then rectangular "turfs" are cut with specially constructed spades, the blades of which are made in the form of a right angle. The turfs or "peats" are placed on end in little groups until dry, when they are stored under cover. In Ireland, where the operations are performed during spring and summer, men, women, and children are employed. And in many cases where the turf is imperfect these people tread the fibrous mud until the peat can be pressed into shape by hand. Owing to its bulkiness, peat cannot be shipped profitably to great distances. The charcoal made from compressed peat is superior to wood charcoal and even compares with coke. That obtained from uncompressed peat is used in tempering cutlery, etc., and as a deodorizer and antiseptic.

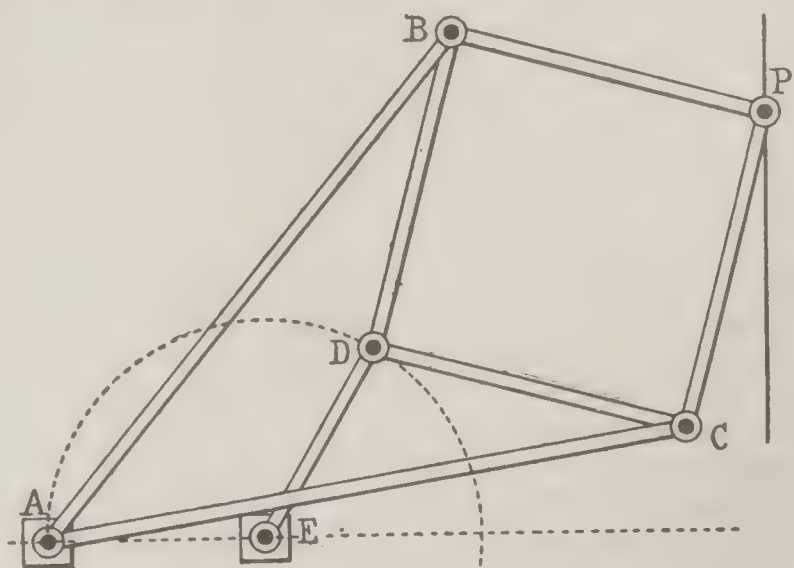
Consult: Koller, 'Die Torf-Industrie' (Leipzig, 1898); Ries, 'Peat,' Mineral Resources,

in United States Geological Survey Report for 1901 (Washington, 1902); Johnson, 'Peat and Muck' (Hartford, 1859); Storer, 'Agriculture' (New York, 1897).

**Peat-bog.** See SWAMP.

**Peate, pēt, John,** American Methodist clergyman and astronomer: b. Ireland 6 May 1820; d. Greenville, Pa., 25 March 1903. He came to the United States when very young, engaged in manual labor, but contrived to gain an education and was ordained in the ministry, holding various pastorates for a period covering 50 years. As an astronomer he won a national reputation, making a specialty of the manufacture of reflecting telescope lenses. He made over 20 lenses each of which exceeded 20 inches in diameter; the largest one he presented to the American University at Washington, D. C.

**Peaucellier, pō-sēl-ē-ā, Cell,** in mechanics, a form of linkage which possesses great theoretical and historical interest, because it was the first known apparatus by which an accurately straight line could be drawn without the use of a straight-edge,—that is, without resorting to the illogical expedient of copying some other straight line. It was discovered in 1864 by M. Peaucellier, an officer of engineers in the French army, who was tardily rewarded for it by the "Prix Montyon" of the Institute of France. It consists of seven "links," or bars of metal, which are connected as shown in the il-



lustration. Four of these are of equal length, and are jointed together so as to form a rhombus, P C D B. Two other bars, equal to each other in length, but not bearing any necessary metrical relation to the first four, are pivoted to each other at A, and to the original rhombus at B and C. The point A is fixed in position, and the point D is connected with a fixed centre E by means of a seventh bar, DE, whose length is arbitrary, but which must be so disposed that the circle (shown dotted) upon which D is constrained to move would pass through A if it were sufficiently produced. When the various conditions here given are fulfilled, and the "cell" is moved in any way, the point P describes a straight line which is perpendicular to the straight line joining A and E. For a simple proof of this fact, and for an account of other remarkable linkages discovered subsequently to Peaucellier's, consult Kempe, 'How to Draw a Straight Line.'

**Peb'rine,** a disease of silkworms. See SILKWORM.



## PECAN — PECK

**Pecan'.** See HICKORY.

**Pec'cary**, the native name of a genus (*Dicotyles*) of small pig-like animals forming the family *Dicotylidæ*, closely allied to the true swine, from which they differ in the character of their dentition and the more complex stomach and some other details. The canine teeth, generally so prominent in the male swine, do not protrude in the peccaries. The peccaries possess a glandular pouch, situated in the loins, which secretes a musky-smelling fatty substance. The Indians cut away this pouch immediately on killing a peccary, to avoid contaminating the flesh.

The peccaries form the only indigenous representatives of the swine in America. There are three species of which the collared peccary (*Dicotyles torquatus*) and the white-lipped peccary (*D. labiatus*) are best known. They are said to interbreed readily. The former occurs abundantly in South America to Patagonia and northward into the United States as far as Arkansas. These animals go either in pairs or in small flocks, and inhabit holes in the ground, or the hollows of trees. The jaguars pursue them with great vigor. Their food consists of maize, potatoes, sugarcane, and similar materials as well as animal matter; and cultivated fields suffer much from their raids. The color of this species, which averages about three feet in length, is a dark gray; the bristles being each marked by rings of gray, straw-color, and black; and a white band passes down each shoulder from the withers, and round the throat, thus appearing as a kind of "collar." This species of peccary is readily domesticated. The flesh is savory, but less fat than pigs' flesh. Unlike the pigs but two young are produced at a birth.

The white-lipped peccary, found in Guiana and as far north as Honduras, congregates in larger bands than the collared species. They appear to migrate in flocks from place to place, and are said to swim well. They are also said to attack sportsmen with great courage when exasperated, and to inflict severe wounds with their sharp tusks. A white patch or strip exists across the chin, and extends backward on each side of the jaw in this species, which is about 40 inches long.

**Peck, George**, American Methodist clergyman: b. Middlefield, N. Y., 8 Aug. 1797; d. Scranton, Pa., 1 May 1876. He began preaching in 1816, was presiding elder of the Susquehanna District in 1824 and in 1835-40 principal of the Cazenovia Seminary. He edited the 'Methodist Quarterly Review' (1840-8), and for the succeeding four years was editor-in-chief of the 'Christian Advocate,' New York. He held pastorates at Scranton, Wilkesbarre, Providence, and Dunmore, and among his books are: 'Universalism Examined'; 'Sketches and Incidents' (1849); 'History of Methodism within the Bounds of the Old Genesee Conference' (1860); 'Life and Times of George Peck,' an autobiography (1874); etc.

**Peck, George Wilbur**, American humorist: b. Henderson, N. Y., 28 Sept. 1840. He learned the printing trade, served two and a half years in the Civil War in the 4th Wisconsin volunteer cavalry, in 1866 established at Ripon the *Representative* newspaper, was later owner

of the *Democrat* of La Crosse, and in 1874 began there *The Sun*, transferred in 1878 to Milwaukee and styled *Peck's Sun*. He wrote some broadly humorous sketches, of which the 'Peck's Bad Boy' series was the best known. In 1890-1 he was mayor of Milwaukee, and in 1891-5 governor of Wisconsin, in both instances as a Democrat.

**Peck, Harry Thurston**, American critic and author: b. Stamford, Conn., 24 Nov. 1856. He was graduated from Columbia in 1881, was instructor in that institution in Latin and for a time in Sanskrit, and in 1888 became professor of Latin there, after study at the University of Berlin. In 1895 he became editor of the American 'Bookman,' upon the establishment of that magazine, in 1898 an editor of the 'International Cyclopædia,' and in 1900 of the 'New International Encyclopædia.' He was also at one time literary editor of the *Commercial Advertiser*. Among his publications are: 'The Semitic Theory of Creation' (1887); 'Suetonius' with commentary (1889); 'Manual of Latin Pronunciation' (1892); 'The Personal Equation,' essays (1897); a rendering of 'Trimalchio's Dinner,' with introduction (1898); 'What is Good English? and Other Essays' (1898); 'Graystone and Porphyry,' verse (1900); and a life of Prescott (1904). He also edited Harper's 'Dictionary of Classical Literature and Antiquities' (1896). He is one of the foremost of American authorities on the early history of the novel.

**Peck, Jesse Truesdell**, American Methodist bishop: b. Middlefield, N. Y., 4 April 1811; d. Syracuse, N. Y., 17 May 1883. He was educated at Cazenovia Seminary, entered the Oneida Conference in 1832 and was pastor of various churches until 1837, when he accepted an appointment as principal of the Gouverneur Wesleyan Seminary. In 1841-8 he was principal of the Tory Conference Academy at Poultney, Vt., and in 1848-52 president of Dickinson College, Carlisle, Pa. In 1854-8 he was secretary and editor of the Methodist Tract Society in New York. He spent the succeeding eight years in California as pastor and presiding elder. After his return eastward he continued his pastoral work, was one of the founders of Syracuse University, and in 1872 was elected bishop.

**Peck, John James**, American soldier: b. Manlius, N. Y., 4 Jan. 1821; d. Syracuse, N. Y., 21 April 1878. Graduated in 1843 from West Point he took part in the Mexican War, and was brevetted major for bravery at Molino del Rey where he operated a captured gun against the enemy. In 1853 he resigned from the service, but became brigadier-general of volunteers 9 Aug. 1861, and after service in the defensive works of Washington fought in the Peninsular campaign, distinguished himself at Williamsburg and Yorktown, and at Malvern Hill. (1 July) was in command of the infantry forces of the Federal rear-guard. Promoted major-general (4 July), he remained until May 1863 in command of the troops left for the defense of the important strategic post at Suffolk, Va. He defended the position successfully against a superior Confederate force under Longstreet and Hill. Subsequently he was on duty on the Canadian frontier, and on 24 Aug. 1865 was mustered out. He organized (1867) a life insurance com-



## PECK — PECTOLITE

pany at Syracuse, and held its presidency until his death.

**Peck, Samuel Minturn**, American lyric poet: b. Tuscaloosa, Ala., 4 Nov. 1854. He was graduated from the University of Alabama in 1876, and later studied medicine in New York but has not practised. He has published in verse: 'Cap and Bells' (1886); 'Rings and Love Knots' (1892); 'Rhymes and Roses'; 'Fair Women of To-Day' (1896); 'The Golf Girl' (1899); and in prose: 'Alabama Sketches' (1902).

**Peck, Tracy**, American classical scholar: b. Bristol, Conn., 24 May 1838. He was graduated from Yale in 1861, studied in Germany, was professor of Latin at Cornell in 1871-80, and has since occupied that chair at Yale. He was president of the American Philological Association in 1885-6 and in 1888-9 director of the American School of Classical Studies in Rome. He has edited with C. L. Smith a series of Latin authors annotated for college use (12 vols. already issued) and has published: 'The Authorship of the Dialogus de Oratoribus' (1879); 'Alliteration in Latin' (1884); 'Cicero's Hexameters' (1897); etc.

**Peck, William Guy**, American educator: b. Litchfield, Conn., 16 Oct. 1820; d. Greenwich, Conn., 7 Feb. 1892. He was graduated from West Point in 1844, assigned to the corps of topographical engineers, and served under Gen. Fremont in 1845, on his third expedition to the Rocky Mountains. He was with the Army of the West in the Mexican War, professor at West Point in 1847-55, when he resigned from the army and accepted the chair of physics and civil engineering in the University of Michigan. He was professor in Columbia College from 1857, occupying at his death the chair of higher mathematics and astronomy in both departments of the college. He wrote: 'Elementary Mechanics' (1859); 'Popular Astronomy' (1883); edited with his father-in-law, Charles Davies, 'Mathematical Dictionary' (1855); etc.

**Peck**, a measure. See WEIGHTS AND MEASURES.

**Peckham, pĕk'am, Rufus William**, American jurist: b. Albany 8 Nov. 1838. He studied at the Albany Academy and in Philadelphia, and was admitted to the bar in 1859. In 1868 he was elected district attorney of Albany County for three years; during this time a daring express robbery occurred on the Albany railroad bridge, and he successfully prosecuted the robbers and obtained their conviction. He was counsel for the Albany & Susquehanna railroad in its suit against the Erie, and had charge of several other important cases. In 1881 he became corporation counsel for the city of Albany. An active member of the Democratic party, he was a delegate to the National Convention of 1876, where he supported Tilden for the presidency, and also to the convention of 1880. He was justice of the New York State supreme court from 1883 to 1886; and was associate judge of the State court of appeals, 1886-95. In the last named year he was appointed to the United States Supreme Court by President Cleveland.

**Peckham, Wheeler Hazard**, American lawyer: b. Albany, N. Y., 1 Jan. 1833; d. N. Y.

City, 27 Sept. 1905. He was educated at Union College, Schenectady, admitted to the bar in 1856, and in 1864 settled in New York, where he acquired a reputation as a constitutional lawyer. He acted with Deputy Attorney-General O'Connor in the prosecution of the "Tweed ring." He was appointed attorney-general of New York in 1884, but soon resigned.

**Peck'sniff**, a hypocritical personage in Dickens' novel, 'Martin Chuzzlewit.' He is the father of two daughters, Mercy or "Merry," who married Jonas Chuzzlewit, and Charity, commonly called "Cherry."

**Pecock, pē'kōk, Reginald**, English prelate: b. Wales about 1395; d. Thorney Abbey, Cambridgeshire, about 1460. He was educated at Oxford, in 1431 was elected to the mastership of Whittington College of London, in 1444 was made bishop of St. Asaph, and in 1450 was translated to Chichester. In 1455 he published the 'Repressor of Over Much Blaming of the Clergy,' a reply to Lollard attacks and a critique of Lollard positions, subtle in argumentation and a pattern of the clear and vigorous English of the time. In a work called the 'Provoker,' not now, so far as known, extant, he denied the authenticity of the Apostles' Creed, a revised version of which he had previously published. By this and similar writings he managed to secure the disfavor of every shade of belief then prevalent in England. He was cited before Bouchier, archbishop of Canterbury, in 1457, who, after Pecock's creed had been condemned, ordered him to recant on pain of death. He obeyed, retired from his bishopric, and went into seclusion at Thorney Abbey.

**Pecos, pā'kōs**, a river of New Mexico and Texas, rising in San Miguel County, N. M., at the eastern base of Baldy Peak, flows south and southeast, enters the State of Texas, and empties into the Rio Grande River. In its upper course it flows through a narrow valley, and is one of the most important rivers of New Mexico for irrigation, large storage reservoirs have been built near Carlsbad, N. M. Its length is about 800 miles, and its volume of water is greatly reduced during the summer months.

**Pec'tase, Pec'tic Acid, Pec'tin.** See PECTOSE.

**Pectin'idæ**, a family of bivalve mollusks, the scallops, nearly allied to the oysters, characterized by a shell sub-orbicular, regular, usually with radiating ribs, beaks approximate, eared, the anterior ones most prominent, the posterior ones a little oblique. Its members have rows of ocelli and delicate crescentic gills. The species number about 175, living on sandy bottoms, down to a considerable depth in all parts of the world, and have a large commercial importance. See SCALLOP.

**Pectolite** (New Lat. "comb-stone"), or **Osmelite** (Gr. *ὀσμή*, smell, and *λίθος*, stone); so called because of its peculiar odor), one of the zeolites, a hydrous silicate of sodium and calcium, with the formula  $\text{HNaCa}_2\text{Si}_3\text{O}_9$ , of a silky grayish or whitish color, and commonly occurring in radiated masses, suggesting the form of a comb, whence the name. It is isomorphous with wolastonite, is subtranslucent, crystallizes in the monoclinic scheme, is soluble in hydrochloric acid, leaving silica, and occurs in the British



## PECTORAL SANDPIPER — PEDRO

Isles, especially Wales, in Monzoni Valley, Tyrol, at Bergen Hill, N. J., etc.

**Pectoral Sandpiper.** See SANDPIPER.

**Pec'tose, Pectase, Pectin, Pectic Acids,** a group of closely related substances, part soluble, part insoluble, found in the soft parts of certain fruits and vegetables during various stages of ripening and to which the power of forming a jelly is due. The unripe fruit contains *Pectose* which is insoluble in both water and alcohol, but which can be changed to soluble *Pectin* either by heating with dilute acids, or, as during ripening, by the action of a ferment-like body called *Pectase*. *Pectase* is always present in the ripening fruit. *Pectin* is further changed by action of dilute acids or alkalies to a number of different but closely related bodies of rather uncertain composition called the *Pectic Acids*. These pectous substances are composed of carbon, hydrogen and oxygen, exact composition unknown, and are related to the carbohydrates, particularly the gums.

**Peculiar People,** an English religious sect, who combine certain tenets of the Dunkards (q.v.) and Faith Curists (see FAITH CURE). They are Perfectionists (q.v.). They claim for themselves the possession of true and undefiled religion, and take their name from a scriptural phrase (1 Peter ii. 9). To be a true Christian, with them, is to live without sin, as they profess to do. Their religion has neither mystery or straining effort; they see and can do all things; young and old are equally competent to accomplish this. All are permitted to preach and pray and all who attend their assemblies are members of their church. They reject creeds, sacraments, and confessions; they have no ministry. It is one of their fundamental doctrines that James v. 14-15 is to be taken literally, and the British government has sometimes interfered, when their refusal to call in a doctor, or administer medicine, has endangered the life, or practically caused the death of some member of the denomination. See RELIGIOUS SECTS.

**Pedal-Point.** See ORGAN-POINT.

**Peddler, or Pedlar,** a traveling salesman or merchant who carries his goods or merchandise with him from place to place. In most of the United States, peddlers are required to take out a license and to conform to legal regulations, for the protection of the public. In Great Britain peddlers are called hawkers.

**Pedee, pē-dē', Great,** a river of South Carolina. See GREAT PEDEE.

**Pedes'trianism.** See WALKING.

**Pedicella'riæ.** See ECHINOIDEA.

**Pedicularis,** a genus of herbs of the natural order *Scrophulariaceæ*, some of which have rather large and finely colored flowers. They have the name louseworts (q.v.) because of an old belief that they produce a lousy disease in sheep. Their acidity renders them obnoxious to sheep; but cattle, goats, and swine eat them. Continental Europe and the northern parts of Asia produce many species, as well as North America. *P. sceptrum*, or King Charles' Sceptre, is one of the principal ornaments of marshy grounds in northern Europe.

**Ped'iment,** in architecture, the triangular finishing above the entablature at the end of buildings or over porticoes. The moldings of the entablature bound the inclined sides of the pediment. When there are triangular finishings over doors and windows these are also called pediments. In the architecture of the Middle Ages small gables and triangular decorations over openings, niches, etc., are called pediments.

**Pedlar.** See PEDDLER.

**Pedom'eter,** a small, clock-like mechanism which indicates the distance traveled by a pedestrian. The instrument is so constructed that it moves with the motion of the person carrying it, the indicator advancing one degree for each step taken.

**Pedrarias Dávila, pā-drā-rē'as dā'vē-lā,** Spanish administrator in Central America: b. Segovia about 1440; d. Spain 1530. He was prominent in the conquest of Granada, and in 1514 set sail with a fleet and a force of 1,500 as governor of the colonies of Spain on the Isthmus. He feared there the rivalry of Vasco Nuñez de Balboa, whom he seized and put to death. This brought upon him the disfavor of the government, but Lope de Sosa, who was sent to supersede him, died before setting foot on land, and so he remained in control of the situation. In 1519 he founded Panama, and extended his sway northward and southward. He claimed Nicaragua, sent Francisco Hernandez de Córdova to take it, and when Córdova withdrew from his allegiance, beheaded him. Finally deposed from his power in Panama, he held Nicaragua for four more years of cruelty. Oviedo, who was his open foe, credited to him 2,000,000 murders. Certainly he was atrocious enough; and, thinks Fiske, if two ciphers were stricken from Oviedo's estimate, the remaining figure would be "quite within the limits of credibility."

**Pedregal y Canedo, pā-drā-gāl' ē kā-nā'dō, Manuel,** Spanish politician: b. Grado, in the Adriatic, 1832; d. Spain, 1896. He studied law and entered upon a political career, identifying himself with the Republican party, in the affairs of which he took an active part during the period immediately preceding the abdication of Amadeus I. in 1873. Under the Republican government he was twice minister of justice and once minister of finance, afterward retiring from public life until 1882 when he was deputy from Oviedo and with the Republican leaders Azcárate, Salmeron, Labra, and others, assisted in organizing the "centralista" which represents the highest principles of the radicals. He wrote: 'El poder y la libertad en el mundo antiguo' (1878); 'Elección presidencial de los Estados-Unidos' (1892); etc.

**Pedro II., pē'drō (Sp. pā'drō),** king of Aragon, called THE CATHOLIC: b. 1174; d. Muret 2 Sept. 1213. He succeeded to the crown in 1196; quarreled with the king of Navarre over his French fiefs; conquered the most of Provence, but gave it up to his brother Alfonso; married Marie of Montpellier in 1204; and in the same year was crowned by the Pope, a political move calculated to facilitate his projected conquest of the Balearic Islands, and to protect himself against his nobles and the restless Albigensians. He even made Aragon a papal fief, receiving therefor the title of Catholic. In



## PEDRO THE CRUEL — PEEBLES

alliance with Castile and Navarre he defeated the Almohades at Las Navas 16 July 1212. But in 1213 he was defeated and killed at Muret by Simon de Montfort, against whom he fought in alliance with the Albigensians. Pedro II. was skilled in Italian and Provençal verse and did much to introduce the Provençal style into Spain.

**Pedro the Cruel**, king of Leon and Castile, not to be confused with Pedro IV. of Aragon, who was called "The Cruel," but more commonly "The Ceremonious": b. Burgos 30 Aug. 1334; d. near Montiel 26 March 1369. He was son and successor (1350) of Alfonso XI., whose mistress Leonor de Guzman he imprisoned, and whose illegitimate children he persecuted cruelly. His general administration of Castile was very severe. On the death of the Seigneur of Biscay, Pedro imprisoned the two daughters and sought the life of the 3-year-old son of the Seigneur, seized the province, and killed Garcilasso de la Vega, who attempted to interfere. He murdered his brother Fadrigue, and the king of Grenada, while the latter was his guest, and picked a quarrel with Pedro IV. of Aragon (also styled "The Cruel"), who called in the help of the Castilian king's natural brother Henry of Trastamare at the head of the famous mercenaries the White Companies. Henry established himself as king of Castile in 1366, was defeated by Pedro, who was aided by the Black Prince Edward, then governor of Guyenne, at Navareto in 1367, but was victorious at Montiel 1369. Pedro was treacherously killed a few days after the battle. Consult: Burke, 'History of Spain' (1895); Mérimée, 'Histoire de Dom Pedro I., Roi de Castile' (1843); and Garcia, 'Castilla y Leon durante los reinados de Pedro I., etc.' (1891).

**Pedro, Dom**, DUKE OF COIMBRA, regent of Portugal: b. Lisbon, Portugal, 9 Dec. 1392; d. Alfarrobeira, Portugal, 20 May 1449. He was the second son of John I. of Portugal; while very young commanded the first expedition against Ceuta. He spent four years, 1424-8, in travel and visited even the court of Bagdad where he was received with high honors. After the death of Edward I. the people became dissatisfied with the regency of the queen and Pedro skilfully contrived his own appointment to the office. He proved a wise and tactful ruler and arranged the marriage between the young king Alfonso V., and his daughter Isabelle in 1446. After the accession of the king a quarrel arose between Pedro and his brother, the duke of Bragança, over the office of constable of the kingdom. The king took the part of Bragança, a civil war ensued and Dom Pedro was killed in battle at Alfarrobeira.

**Pedro I.** (ANTONIO JOSÉ DE ALCANTARA), called Dom Pedro, king of Portugal and emperor of Brazil: b. Queluz, near Lisbon, 12 Oct. 1798; d. there 24 Sept. 1834. On the invasion of Portugal by the French in 1807, the royal family fled to Brazil. Dom Pedro became regent of Brazil in 1821. The Cortes angered the colony, a revolution took place, and Dom Pedro, placing himself at the head of the movement, was proclaimed protector and perpetual defender of Brazil; and the country being declared independent 1822, he was proclaimed constitutional

emperor (12 October) and on 1 December was crowned. In 1825 Portugal recognized the independence of Brazil, and a treaty was made on terms highly unsatisfactory to the Portuguese. His father dying in 1826, Dom Pedro became king of Portugal, but immediately abdicated in favor of his infant daughter, Dona Maria da Gloria, as the Brazilians feared that they were once more to be made dependent upon the mother country. The internal discontent increased, and at length a popular tumult in Rio Janeiro compelled the emperor to abdicate in favor of his son, 7 April 1831, and to return to his native country. In the meantime the crown of Portugal had been usurped by his brother Dom Miguel. He landed at the island of Terceira, in the Azores, issued a decree in favor of Dona Maria, and with the assistance of French and English volunteers began a war which terminated in 1834 by the complete success of the queen's party. On 26 May an agreement was signed by which Dom Miguel was to leave the kingdom forever. Dom Pedro was appointed regent during his daughter's minority, but died before it expired. See BRAZIL and PORTUGAL, *History*.

**Pedro II.** (DE ALCANTARA, dā ä'l-kän'tä-rä), called Dom Pedro II., emperor of Brazil: b. Rio Janeiro 2 Dec. 1825; d. Paris 5 Dec. 1891. He was the only son of the Emperor Pedro I., and succeeded to the throne on the abdication of his father 7 April 1831. He married the Princess Theresa Christina Maria (d. 1889), sister of Francis I., king of Naples, in 1843. Brazil prospered greatly under the rule of Pedro II., who was an enlightened ruler, and did much to develop its resources in every direction. He was scholarly in his tastes, and never sought to employ aggressively even the restricted powers which the constitution permitted him. During his reign several foreign wars occurred, such as those with the dictator Rosas of Buenos Ayres in 1851-2, with Uruguay in 1854-5 and 1864-5, and with Lopez of Paraguay in 1865-70. As a private individual he visited Europe (1871-2) and in 1876 attended the Centennial Exhibition in Philadelphia, being present and assisting at the opening ceremonies.

**Pedro V.**, king of Portugal: b. Lisbon, Portugal, 16 Sept. 1837; d. there 1861. He was the son of Dona Maria II., whom he succeeded under the regency of his father Prince Ferdinand of Saxe-Coburg-Gotha, in 1853. The most important events of his minority were the conclusion of the extradition treaties with France and Belgium and the commercial treaties with the South American states. The regency of his father ended 16 Sept. 1855 and Pedro devoted himself to strengthening the financial condition of the country and furthering industrial arts. He died of yellow fever contracted by assisting his plague-stricken subjects in 1861.

**Peebles**, pē'blz, **James Martin**, American editor and physician: b. Whittingham, Vt., 23 March 1822. He was graduated from the University of Pennsylvania, was president of the California College of Science four years, professor in the Eclectic Medical College at Cincinnati for three years, and in 1869 was United States consul at Trebizond, Turkey. He has lectured on medical subjects in many countries and has published: 'Seers of the Ages' (1875); 'Our Homes Hereafter' (1880); 'Three Jour-



## PEEBLES — PEEL

neys Around the World' (1891); 'The Christ Question Settled' (1897); 'Death Defeated' (1900); etc.

**Peebles, Mary Louise Parmalee** ("LYNDE PALMER"), American author: b. Lansingburg, N. Y., 10 Dec. 1833. She was graduated from the Lansingburg Academy in 1850 and in 1862 was married to Augustus A. Peebles. As a writer of juvenile books she has gained some reputation and among her works are: 'The Little Captain' (1861); 'The Good Fight' (1865); 'Drifting and Steering' (1867); 'Jeanette's Cisterns' (1882); 'Where Honor Leads' (1894); etc.

**Peekskill, pēk'skīl**, N. Y., village, in Westchester County; on the Hudson River, and on the New York Central & Hudson River Railroad; about 40 miles north of New York city. It is connected by steamboats with New York, Albany, and all the Hudson River ports. It was settled in 1664 by the Dutch. The Indians had here a village called Sachoes, but the Dutch changed the name in honor of Jans Peek, a Dutch navigator. In 1665 royal confirmation was given and the territory was known as Ryck's Patent. In 1764 several families from England located here. During the Revolutionary War, Fort Independence, just above the village, was occupied by American soldiers. Continental Village, a fortified camp a few miles northeast, was for a time the headquarters of General Parsons and Putnam. The old Robinson House which they occupied in 1778-9 is still standing. Arnold occupied this same house in 1780. It was in Peekskill that Arnold heard of the capture of André. John Paulding, the captor of André, is buried here in old rural cemetery. Gallows Hill, in whose "Wayside Inn" André tarried after his capture, is about three miles distant. On the north side of Gallows Hill is the spring from which the Mohicans drank. Near the "Wayside Inn" is the old Van Cortlandt mansion, and nearby were other residences of the Revolutionary days.

The chief industrial establishments are knit-goods factories, foundry, brick works, stone factories, hat factory, and machine-shops. It has Saint Joseph's Home (R.C.) for children, over 1,000 inmates (1903), Saint Anne's Home, and Helping Hand Hospital. The State Military Camp ground is just north of the village and facing the Hudson. It is the seat of Saint Gabriel's Academy (P.E.), military and business schools, a high school, public elementary schools, and a free library. A fine school stands on "Drum Hill." The Field Library has about 7,000 volumes. Peekskill is the birth-place of Chauncey M. Depew (q.v.). Henry Ward Beecher's farm, his summer home, is two miles east of the village. Pop. (1890) 9,676; (1900) 10,358.

**Peel, Paul**, Canadian artist: b. London, Ontario, 1860; d. Paris 25 Oct. 1892. He studied at the Philadelphia Academy of Fine Arts, in 1880 entered the Royal Academy at London, and later at Paris was a pupil of Boulanger and Gérôme. His studio was at Paris, and his work was French in its characteristics. His 'How Bitter Life Is!' obtained honorable mention at the Salon of 1889. Among his other works are: 'Two Friends'; 'Fording the Stream'; 'In Punishment'; and 'The Unexpected Meeting.'

**Peel, Sir Robert**, English statesman: b. near Bury, Lancashire, 5 Feb. 1788; d. London 2 July 1850. He was graduated from Oxford, in 1808; in 1809 entered Parliament as Tory member for Cashel, later exchanged for Chippenham; in 1810 made his first speech, in seconding the address to the throne; and in 1811 entered his official career as under-secretary of state for the colonies. In 1812 he was transferred to the chief secretaryship for Ireland, a post whose usual difficulties were at that time much increased by political disturbances. He greatly improved the routine administration of the office, promoted secular education, and for the security of life and property established the Irish constabulary, thence known as "Peelers." But his Tory views and his opposition to Catholic emancipation dissatisfied the extreme members of the Catholic party, who generally referred to him as "Orange Peel." In 1817 he was returned for Oxford, thus obtaining the chief parliamentary distinction in the Tory party; and in 1818 resigned the Irish secretaryship, whose peculiarly exacting labors he had long since found distasteful. He became chairman of the bullion committee in 1819, and on 24 May in one of his great speeches carried resolutions for a return to cash payments, in place of the depreciated paper then in circulation. In so doing he differed somewhat from his party, but established his reputation as a financier. He was made home secretary in 1822; during his tenure of office achieved by five acts, introduced by another notable speech (9 March 1826), an important reform in British criminal law, thus making effective the endeavors of Sir Samuel Romilly and Sir James Mackintosh; and in 1827 retired from the ministry. In 1828 he became home secretary in Wellington's Tory ministry, and leader of the House. He made large retrenchments in expenditures, allowed the importation of corn under a sliding tariff-scale, and by the new metropolitan police act reorganized the London force (thence known as "Peelers" and "Bobbies") after the manner of the Irish constabulary. But the cause of Roman Catholic emancipation had now arrived at a point where the ministry must either support it or resign. For the sake of an expedient settlement of the question, the former course was decided upon, and "Orange Peel" in a speech of more than four hours (5 March 1829) introduced the measure. This change in attitude lost him his seat as representative of Oxford (1829). He relinquished his ministerial post when the Tories were driven from power in 1830, and upon the formation of a Whig ministry became the leader of the opposition. He resisted the Reform bill with much adroitness, and when it had been passed in 1832, organized a powerful opposition in the Conservative party, and by a temperate policy gradually regained for modified Tory principles the influence of which Liberal advance had threatened to deprive him. In 1834 with Wellington he formed a cabinet, becoming first lord of the treasury and chancellor of the exchequer. But in 1835 he was beaten and resigned. In 1841, however, he again became prime-minister as 1st lord of the treasury, and at once proceeded to a thorough reorganization of the finances. In 1842 he carried a tariff measure based on the sliding-scale in operation



since 1828, and in the same year a bill for the imposition of an income-tax. By 1845 a surplus of £5,000,000 had replaced a deficit of £2,000,000. The potato-rot in Ireland and consequent famine made cheap corn a necessity, and the activity of the Anti-corn law league led Peel to declare in favor of the repeal of the laws. Some of his colleagues disagreed, and he resigned; but he was quickly once more in power, and on 27 Jan. 1846 presented the repeal to the House. The measure was passed, but the protectionists brought about his defeat on the Irish coercion bill, and he resigned. He gave a general support to the Whig ministry of Lord John Russell, but on 28 June 1850 made a speech in opposition to Palmerston's interference in the Greek question. Peel was an eminent statesman and parliamentary leader. In many notable ways he furthered justice and practical reforms; and his foreign policy was wise and pacific. He was somewhat noted for private charities, and made an important collection of paintings. Consult Guizot, 'Sir Robert Peel: Etude d'Histoire contemporaine' (1857); Stanhope and Cardwell, 'Memoirs' (1857); Dalling, 'Sir Robert Peel' (1874); and biographies by Montague (1888); McCarthy (1891); Thursfield (1891).

**Peele**, pēl, **George**, English dramatist and poet: b. Devonshire about 1558; d. about 1598. He was educated at Oxford, ultimately settled at London as a writer for the stage, and was also known as an accomplished actor. He was the associate of Nash, Marlowe, and Greene. Of the many dramas of which he was reputed to be the author only a few are certainly known to be his, among these being 'The Arraignment of Paris'; 'The Chronicle History of Edward I.' (1593); 'The Old Wives' Tale' (1599); 'David and Bethsabe' (1599). His blank verse, though often tedious, not seldom rises to something like real grandeur and force, and throughout his works many extremely beautiful lyrics will be found. His works, edited by Bullen, appeared in 1888.

**Peele**, **John Thomas**, Anglo-American artist: b. Peterborough, England, 1822; d. 1897. He early came to the United States, began portrait-painting, but later took up genre-work, in 1846 set up a studio at New York, and in the same year was made a National academician. In 1851 he returned to England, and there he afterward worked. His works number: 'Music of the Reeds' (1857); 'Highland Supper'; 'Village School'; 'A Bit of Gossip'; and 'The Bird's Nest.'

**Peep-o'-Day Boys**, a name given to the Irish revolutionists of 1784. (See ORANGEMEN.) They were so named from visiting the houses of their enemies at daybreak in search of arms.

**Peeper**, a common name for tree-frogs, which make a peeping noise in the early spring, when they go to the water for breeding purposes. The term is especially applied in the Northern States to the small yellowish thin-voiced Pickering's tree-frog (*Hyla pickeringii*), and in the South to a small greenish species (*H. squirella*). See TREE-FROG.

**Peeping Tom**, a common name for an inquisitive person. It was originally "Peeping Tom of Coventry," a person who disobeyed the injunction not to look in the street when Lady Godiva (q.v.) rode by.

**Peepul**, **Pipul**, **Pippul**, **Bo-tree**, or **Sacred Fig**, an East Indian tree (*Ficus religiosa*) of the order *Urticaceæ*. It often attains a height of 100 feet, bears heart-shaped leaves with attenuated points which act as drainage for dew in moist tropical forests. The fruits, which are about the size of a gooseberry, are little used for food. The trees are frequently planted around Hindu temples because tradition says that Vishnu was born under one of these trees, hence their sacredness. Buddhists also revere this tree, and it is a favorite food-plant of the lac insect and is valued on that account also. Its juice is used as bandoline and as a source of caoutchouc. As an ornamental tree it is specially attractive because the leaves upon their long slender petioles move with the slightest breeze.

**Peer and Peerage**. In Great Britain peer signifies a nobleman; in France the term formerly signified those who had a seat in the upper house. The dignity and privileges of peers originated with the growth of the feudal system. In the feudal system the principle was developed that every association should take care of its own affairs, including the judicial decision of disputes among themselves and with their superiors; and it became an obligation as well as a privilege of the vassal to appear at the court of the immediate lord on days of state and of the administration of justice. In France, at the time of the revolution by which Hugh Capet ascended the throne in 987, there were but seven secular princes immediate vassals of the crown. When the Duke of France became king there remained but six, to whom were added the Archbishop of Rheims as spiritual primate of France, and the Bishop of Laon, with the title of duke, those of Beauvais, Noyon, and Chalons, with that of count; and at a later period, under Louis VII., also the Bishop of Langres, because their dioceses were situated within the immediate domains of the crown. The ancient principalities of peers were by degrees united with the crown; only the spiritual lords maintained their titles. The Revolution of the 18th century abolished the French peerage, but Louis XVIII. re-established it after the model of that of England by the charter of 1814. In 1831 hereditary peerages were abolished in France.

In England the peerage originated as in France. This dignity belongs to the five degrees of nobility (duke, marquis, earl, viscount, and baron), by right, which was not the case with the French nobility, though the idea of *mésalliance* does not prevail by any means to the same extent in England as on the continent of Europe. In the beginning all the crown vassals appeared at court on the days of state, and attended the diets; afterward only those who were summoned to appear by writ. This custom grew at length into a rule, and the summonses were considered proofs of hereditary peerage. There is one lordship—the borough of Arundel—which confers the dignity of earl on its possessor by prescription. In regard to all other titles the peerage is personal, and descends in a direct line from male to male. The chief privileges of peers are that of a seat in the House of Lords, of a trial by persons of noble birth in case of indictments for treason and felony, and misprision thereof, and of ex-



## PEER GYNT — PEGRAM

emption from arrest in civil cases. See PARLIAMENT.

**Peer Gynt**, pâr gûnt, a drama by Henrik Ibsen (q.v.), published in 1867, and deriving its title from an old Norwegian folk-tale of the same name. It has been called primarily a satire on the modern Norwegian character, as Ibsen sees it, with its superficial culture and its ineffectiveness. But it may be given a wider application. The central personage, Peer Gynt, passes dissatisfied, through many lands, and at last returns homeward to close his unhappy existence. Edvard Grieg (q.v.) made the drama the basis of a symphonic suite in eight numbers, among the finest of his compositions.

**Peerybingle**, pē'rī-bīng-gl, **Mrs.**, in Dickens' 'Cricket on the Hearth,' the wife of John Peerybingle, a carrier. She is a cheerful little woman, whom her husband calls "Dot." This pet name Dion Boucicault made the title of his dramatization of the story (1862).

**Peet, Harvey Prindle**, American educator: b. Bethlehem, Conn., 19 Nov. 1794; d. New York 1 Jan. 1873. He was graduated at Yale in 1822, and in 1824 became superintendent of the American Asylum for the Education of the Deaf and Dumb at Hartford, the first institution of its kind in the United States. In 1831 he was appointed president of a like institution in New York which position he occupied until 1868 when he resigned. He found the supply of suitable books for use in his work decidedly insufficient and in 1844-6 published 'A Course of Instruction for the Deaf and Dumb' which came into general use.

**Pef'fer, William Alfred**, American lawyer and politician: b. Cumberland County, Pa., 10 Sept. 1831. He was engaged in farming in Indiana and Missouri; forced to leave Missouri on account of his open support of the Union cause he went to Illinois in 1862. He then enlisted in the Federal army, was promoted to the rank of 1st lieutenant, and served as adjutant, judge-advocate, and quartermaster. Mustered out in 1865, he settled in Clarksville, Tenn., and began the practice of law. In 1870 he moved to Kansas, where he continued his law practice, and established the 'Fredonia Journal' and 'Coffeyville Journal.' In 1874 he was elected to the State senate, and was chairman of the legislative committee on the Centennial Exhibition in 1876; in 1880 he was a presidential elector on the Republican ticket. In 1881 he became editor of the 'Kansas Farmer,' in which he advocated government control of railroads, the free coinage of silver, and reduction of the rates of interest, and opposed national banks and monopolies. Through his advocacy of these measures he became one of the founders of the People's Party, and in 1891 was made the president of the national conference of that party at Cincinnati. In 1890 he was elected to the United States Senate on the Populist ticket; during his term he was chairman of the committee on civil service, and was a member of the select committee of woman's suffrage. He subsequently allied himself with the Prohibition party and was their candidate for governor of Kansas in 1898. He has written 'Geraldine, or What May Happen' (1888); 'Peffer's Tariff Manual' (1888); 'The Way Out' (1890); 'The Farmer's Side' (1891); 'Ameri-

canism in the Philippines' (1900) 'Rise and Fall of Populism in the United States' (1900).

**Peg Woffington**, a novel by Charles Reade, published in 1852, and subsequently dramatized under the title 'Masks and Faces.' This delightful tale of 18th century manners opens in the green-room of Covent Garden Theatre, where the Irish actress, Margaret Woffington, in the heyday of her fame and beauty, tricks the entire dramatic company, including Colley Cibber, the famous playwright and comedian, by personating the great tragic actress Mrs. Bracegirdle.

**Peg'asus**, (1) in Greek mythology, a winged horse, the offspring of Poseidon and Medusa, which sprang from the body of the latter when Perseus struck off her head. He was called Pegasus because he was supposed to have made his appearance near the sources of the ocean. (2) In astronomy, the Flying Horse, one of the 20 ancient northern constellations, bounded on the north by Lacerta and Andromeda, on the south by Aquarius, on the east by Pisces, and on the west by Equuleus and Delphinus. It is on the meridian in September at midnight. Alpha Pegasi is Markab, Beta Pegasi is Scheat, and Gamma Pegasi is Algenib. These with Alpha Andromedæ constitute the great square of Pegasus.

**Peggotty**, pēg'ō-tī, in Dickens' 'David Copperfield,' a family name, belonging especially to Clara Peggotty, the faithful nurse of David, who by that endeared surname always addresses her. The other members of the Peggotty family are Clara's brother Dan, a retired sailor, and her nephew Ham, a Yarmouth boatman. With Little Emily and Mrs. Gummidge they all live in an old barge which they have converted into a tolerable dwelling. Clara Peggotty marries Barkis, a country carrier.

**Peg'matite**, a very coarse granitic rock, composed essentially of lamellar feldspar and quartz, frequently with white mica. It is best known commercially from its use in the manufacture of porcelain.

**Pegram**, pē'gram, **John**, American soldier: b. Petersburg, Va., 24 Jan. 1832; d. Hatcher's Run, Va., 6 Feb. 1865. He was graduated from West Point in 1854, appointed to the 1st dragoons, and in 1857 was made 1st lieutenant. He was assistant instructor of cavalry and in 1857-8 accompanied the Utah Expedition. In 1860 he served against the Indians in Mexico and at the outbreak of the Civil War resigned his commission and entered the Confederate army, where he was appointed captain of cavalry. He was captured at Rich Mountain, and after his exchange was appointed chief of engineers under Gen. Bragg in Mississippi, later becoming chief of staff to Gen. Kirby Smith in Tennessee. In 1862 he was commissioned brigadier-general of cavalry, was engaged at Murfreesboro and commanded a division at Chickamauga. He was promoted major-general, transferred to the command of Gen. Early's division in the Army of Northern Virginia, fought in the battle of the Wilderness and against Sheridan in the Shenandoah Valley in 1864. He was fatally wounded in the battle of Hatcher's Run, near Richmond.



## PEGU — PEIXOTO

**Pegu**, pĕ-goo', Lower Burma, (1) ancient Malay kingdom, dating back to the 6th century, when the city of Pegu was built, destroyed in the 18th century, but rebuilt and from 1754 to 1852 a dependency of Burma, and now under British control as (2) a division of lower Burma, with area of 13,083 square miles and population (1901) of 1,818,845, including five states or districts, namely Rangoon, Hanthawadi, Tharawadi, Prome, and (3) Pegu, the largest district of the division, with an area of 4,276 square miles and a population (1901) of 339,942, mostly Buddhists. Rice is the principal crop of the surrounding country. In the district is the famous temple of Gautama Schwema-da, which its priests say is more than 2,300 years old. Rangoon is the largest city.

**Pehlevi**, pā'lē-vē, or **Pahlavi**, pā'la-vē, a sacred language of the Parsees, which succeeded the Zend and preceded the modern Persian. The Zend Avesta was translated into it. The Pahlavi literature and language extended from the 3d to the 9th century. See PERSIAN LANGUAGE AND LITERATURE.

**Pei-ho**, pā-hō', the "North River," sometimes called PAI-HO, the "White River," a river of North China, rising in the mountains on the Mongolian frontier of Manchuria, crossing the line of the Great Wall thrice, flowing tortuously to the southeast, receiving the Tung-hui 12 miles from the city of Peking, and joining the Sha-ho at Tung-shu, where it becomes navigable. Near Tien-tsin the Hu-to-ho empties into the Pei-ho, and a little further down the Imperial Canal also joins this stream, which empties into the Gulf of Pe-chi-li, about 350 miles from its source. At its mouth is the fortified town of Taku (q.v.); near the embouchure the Chinese were defeated by the French and English 19 May 1858, repulsed the English 25 June 1859, and were again defeated, the forts being taken, 21 Aug. 1860 by the allies.

**Peine Forte et Dure**, pān fōrt ā dūr, the name given in Europe to a kind of punishment formerly inflicted upon a prisoner charged with felony if he refused to answer on his indictment. In an indictment for high treason a prisoner who was obstinately mute was liable to receive judgment and execution the same as if he had been convicted. In the lowest felony, or petty larceny, standing mute was also held equivalent to conviction, and the prisoner received sentence and punishment accordingly. But in all other felonies the prisoner was required to plead before a conviction could be obtained, hence if he refused he was subjected to the *peine forte et dure*, "a judgment which was purposely ordained to be exquisitely severe, that by that very means it might rarely be put in execution." The judgment for standing mute was as follows: That the prisoner be remanded to the prison from whence he came, and put into a low, dark chamber, and there be laid on his back on the bare floor, naked, unless where decency forbids; that there be placed upon his body as great a weight of iron as he can bear; and more, that he have no sustenance, save only, on the first day, three morsels of the worst bread; and on the second day three draughts of standing water, that should be nearest to the prison door; and in this situation this should be alternately his daily diet till he an-

swers. The penalty was abolished by George III. There are various cases recorded of persons, including at least one female, who have died under the infliction of this penalty.

**Peipus**, pī'poos (Russian, TCHUDSKOYE-OZERO, that is, "Lake of the Tchuds"), a great lake bordering the governments of St. Petersburg, Esthonia, Livonia, and Pskoff, and belonging in part to each. It is about 50 miles long and 32 wide and is joined by a narrower passage (about 20 miles wide) to Lake Pskoff, with which it has an area of about 150 square miles. The banks are high, and the water very deep in places. There are several islands; Porka is the largest. Several rivers empty into this inland sea, on which there is sailing, commerce, and good fishing. A naval battle between the Russians and Swedes in 1702 was won by the former.

**Peirce**, pĕrs or pĕrs, **Benjamin**, American mathematician: b. Salem, Mass., 4 April 1809: d. Cambridge, Mass., 6 Oct. 1880. He was graduated from Harvard in 1829, was tutor there in 1831, and in 1833 was appointed professor of mathematics and natural philosophy. In 1842 he accepted the Perkins chair of mathematics and astronomy which he occupied until his death. He was consulting astronomer of the 'American Ephemeris and Nautical Almanac' 1849-67; and superintendent of the United States coast survey 1867-74, personally conducting the expedition to Sicily for the purpose of observing the eclipse of the sun in 1870 and organizing various important expeditions. He assisted in the organization of the Dudley Observatory at Albany in 1855, and through his efforts the observatory at Harvard was established. As an astronomer he made valuable investigations and discoveries and as a mathematician his work is of great importance. He prepared a series of mathematical text-books for use in the university which made many departures from the beaten path and which have had a highly beneficial effect upon methods of teaching. His astronomical and mathematical treatises are of great scientific value and include: 'Analytic Mechanics' (1855); 'Linear Associative Algebra' (1870); 'Ideality in the Physical Sciences' (1881); etc. Consult King, 'Benjamin Peirce, a Memorial Collection' (1881).

**Peirce, Benjamin Osgood**, American educator: b. Beverly, Mass., 11 Feb. 1854. He was graduated from Harvard in 1876, studied in Germany, and was assistant instructor in mathematics at Harvard in 1881-4, later becoming assistant professor, and now (1904) occupies the Hollis chair of mathematics and natural philosophy there. He has published: 'Theory of the Newtonian Potential Function' (1899); 'Experiments in Magnetism'; etc.

**Peirce, Charles Sanders**, American psychologist, son of Benjamin Peirce (q.v.): b. Cambridge, Mass., 10 Sept. 1839. He was graduated from Harvard in 1859. He published 'Philometric Researches' (1878); and many memoirs and articles upon psychology, metaphysics, etc., and contributed largely to the 'Century Dictionary' and Baldwin's 'Dictionary of Psychology and Philosophy.'

**Peixoto**, pā-shō'too, **Floriano**, Brazilian soldier: b. Pico, province of Algoas, Brazil, 30



## PEIXOTO — PEKING

April 1842; d. Rio Janeiro, Brazil, 29 June 1895. He entered the army as a private, rose rapidly, gained high honors in the war with Paraguay in 1865-70, and afterward resigned to oversee his estate. The abolition of slavery greatly affected his fortunes and he rejoined the army, assisted Fonseca to overthrow the empire, and was elected a senator of the new republic; acted as first minister of finance, was vice-president in 1891, and succeeded Fonseca as president in that year. In the civil war which ensued he firmly upheld the constitution and, though unpopular with the army, crushed the revolts of De Mello and Da Gama, successfully completed his term, and when defeated by Moraes in 1894 peacefully resigned the office. Consult Luiz Jose Pereira da Silva, 'Floriano Peixoto.'

**Peixoto, Ignacio José de Alvarenga**, Brazilian soldier and poet: b. Rio Janeiro 1748; d. Ambaca, Angola, Africa, 22 May 1792. He was graduated from the University of Coimbra, Portugal, returned to Brazil in 1776 and was there appointed a district judge. He was implicated in a revolutionary uprising, arrested, imprisoned for two years without trial, and on 18 April 1792 was condemned to death. The sentence was commuted to transportation for life and he died a few weeks later in the penal colony at Ambaca, Africa. His poems, which take high rank in Portuguese literature, were collected and published in Paris, 'Obras poeticas collegidas anotadas, precedidas de Juizos criticos' (1866).

**Peixotto, pīks-ōt'ō, Benjamin Franklin**, American diplomat and journalist: b. New York 13 Nov. 1834; d. there 18 Sept. 1890. Receiving his earliest training in New York, he settled in Cleveland after his father's death, in 1847, studying law for a time under Stephen A. Douglas (q.v.). In 1863 he was chosen head of the Order of Benai Berith, the leading Jewish fraternity, whose membership he rapidly trebled. He advocated an American Jewish University which was not favored at the time, but his suggestion to establish an orphan asylum at Cleveland was adopted. In June 1870, when the Rumanian persecution of the Jews reached alarming proportions, he was appointed Consul-General to Bucharest by President Grant, where he succeeded in arresting disorder, with the co-operation of Secretary Hamilton Fish and the active sympathy of the European powers whose representatives in Rumania joined with Peixotto in his work of enlightenment. In addition, he did much educational work among the Rumanian Jews. In 1876 he returned to the United States and was tendered by President Hayes the post of Consul-General at St. Petersburg, which he declined, accepting, however, the consulship at Lyons, France. In 1885 he returned to New York, resumed the practice of law, established the 'Menorah Monthly,' and co-operated in social and educational work.

**Peixotto, Daniel Levy Maduro**, American physician: b. New York 18 July 1800; d. there 13 May 1843. He was graduated from Columbia in 1816 and entering the office of Dr. David Hosack received his M.D. degree in 1819. He became in 1825-6 one of the editors of the New York 'Medical and Physical Journal' and 'Gregory's Practice.' He was president of the New York Medical Society 1830-2. In 1836 he was called to the presidency of the Willoughby

Medical College, Cleveland, Ohio, and remained there several years.

**Peixotto, Ernest Clifford**, American artist: b. San Francisco 15 Oct. 1869. He was educated in the schools of his native city, and displaying marked taste for art studied five years in Paris under Benjamin Constant and Jules Lefebvre. He exhibited in the salons of 1890, 1891, and 1895, and also at the World's Columbian Exposition of 1893. Since 1897 he has done much illustrating for 'Scribner's Magazine' and for many books as well.

**Peixotto, George D. M.**, American portrait painter: b. Cleveland, Ohio, February 1859. He was a son of B. F. Peixotto (q.v.) and on his father's appointment to the Rumanian consulate, he studied at the Dresden Royal Academy of Fine Arts, where he was graduated in 1877. He then went to Paris for further study and now his portraits of Cardinal Manning and Sir Moses Montefiore began to arouse attention, and were followed by paintings of Father Sylvester Malone, Chief Justice M. R. Waite, Bishop Gilmour, Chancellor Eliot of St. Louis, and many others. Mr. Corcoran purchased the portrait of Montefiore for his art gallery at Washington.

**Pek'an, or Fisher**, the largest of North American martens (q.v.); also called black cat. See MARTEN.

**Pekin, pē'kīn**, Ill., city, county-seat of Tazewell County; on the Illinois River, and on the Illinois Central, the Chicago, P. & St. L., the Cleveland, C., C. & St. L., the Atchison, T. & S. F., and the Chicago & A. R.R.'s; about 11 miles south of Peoria. It has steamboat connection with ports on the Illinois River. It was settled in 1829, and in 1850 was incorporated. It is in a productive agricultural section in which wheat and corn are the chief products. In the vicinity are coal deposits. The chief manufactures are ammonia, alcohol, beet sugar, glucose, agricultural implements, wagons, carriages, lumber and lumber products, foundry products, fertilizers, brick, tile, organs, and furniture. It has an extensive trade in corn, and considerable trade in grain, coal, and its manufactured goods. There are good public and parish schools, and a free library. Pop. (1890) 6,347; (1900) 8,420.

**Pekin Duck**, a large, white, heavy duck, weighing in some cases 10 pounds, which was introduced into the United States from China about 1870. It is hardy, easily reared, and profitable as an egg-layer, as well as because of its excellent flesh. The bill and feet are yellow or orange.

**Peking, pē-kīng', or Pekin, pē-kīn'** (*Pe* north; *King*, court), the capital of the Chinese empire, in the province of Chi-Li, on an extensive, barren, sandy plain, between the rivers Pei-ho and Hoen-ho; lat. 39° 54' 13" N.; lon. 116° 27' E. It is about 40 miles from the great wall, 100 miles from the Gulf of Pechi-li, and since 1897 has been connected by rail with Tien-tsin, about 80 miles to the southeast. The entire circuit of the walls and suburbs is reckoned at 25 miles. The wall is 30 feet high, and 25 feet thick at the base, diminishing to 12 feet at the top. It is faced nearly throughout with large bricks, laid in a mortar of lime and



## PEKING

clay, which, in time, becomes almost as durable as stone. Square towers, projecting 50 feet from the outer side of the walls, occur at intervals of about 60 yards, and the whole is surrounded by a ditch. There are in all 16 gates leading into the city.

The city consists of two portions, the north or Tartar city, called Nui-Ching; and the south, called Wai-Ching. The former is built in the shape of a parallelogram, facing the four quarters of the globe, and consists of three enclosures, one within the other, each surrounded by its own wall. The innermost enclosure or area is called Kin-Ching (prohibited or forbidden city), and contains the imperial palace, and buildings connected with it, in which the emperor and royal family reside. It is about two miles in circumference, is surrounded by a solid wall faced with glazed bricks, and covered with yellow tiles. The second enclosure is of an oblong shape, about six miles in circuit, surrounded by a wall about 20 feet high. It was originally intended for the officers of the court, but is now occupied by Chinese merchants and tradesmen. The third enclosure comprises the open city, which presents all the evidences of an industrious people intent on the pursuit of gain, mercantile bustle pervading every corner of it. Many of the principal streets are spacious, being more than 100 feet wide, but they are unpaved, and in rainy weather impassable from mud. Among the principal public buildings besides those already mentioned are the Temple of Eternal Peace, belonging to the lamas, and said to be the largest and most splendid temple in Peking; the Mohammedan mosque; the observatory; the church of Heaven's Lord, with a convent attached to it, considered one of the finest specimens of architecture in the city, but now going to decay. There are also edifices dedicated to several other forms of religion; among these are the Greek and Roman churches, Moslem mosques, Buddhist temples, besides temples dedicated to Confucius and other deified mortals. Among other institutions is the national college, Han-lin-yuen, where all Chinese learning and literature are concentrated, also Manchu, Chinese, and Russian; all religions, though some of them are proscribed, share the honor of being sanctioned within its precincts. The other learned and scientific institutions of note are the medical college, astronomical board, and the imperial observatory. Many of these buildings were injured or destroyed during the siege of the legations in 1900, but are being rebuilt. Peking is sustained solely by its being the seat of government, having no trade except that which is produced by the wants of its vast population. There are no manufactories of any importance, beyond those necessary for making articles of luxury for the resident aristocracy and gentry. The principal part of the provisions required comes from the southern provinces, or from the flocks reared in the northern part of Chi-Li, the adjacent plain producing but a small amount of the food demanded. A considerable portion of the taxes levied upon the productions of the whole empire is paid in kind, and is here stored up; the amount of rice alone in these granaries at one time of the year is enormous; but they are often empty before the new crop is gathered, so that a great many die for want of food. The large establishment of the emperor, and the

numerous persons in the employment of the government, who are paid out of the public revenue, absorb a great portion of the grain.

According to the terms of the Treaty of Tien-tsin (1858) English and French ministers are allowed to reside at the Chinese capital, and subsequently the same privilege was granted to America and some other nations. Foreigners generally are also allowed to visit the city, but they must be provided with a passport from the ambassador or consul of the nation to which they belong, and on no account is any individual allowed to carry on trade. Previous to the ratification of that treaty, Russia was the only foreign power privileged to have a resident embassy. Besides the old established Roman Catholic missions there are six other Christian missions—four British, one American, and one Russian. Of the native population a more correct estimate has been obtained since our countrymen have had free intercourse with the inhabitants; at the same time it is only approximate, in the absence of a native census. The Tartar section of the city is calculated to contain 800,000 civilians and 110,000 soldiers, of the Tartar Banner corps; and the Chinese section about 400,000 persons; making a total, in round numbers, of 1,310,000. The Pekingese have more of the Tartar element among them than the inhabitants of any of the more southern cities of China; still the Chinese predominate, and they are gradually superseding their fellow-subjects by their greater industry and wealth. Even the old Tartar Banner corps is being dispersed.

Peking is more healthful than the more southern cities, although the range of temperature is much greater. This arises from the comparative dryness of the site, so that, although the thermometer falls to 10° below zero in the winter, and rises to 110° in the shade in summer, less inconvenience is felt than in Shanghai, where intense humidity prevails at a lesser range. A rude system of drainage intersects the city, but not sufficient to carry off the effluvia of the sewage, which even pervades the dust in summer. Attempts at modern sanitation have been made since 1900, but the progress is slow. The water supply is abundant, and a very complete fire brigade uses it to advantage in quenching the frequent conflagrations that take place. These and other matters are under the management of a governor of the city, irrespective of the central administration, which holds its offices in the imperial quarter of the Tartar section.

Peking is regarded by the Chinese as one of their most ancient cities. It was besieged and taken by the Mongols, led by Genghis Khan, when the inhabitants, for want of ammunition, are said to have discharged ingots of gold and silver on their assailants. Kublai Khan rebuilt it, and made it his capital in 1260. The Mongol dynasty, founded by Kublai Khan, continued to occupy this city till it was expelled from China, in 1367. In 1421, the third emperor of the Chinese dynasty of Ming transferred his residence thither from Nankin, since which it has been the capital of the empire. It surrendered to the allied armies of France and England in 1860, on which occasion the Yueng-ming, or summer palace of the emperor, situated in the vicinity of the city, was destroyed. During the "Boxer"



## PEKING

uprising of 1900 the various foreigners in Peking were besieged in the English legation. For weeks they were given up as lost, but they managed to hold out till the arrival of the foreign troops. See BOXERS; CHINA.

**Peking, the Siege in.** The siege in Peking in 1900 was the outgrowth of the Boxer uprising. The latter was a secret society formed, at first, for the suppression of lawlessness. This aim was altered later and the Boxers banded themselves together anew for the extermination of foreigners and the prevention of foreign intercourse with China. In 1808 the empress dowager, Tse Hi, by a *coup d'état* made herself the ruling power, holding the young reform emperor, Kwang Hsü, a semi-prisoner. The Dowager represented the reactionary forces of the Empire. The rise of the Boxers against foreigners in 1899-1900 was due to the encouragement of the Empress Dowager and her coterie who opposed the reforms of Kwang Hsü.

The Boxer movement was not a great anti-religious uprising, nor was it an anti-missionary crusade. It was distinctly anti-foreign, and this, irrespective of race, color, religion or nationality. The Boxers murdered European merchants, killed foreign engineers, massacred British and American missionaries, one and all, for the same reason, namely, that they were foreigners. Native Christians fell under their ban and were put to death by thousands because they were representatives of the new forces that had instituted the reforms of the young Emperor. The feeling against anything and everything foreign ran so high in the city of Peking that native shops were destroyed for selling American cottons or Japanese lamps.

All this time the rumor was spreading that the Empress was lending her aid to the Boxers in the hope that, instituting a reign of terror, all foreigners might be driven out of China. Many Chinese saw in this only disaster to the Government, but even members of the Tsung Li Yamen (Foreign Office) were put to death when they opposed this insane policy of exterminating foreigners. This fact, together with documents found in Peking, shows beyond question the complicity of the Chinese Government in bombarding the legations. In May 1900 seven of the eleven legations, fearing mob violence, secured from their respective navies detachments of marines as legation guards. This force was less than 500, but in addition, there were probably 450 foreigners in Peking. By June the anti-foreign element was in possession of both the executive and military arms of the Empire. The end of the first week found a critical state of affairs in Peking. The telegraph had been cut, the railroad to the port city of Tientsin had been rendered useless, and all foreigners in and near Peking had fled from their homes and banded together in several places for self protection. During this time dangers thickened, foreign property was looted and burned, while thousands of native Christians and foreign sympathizers fell by the sword. Matters reached a crisis on the 19th of June when the Chinese Government sent word to the legations that all the foreign diplomats and their attachés should leave Peking within 24 hours. This was the beginning of the siege proper. The morning of the 20th, Baron Von Kettler, the German minister, while on his

way to the foreign office to expostulate against this treatment of the representatives of friendly powers, was shot down on the streets of Peking by Imperial soldiers. The Chancellor of the Japanese legation had met a similar fate a few days before.

Upon the news of the murder of Baron Von Kettler, the other ministers and their nationals who were preparing to leave the city decided that it would be impossible to make a journey of nearly 100 miles through hostile territory infested by bands of Boxers and Chinese troops. Certain massacre would have followed had the foreigners left the walls of Peking and exposed themselves to the attacks of the Chinese in the open country. Rather than take such a perilous journey, fearing the fate of Baron Von Kettler, the foreigners massed together in the British Legation, and the legations immediately surrounding it, and decided to try to hold out until relief should arrive. Fortunately, the legations in Peking, after Oriental style, were surrounded by strong walls. Withdrawing within this enclosure, supplying themselves with what food they could procure, they fought only on the defensive. Three thousand native Christians went into siege with this handful of foreigners. In round numbers, there were 900 foreigners, including marines, in the legations. Of these, 228 were women and children. In addition, there were the 3,000 native Christians. Besides those in the legations, 41 marines, 13 French fathers, 20 sisters and 3,200 natives were besieged in the North Cathedral. The foresight of Bishop Favier had laid in food for his refugees. Sir Claude McDonald, British Minister, was commander-in-chief of the legation forces. This little band for 56 days held at bay an unknown multitude of Chinese soldiers. Firing was almost continuous upon the legations for 28 days, when a semi-truce followed until about 10 days before the relief forces arrived. The first effort of the Chinese was to set fire to the legations. Dangerous conflagrations were fought day and night until the legations themselves stood in the midst of charred ruins. The great Hanlin library was fired by the Chinese in an effort to burn the British legation. The besieged had only, beside their rifles, one cannon throwing a one-pound shell, a Nordenfeldt, a Colts, some more rapid-fire guns and an old English cannon of 1860.

As many as 400 shells and solid balls were thrown at the legations in a single day. Forty-three days of the siege were filled with the hail of bullets and the crash of shells. The Chinese soldiers indulged by night in furious attacks of rifle fire. Major Conger, the American Minister, said that never had he heard during the Civil War a half hour of such fusillades of firing as these night attacks. Only the bad marksmanship of the assailants prevented the annihilation of the besieged. Yet every hour witnessed miraculous escapes. From the beginning the siege was well organized. In addition to the military, there were the following committees: (1) general management, (2) fortifications, (3) food supply, (4) labor, (5) fire, (6) confiscated goods, (7) on care of the horses, (8) sanitary and hospital. Constant effort was made by native messengers to reach the port with news. Out of 20 messengers dispatched, 17 were killed—three reached Tientsin. The besieged subsisted on rice, wheat, horses and



## PELADAN — PELAGIANISM

mules. In many cases the native besieged became reduced in rations until they ate dogs. Fortunately the wells of water held out. The heat was often great. Smallpox, scarlet fever, diphtheria, and dysentery especially, broke out in the native camp, but were held in check. Only one foreign infant out of seven survived. Marines and civilians vied with each other in the display of bravery. The mortality among officers was large. Capt. Thomann (Austrian), Capt. Ando (Japanese), Capt. Strouts (British), Capt. La Bruce (French), Lieut. Henry (French), Lieut. Paolini (Italian), were killed. Two British, two American, three Austrian, one Russian, one French, and two Italian officers were wounded. The Belgian and American captain-surgeons were wounded, and the Japanese surgeon was killed. Among the defenders almost 50 per cent were killed or wounded. At the cathedral 400 natives and foreigners were killed. The American marines held a perilous position on the city wall, reinforced by British and Russians. Seventeen languages were represented among the besieged.

The Siege of Peking is without a parallel in history. Never before were the representatives of a friendly power brought to such straits by a nation to whom they had been accredited. Diplomats, missionaries, merchants, business men, teachers in the schools, and even an Englishman who was in the capital as a guest of the Chinese Government, were penned up in a state of siege and saved themselves only by the valor of a handful of marines, their own pluck and the assistance of the Chinese Christians. Most of the French, the Austrian, Italian, Dutch and Belgian legations were entirely destroyed. All the others, while held, were almost demolished by the terrific bombardment. On 10 June an effort had been made at Tientsin by 2,000 internationals under Admiral Seymour (Br.) and Capt. McCalla (U. S.) to reach Peking. After getting half way and enduring terrible hardships this force had to retreat to Tientsin. The latter place itself was shelled for 30 days. On 4 August about 20,000 allies under Generals Gaselee (British), Chaffee (U. S.), Fukushima (Japanese), Linievitch and Vassielevsky (Russian), and Frey (French) left Tientsin and after a terrible march of 10 days reached Peking. Every mile of the way they drove the Chinese forces before them.

The allies attacked the city early the morning of the 14th and the same afternoon a detachment of Sikhs and Bengal Rajput Infantry under Gaselee reached the British Legation. These were soon followed by the 14th U. S. Infantry and the other nationals. A thanksgiving service marked the close of the siege. The *Te Deum Laudamus* was read by the chaplain of the British Legation.

The siege in Peking adds one more chapter to the conflict between the East and the West. Many of the underlying causes will ever remain obscure. The siege represented, what is to be hoped, is the final effort of the old China to crush the rising influences of the new. The patience and faith of the women were exemplified under circumstances few have ever had to endure. That the foreigners besieged should ever have escaped is one of the miracles of history. It shows what a small band of men driven to bay, can do with few resources and against overwhelming odds.

*Bibliography.*—Headland, 'Chinese Heroes'; Landor, 'China and the Allies'; Martin, 'The Siege in Peking'; Matter (Mrs. Calvin), 'Siege Days'; Morrison, 'Letters to the London Times'; Smith, 'China in Convulsion.'

JOHN INGLIS, A.M., M.D.

**Peladan**, pā-lā-dän, **Joséphin** ("LE SAR"), French mystical writer: b. Lyons 1858. He became an eccentric and mystic, took the title of "Sar" (chief), posing as a descendant of the last Babylonian kings, and went about in theatric costume. Among his writings are 'Rembrandt' (1881); 'Introduction à l'Histoire des Peintures' (1884), and a romantic cyclis 'Décadence Latine' (1886 et seq.), a mixture of astrology, mysticism, and esotericism, which includes 'Le vice suprême' (1886); 'Curieuse' (1886); 'L'initiation sentimentale' (1887); 'A cœur perdu' (1888); 'Istar' (1888); 'La victoire du mari' (1889); 'Cœur en peine' (1890); 'L'Androgyne' (1890); and 'Le Gynandre' (1891). Apart from this cyclis are 'Femmes honnêtes' (1885); and 'La décadence esthétique' (1888). He was the founder, in 1892, of the order of La Rose Croix, or Croix du Temple, which, similar to the English Pre-Raphaelite movement several years before, was in reality a reaction against the material side of French art. The cult had great vogue for several years, as the Geste Esthétique salons were held by the Rosicrucians, which promulgated his views and gave lectures and plays written by the Sar Peladan.

**Pelagianism**, pe-lā'ji-an-ism, a heretical doctrine in regard to original sin taught by Pelagius, a Welsh monk of the latter end of the 4th and beginning of the 5th century. His name, Morgan, was Latinized into *Marigena* (sea-born), and rendered into Greek by Pelagius (from *pelagos*, sea). He was in Rome about the year 400. He learned his opinions from the monk Rufinus, a follower of Origen. Pelagius was a contemporary of Augustine, who was influenced by his opposition to Pelagianism in expounding his own views on the subject. According to Pelagius, the sin of Adam was not transmitted to his posterity; it was possible for man to live altogether without sin; grace, that is, the divine aid, was not necessary or even possible to the human will. The Pelagians generally affirmed that Adam was born subject to death; that every child was born in the same state of innocence as Adam was, and that his perseverance in virtue depended upon himself; original sin was an impossibility, since sin was the result of a depraved volition, not an infirmity of nature. A *peccatum naturale*, as they called it, was a confusion of terms, and a contradiction; infant baptism was administered to sanctify and admit children to the kingdom of Heaven, not to remove the stain of sin, because infants had none; unbaptized infants dying in infancy have eternal life; and men may attain Heaven through a righteous life, that is, by keeping the law, as well through the Gospel, some men having lived without sin, while others may. Augustine, opposing these views, maintained that Adam's sin affected the human race, involving all mankind in guilt; physical death is the penalty of sin; infants are baptized for the remission of original or inherited sin, and Jesus Christ was the only sinless man who has appeared upon the earth.



## PELAGIANS -- PELARGONIUM

Between 412 and 431 A.D. 24 councils were held to condemn the Pelagian doctrine. The pope confirmed the sentence of the Third General Council at Ephesus (431), and anathematized the Pelagians. Pelagius was expelled from Jerusalem (421) and found refuge with Nestorius at Constantinople. According to tradition his death occurred in Palestine at the age of about 70 years. Among his writings are works 'On the Trinity'; 'On Free Will'; a 'Commentary on Paul's Epistles,' supposed to exist in a revised form among Jerome's works; 'Eulogiæ,' a collection of Scriptural extracts for use as an aid to Christian living; the creed which he submitted to Bishop Zosimus, a letter to Demetrius on asceticism; and various fragments. See ORIGINAL SIN; AUGUSTINE, SAINT.

**Pela'gians.** See RELIGIOUS SECTS.

**Pelag'ic Animals,** animals whose life is spent in mid-ocean, either near the surface or at various depths. Some, as the pelagic birds (albatrosses, petrels, and the like), may come to shore to make their nests; but many forms are to be found nowhere except in the open sea. See DEEP-SEA EXPLORATION; GLOBIGERINA; OOZE; PLANKTON; etc.

**Pelagic Sealing,** a term applied to the taking or capturing of seals in the open sea. According to the Paris Award of 1893, pelagic sealing within a zone of 60 miles of the Pribyloff Islands was forbidden. See BERING SEA CONTROVERSY: FUR TRADE, THE.

**Pelagius I.,** pe-lā'jī-ūs, pope: b. Rome; d. there 3 March 560. He represented Pope Vigilius at Constantinople, won the favor of the Emperor Justinian, and as the choice of the emperor succeeded Vigilius in the papal chair in 555. Only two bishops and a presbyter assisted in his consecration, and the refusal of many bishops to accept the decrees of the 5th œcumenical council, which Justinian had convened in 555 upon the monophysite controversy, made his pontificate a period of trouble and dissension. He endeavored to reform the clergy; and when Rome was besieged by the Goths, he obtained from Totila, their general, many concessions in favor of the citizens.

**Pelagius II.,** pope: b. Rome; d. January 590. He succeeded Benedict I., in 577, and was the first independently elected pontiff following the Byzantine conquest of 536. His most trusted counsellor was Gregory the Great who succeeded him.

**Pelagius,** originally **Alvarez Paez,** celebrated Portuguese prelate and ecclesiastical jurist: b. about 1280; d. Seville 1352. After receiving the degree of doctor at Bologna, where he had studied theology and canon law, he went to Paris to continue his studies under the famous Scot. His talents and the purity of his life recommended him to John XXII. of Portugal, who appointed him grand penitentiary to supervise and remedy the abuses and immorality that prevailed among the clergy. In 1332 Pelagius became bishop of Coron, and subsequently bishop of Silves and papal nuncio to Portugal. Among several treatises on theology and canonic law from his pen are 'Summary of Theology'; 'De planctu Ecclesiæ libri duo' (1474), a highly esteemed treatise, in which he

establishes the spiritual and temporal rights of the papacy, and vigorously attacks the disorderly clergy; and also a notable 'Apology of John XXII.'

**Pelagonius,** a Greek veterinary surgeon who lived in the 4th century. Numerous fragments of his writings are found in Greek veterinary collections, and in the 'Geoponiques.' A Latin work with an Italian translation, published at Florence in 1826, is entitled 'Pelagonii veterinaria ex Richardiano codice excerpta et a mendis purgata.' It contains numerous formulæ for veterinary remedies, which probably form a collection of different veterinary fragments, but chiefly those of Pelagonius.

**Pelargon'ic Acid,**  $\text{CH}_3(\text{CH}_2)_7\text{COOH}$ , normal-nonoic acid. A monobasic acid, belonging to the acetic acid series, present in the leaves of the *Pelargonium roseum* and in the fusel oil from the beet-root. May be prepared in the laboratory by oxidation of oleic acid or oil of rue; a viscous oil at ordinary temperatures, becoming solid when cooled; boils with decomposition at  $254^\circ \text{C}$ .

**Pelargonium,** a genus of shrubs and shrubby perennial herbs of the order *Geraniaceæ*. About 170 species have been described, mostly natives of South Africa, whence some of them were introduced into European gardens during the latter part of the 17th and early part of the 18th century. Under the popular name geranium some of the species and their innumerable varieties and hybrids have long been popular garden, greenhouse and house plants, because of their fresh green or otherwise colored fragrant leaves, their bright, usually red or white flowers and free blossoming habits, and for the ease with which they may be propagated and cultivated. Though the flowers vary little in form, except double varieties, they exhibit great diversity of color, markings, and size. And on this account and because of the various markings of the foliage the cultivated species, their hybrids, and varieties are arranged for convenience into various groups of which those to be mentioned are the principal. Zonal, horseshoe, bedding, or fish types, popularly known as "geraniums," which appear to be the progeny of *P. inquinans* and *P. zonale*, are popular wherever ornamental plants are grown, but especially in the United States, where they thrive admirably in the hot, dry, sunny climate, and probably outnumber any other house and home-garden plant in America. A subdivision of this group has double flowers, but is less popular than the single-flowered forms because of their unkempt appearance. Ivy-leaved "geraniums" are derived from *P. peltatum*, a species which is said to have appeared in Great Britain in 1701. The plants are rather scraggly, but are popular for window-boxes, hanging-baskets and such things. The thick leaves are conspicuously angled, the flowers usually often double pink, and of pleasing tints. Rose "geraniums" are derived from various species; for instance, *P. radula* and *P. graveolens*. These are grown for their scented foliage. *P. odoratissimum*, the nutmeg geranium, belongs to this group.

The fancy types which gardeners call "pelargoniums," or Lady Washington geraniums, are less grown in America than in Europe, where they have an immense number of varieties and figure



## PELASGIAN ARCHITECTURE — PELEE ISLAND

prominently not only in flower shows but in home gardens. The hot American summers seem to be against them; but they are somewhat cultivated in greenhouses. The species from which the group is derived are not definitely determined, but *P. cucullatum*, *P. angulosum*, and *P. grandiflorum* are all thought to be blended more or less. There are also several species which are cultivated under their specific names, but none are as popular as the above.

As a rule the plants are propagated by means of cuttings rooted under glass during spring and potted in good loam. When the weather has become settled in the spring the plants are removed to the garden where they are allowed to remain until danger of frost when they are dug up, such cuttings taken as are needed, and the plants potted for winter bloom or for stock. They may be stored in straw or hung from the ceiling of a dry cellar until wanted. Some of the kinds must be more carefully managed; but the common, popular ones can be "mismanaged" more satisfactorily than probably any other plant.

**Pelas'gian Architecture.** See CYCLOPEAN WORKS.

**Pelasgians**, pe-lās'jī-anz, an Indo-Germanic race which in prehistoric times was spread over Greece, Asia Minor, and Italy. It has been suggested that the name does not represent a distinct race, but is merely an epithet, like *autochthones* or *aborigines*.

The Pelasgi are mentioned by Homer as dwelling in Argos and in Epirus; by Hesiod with Dodona as their seat. Herodotus says they worshipped all the gods at Dodona without giving a name to any. Strabo speaks of them as formerly spread over the whole of Hellas. There are also accounts of their inhabiting Bœotia and Attica. Herodotus mentions their non-migratory habits. Various accounts are given of their expulsion from Athens. Thucydides refers to Pelasgic as a word common among the Greek tribes before the use of the term Hellenic. Herodotus also says it was thus applied among the Athenians. They are mentioned by various writers from Homer downward as occupying islands in the Ægean. Herodotus enumerates 17 islands on the coast of Asia as belonging to them. They inhabited in his time the cities of Scylace and Placie on the Propontis, and spoke a language different from Greek.

Italian accounts of the Pelasgi are vague and difficult to reconcile. The Pelasgi are supposed here to have given to the Latin language the element it had in common with the Greek. Bishop Thirlwall interprets the reference of Herodotus to the language of the Pelasgians as signifying that they spoke a language differing from Greek as a remote but cognate branch of the same stock. Grote holds that Herodotus meant that the language they spoke was not Greek at all.

Niebuhr regarded the migrations of the Pelasgians as mythical, while he held that they inhabited all the countries from the Po to the Bosphorus, and supplying a common foundation to the Greek and Latin languages. The supposed Pelasgian migrations are, he believed, only the scattered fragments of this once united people, whose greatness he places in prehistoric times. Other writers, such as Grote, receive the

entire tradition of the Pelasgians with skepticism. Remains attributed to the Pelasgi are found in Italy, Greece, and Asia Minor, and their diffusion hardly accords with the notion of their being the works of a single people, so as to form an independent testimony to the otherwise doubtful existence of a race by whom they might have been executed. These remains belong to the style of architecture called Cyclopean. See CYCLOPEAN WORKS.

**Pelayo**, pā-lā'yō, a historical personage who is supposed to have been successfully the first Christian king of Spain. He appears to have withstood the Arabs in Asturias (q.v.) in the 8th century.

**Pelecypoda**, pēl-ě-sīp'ō-dā, or **Lamelli-branchiata**, the class of *Mollusca* which are distinguished externally by the possession of shells in two parts or "valves." They are the bivalves, and include the clams, oysters, cockles, mussels, shipworms, and similar forms. See BIVALVES; MOLLUSCA, and the names of various groups and species.

**Pelée, Mont**, mõnt pē'lē (Fr. mõn pā-lā), Martinique, West Indies, an active volcano in the northwestern part of the island, noted for its eruptions in 1902, that of 8 May destroying the town of St. Pierre (q.v.), and nearly 30,000 people, and that of 30 August destroying Morne Rouge, Ajoupa-Bouillon, and other localities, with a loss of about 2,500 persons. Previously recorded eruptions were those of 1762 and 1851.

Prior to 1902 the mountain was characterized as a lofty, solitary peak about 4,600 feet high with gradual slopes. Its crater was about one and a half miles in circumference and had a depth of from 1,000 to 2,000 feet below the level of the crater rim. On the southwest side the crater rim was breached to the base by a great gash which continued into the gorge of the Rivière Blanche; over 20 other ravines and waterways indented the mountain slopes. Within the great crater lay L'Etang Sec, a small crater lake. Since the eruptions of 1902 the crater has increased in width toward the east, south, and southwest, the tuff walls on the east and south are almost if not quite vertical, while the V-shaped gash in the southwestern rim is wider and the southern side of it has been cut away and is now filled by volcanic debris. Over 180 feet of the summit was blown away, and the crateral basin L'Etang Sec disappeared, but from it an enormous obelisk of polished rock with a basal thickness of 300 to 350 feet has extruded to a height of 1,600 feet or more, towering above the lowest portion of the present crater rim 475 feet, and giving Mont Pelée a varying altitude of from 5,100 to 5,140 feet as the extrusion continues and fragments break away from its summit. Profs. Heilprin, Giraud, Sapper, Hovey, and Lacroix, among the scientists who made personal observations of the volcano, its operations, and changes, confirm the theory advanced by Lacroix that Mont Pelée is to be classed as a cumulo-volcano. (See MARTINIQUE.) Consult Heilprin, 'Mont Pelée and the Tragedy of Martinique' (1903).

**Pélée** (pē'lē) **Island**, an island in Lake Erie, lying off the southwestern coast of the province of Ontario, Canada, south of Point Pélée. It is a part of Essex County. It is



## PELEG ARKWRIGHT — PELICAN

nine miles long, and from three to four miles wide. Its chief product is grapes, and it also has some timber land; the sand on the shores is used for building.

**Peleg Arkwright.** See PROUDFIT, DAVID LAW.

**Pele'ides**, in Greek mythology, a son of Peleus. See ACHILLES.

**Peleus**, pē'lūs or pē'lē-us, in Greek mythology, the king of the Myrmidons, and the father of Achilles (q.v.).

**Pelew** (pě-loo') **Islands**, a group of 26 small islands lying to the west of the Caroline group, and sometimes considered a part of this group; area, 190 square miles. Six of them are inhabited; the largest island is Babelthuat, in the northern part of the group, 24 miles long. The islands are hilly, heavily wooded, and completely surrounded by coral reefs. The soil is fertile, and sugar, bread-fruit, tobacco, bananas, oranges, and other fruits are raised. Tortoise shells and mother of pearl are also obtained. The people are of Malay race and are ruled by a king who resides on the island of Korrör. They are a primitive people and have a number of interesting social customs which make an important subject of ethnological study. These islands were discovered by Spaniards in 1545 and were held by Spain until 1899 when they were sold to Germany with the Caroline and Marianne Islands (except Guam). Pop. 3,000.

**Pelham**, pěl'am, **Peter**, English mezzotint-engraver: b. England about 1684; d. Boston, Mass., December 1751. Data concerning his early life is not obtainable, but he was probably born at Chichester and some authorities fix the date of his birth about 1694. His first plate is dated 1720 and in 1726 he came to Boston, where he established a school in which painting, reading, writing, dancing, and needlework were taught, at the same time continuing his engraving. He was the earliest artist resident there and his portrait of Cotton Mather (1727) was the first mezzotint engraving produced in America. He was stepfather to John Singleton Copley (q.v.) and his first instructor in art. Among his subjects are: George I.; Queen Anne, after Kneller; Oliver Cromwell, after Walker; Rev. John Moorhead (1731) Governor Shirley, after Smibert (1747); Rev. Edward Holyoke, after Highmore (1749).

**Pelham**, or **The Adventures of a Gentleman**, a novel by Bulwer-Lytton, appeared anonymously in 1828. It belongs to the writer's initiatory period, being the first work of his that gave promise of his ability.

**Pelham-Holles**, **Thomas**, 1st Duke of Newcastle. See NEWCASTLE, THOMAS PELHAM-HOLLES, 1ST DUKE OF.

**Pelias**, pē'lī-as, in Greek mythology, the son of Poseidon and Tyro. He drove his stepbrother Æson from the throne of Iolcus. He was killed and his body dismembered and boiled, by his own daughter, at the instance of Medea; according to another form of the myth Medea killed him.

**Pelican**, a web-footed bird of the genus *Pelecanus*, order *Steganopodes*. The pelicans form a distinct family (*Pelecanidæ*) easily distinguished by the great membranous pouch

which is attached to the throat and hangs from the rami of the long lower mandible. The upper mandible is straight, very long and sharply hooked at the end. Pelicans are large birds, with very long wings bearing numerous quill-feathers, and great powers of flight. As in some related birds the pneumatic system is wonderfully developed, extensions of the anterior air-sacs passing beneath the skin and there developing into an extensive area of subcutaneous air-cells. Six or eight species of pelicans are known which inhabit most tropical and temperate parts of the world. Three of these are American. The American white pelican (*Perythrorhynchus*) is abundant along the Gulf coast and, in the interior, in the Mississippi Valley and westward, far into Canada, and is common on the coast of California; elsewhere in temperate North America it is rare. With the exception of the black primary wing-quills and neighboring parts, the plumage is entirely white. In the breeding season the beak of the male develops a rough horny crest which is subsequently moulted. This species often lives in great communities, especially during the breeding season. The only nest is a rude heap of earth and trash, on which a single egg with a thick, chalky, white shell is deposited. The flight is easy, graceful and sustained; and when feeding they skim the surface of the water or dive beneath it, and scoop up small fishes in the net-like pouch, and, after draining the water off, swallow them. Contrary to a popular notion, the young are fed on fish regurgitated from the crop, and not upon living fish carried in the pouch. Unlike the white pelican, which frequents the shores of lakes and rivers, as well as the sea, the brown pelican (*P. fuscus*) is strictly maritime on the Atlantic coast of tropical and subtropical America. The general color is mottled brown, and there is no crest on the beak. In feeding this species plunges on its prey from a height, thus differing from other pelicans. Two or three eggs are laid in a coarse nest of sticks placed on the ground or in trees. The general habits resemble those of the white pelican. The California pelican (*P. californicus*) is the representative on the Pacific coast of the brown pelican, which it closely resembles. In Europe are found a white pelican (*P. onocrotalus*) lacking the rostral crest, and a larger and rarer species (*P. crispus*). Other species of similar habits occur in Australia, Asia and Africa.

The pelican is the Hebrew Kâath, and from the fact of its resorting to the most lonely places it is used in the prophecies and psalms as an emblem of solitude and desolation. Popular fancy has ascribed the red tip at the end of its beak to blood drawn from its own breast for the nourishment of its young; hence in ecclesiastical symbolism it represents the church feeding her children with her life. Thus the pelican early found a place in Christian art, and like the fish and the peacock has been emblazoned in windows and mosaics, carved in stone and wood, and enameled in crimson and white on chalices and sacred vessels. Its highest symbolic significance was reached when it was used as an emblem of Christ whose blood was poured out for mankind. There are traces of this symbolism in the litanies and hymns of the ancient church, as well as the creations of art. Consult: Twining,



## PELICAN-FISH — PELLAGRA

'Symbols and Emblems of Christian Art' (1886).

**Pel'ican-fish**, a fanciful name given to the deep-sea fishes of the families *Eurypharyngidæ* and *Saccoramphidæ* (specifically *Eurypharynx pelecánoides*), representing a distinct group (*Lyomeri*, the gulpers). These rare fishes have an eel-like body, reaching at least six feet in length, four fifths of which is tail, and an extraordinary structure probably derived from some eel-like ancestor. The bones, especially of the head, are very soft and elastic, and the throat and stomach are capable of great distension, so that some of these creatures may swallow a fish as large or larger than itself. The attempts of the saccoramphus to exceed even that limit have resulted in our only knowledge of its family, the few specimens known being those found floating dead with a fish in the pouch too large to be disposed of. Consult Goode and Beau, 'Oceanic Ichthyology' (1895). See DEEP-SEA EXPLORATION.

**Pelican Island**, an island off the east coast of Florida, in Indian River, so called because brown pelicans breed there. Desiring to prevent the extinction of the birds, the Audubon Society tried to gain possession of it, but failed to accomplish their purpose on account of the large amount of litigation involved. In 1903 the United States Government took possession and the secretary of agriculture established a government aviary there, this being the only effective method to guard against the total extinction of the pelicans.

**Pelican State**, a popular name for the State of Louisiana.

**Pelican's Foot**, a mollusk. See SPOUT-SHELL.

**Pelion**, pē'lī-ōn, Greece, now Mount Plesidi. See OSSA.

**Pelissier**, pā-lē-sē-ā, **Jean Jacques Anable**, Duke of Malakoff, marshal of France: b. Maromme, near Rouen, 6 Nov. 1794; d. Algeria 22 May 1864. Educated at the military school of St. Cyr, he entered the army in 1815 as sub-lieutenant of artillery, subsequently serving in Spain in 1823, in the Morea in 1828-9, and in Algeria. In this country, being now a colonel, in 1845 he suffocated in a cave some 600 Arabs who had taken refuge in it, by lighting a fire at the mouth, an atrocity which aroused great indignation; but Bugeaud, commander-in-chief, declared that Pelissier had only obeyed positive orders. On the capture of the Malakoff and the fall of Sebastopol he was appointed marshal of France and made Duke of Malakoff. He was afterward vice-president of the senate, a privy-councillor, and ambassador to England (1858). In 1860 he was appointed governor-general of Algeria.

**Pell**, **John**, English mathematician: b. Southwick, Sussex, 1 March 1611; d. London 12 Dec. 1685. Educated at Cambridge he became professor of mathematics at Amsterdam in 1643 and in 1646 at Breda, while from 1654 to 1658 he was the agent of Cromwell to the Protestant cantons of Switzerland. In 1661 he took orders in the English Church and was rector of Fobbing, and vicar of Laindon, Sussex, till his death, but was more efficient in his mathematical endeavors than in his clerical labors. To him is

frequently attributed the invention of the symbol of division  $\div$  but the credit of this is in reality due to Rahn, whose work, which Brancher had translated, was edited by Pell in 1688. Among his works are: 'Astronomical History of Observation of Heavenly Motions and Appearances' (1634); 'Ecliptica Prognostica' (1634); 'A Table of Ten Thousand Square Numbers.'

**Pel'la**, (1) a city of ancient Macedonia in a marshy lake formed by the river Ludias; a royal city in the 5th century, when it was Archelaus' capital, it was remodeled by Philip II. and was the birth-place of Alexander the Great, the site of a splendid castle adorned with paintings by Zeuxis and of a cenotaph of Aristotle, and in Roman times was the central military station for the province. It is identified with the modern Palatitza, where excavations of importance (described in Hauzey and Daumet, 'Mission archéologique en Macédoine' 1876) have been made. (2) A city of Palestine, east of the Jordan, famous as the refuge of the Christians of Jerusalem when that city was taken by the Romans (67 A.D.), and identified with Tabakat Fahil.

**Pel'lagra**, a dreaded disease, or complication of diseases, first observed about the beginning of the 19th century, and which since that time has been rapidly increasing. It is common in northern Italy, in the south of France, in Spain, and in countries further east in southern Europe. It begins with an erysipelatous eruption on the skin, which breaks out in the spring, continues till the autumn, and disappears in the winter, chiefly affecting those parts of the surface which are habitually exposed to the sun or air. The disease is accompanied or preceded by remarkable lassitude, melancholy, moroseness, hypochondriasis, and not seldom by suicidal mania. With its progress and duration the disorder becomes more aggravated, with shorter and shorter intervals in the winter. At length the surface ceases to clear itself, and becomes permanently enveloped in a thick, livid, leprous crust, somewhat resembling the dried and black skin of a fish. By this time the vital powers are reduced to a very low ebb, and not seldom the intellectual functions as well. The victim loses the use of his limbs, especially of the legs, suffers with violent colic, headache, nausea, flatulence, and heartburn, the appetite being variable. The countenance becomes void of expression. There is a sense of burning heat in the head and along the spine, whence it radiates to other parts, especially to the palms and soles, tormenting the victim day and night. To these severe afflictions are often added strange hallucinations. The disease, when advanced, takes the form of many other maladies, such as tetanus, convulsions, epilepsy, dropsy, mania, and marasmus, the patient being at last reduced to the appearance of a mummy. It is mainly confined to the poor residing in the country districts, and is seldom seen in very young children.

The cause of this disease is traced to the eating of altered maize, in which a putrefaction occurs during the warm season. There is no record of its appearance in America. Consult: 'La pellagra in Italia,' official report (Rome, 1880); and Arnould, in 'Dictionnaire Encyclopédique des Sciences Médicales,' Vol. XXII. (Paris, 1886).



## PELLEGRIN — PELOPONNESIAN WAR

**Pellegrin**, pěl-grăn, the pseudonym of the Baron de la Motte Fouqué. See FOUQUÉ, FRIEDRICH HEINRICH KARL, BARON DE LA MOTTE.

**Pellegrini**, pěl-lā-grē'nē, **Carlo**, English caricaturist: b. Capua, Italy, March 1839; d. London, England, 22 Jan. 1889. He was descended from a distinguished family and received a good education, but soon dissipated the fortune inherited from his father. He entered Garibaldi's army and fought at Volturmo and Capua; and went to England in 1864, where he began his career as a caricaturist. His humorous drawings of men in public life which were published in 'Vanity Fair' under the signature of "Ape," from 1869 until his death, won for him a national reputation.

**Pellegrino**, pěl-lā-grē'nō, **Tibaldi**. See TIBALDI PELLEGRINO.

**Pelletier**, pěl-tē-ā, **SIR Charles Alphonse Pantaléon**, Canadian statesman: b. Rivière Ouelle, P. Q., 22 Jan. 1837. He was graduated from Laval University in 1858, studied law and was admitted to the bar in 1860, becoming Queen's Counsel in 1879. He sat in the Dominion Parliament for Kamouraska 1867-77, was minister of agriculture, 1877-8, was made speaker of the senate in 1896, having been a member of that body from 1877, and was knighted in 1898.

**Pellew**, pěl'oo, **Edward**. See EXMOUTH, VISCOUNT.

**Pellico**, pěl'lē-kō, **Silvio**, Italian poet: b. Saluzzo, Piedmont, 25 June 1789; d. Turin 1 Feb. 1854. In 1810 he became an instructor in an institution at Milan, in 1818 joined Romagnosi, Manzoni, and others in establishing 'Il Conciliatore,' a literary journal in the patriotic interest suppressed by Austria after a two years' publication (1818-20). He was arrested in 1820 as a member of the Carbonari, and on 21 Feb. 1822 was finally condemned to death. The emperor, however, commuted the sentence to an imprisonment for 15 years in the citadel of Brünn, Moravia. He was released in 1830, but his health had been broken by his sufferings, his record of which, 'Le Mie Prigioni' ('My Prisons,' 1832), made him, says Garnett, "as typical a figure as the Iron Mask or the Prisoner of Chillon." It was soon translated into many languages; there is an English version by Roscoe (1833). Pellico's lyric verse is indifferent, and but one of his tragedies, 'Francesca da Rimini' (1818) is at all distinguished. Of this there is a rendering into English by Bingham (1897; 'Italian Gem' series). Consult: 'The Foreign Quarterly Review,' April and October, 1833; Longfellow, 'The Poets and Poetry of Europe' (1845); Giuria, 'Silvio Pellico e il Suo Tempo' (1854).

**Pel'litory**, or **Spanish Camomile**, a plant (*Anacyclus pyrethrum*) closely related to and resembling camomile (q.v.) of the same order and belonging to an allied genus. The flowers are considerably larger, and are less numerous than those of camomile. It is a native of the Levant and of southern Europe. The root has a hot, pungent taste, derived from a fixed resinous matter, which stimulates the salivary glands, and excites a glowing heat in the mouth.

A genus of plants (*Parietaria*) of the nettle family is known as wall-pellitory. The common wall-pellitory (*P. officinalis*) is a herbaceous

perennial, which contains nitre, and was formerly used as a diuretic.

**Pelopidas**, pē-lōp'ī-das, Theban general and statesman: d. Cynoscephalæ, Thessaly, 364 B.C. He was a son of Hippoclus, inherited great wealth, and was an intimate friend of Epaminondas. In 382 the Spartan leader Leontiades seized the Cadmeia, the Theban citadel, and Pelopidas was driven into exile at Athens. He returned in 379, recovered the Cadmeia, overthrew the Spartans and with his own hand slew Leontiades. A democratic government was formed and Pelopidas became its leading general. He won the battle of Tegyra against the Spartans in 375, and aided Epaminondas to defeat the Lacedemonians at Leuctra in 371, making Thebes for a time the ruling power of Greece. In 368 Pelopidas headed the expedition against Alexander of Pheræ and was treacherously taken prisoner, but was liberated by Epaminondas and was sent on an embassy to the Persian court, where great success attended him. In 364 he again moved against Alexander and defeated the latter's forces at Cynoscephalæ, but was slain in the battle. Consult Plutarch, 'Life of Pelopidas.'

**Peloponne'sian War**, the contest between Sparta and Athens for the hegemony of Greece 431-404 B.C. The aristocratic party in Athens, after the second Persian Invasion in 480, had in general under the leadership of Aristides and Cimon aimed to effect a cordial understanding with all the Greek states and especially with Sparta, leaving her leadership unquestioned. But the democratic leaders of Athens' golden age, coming into power in 460, changed all this, recognized the natural contrariety of the interests of the two states, built up the city's navy, strengthened the Peiræus, formed an Ionic league, which soon proved a mere means of money getting for the expenses of the growing navy, and provoked the struggle. In 435 Athens as ally of Corcyra assisted that city when Corinth undertook to protect Epidamnus, a Doric colony, against Corcyra; and immediately Corinth summoned the aid of Sparta. In 431 when Thebes, a city of central Greece, but a bitter enemy of Athens, opened the war by attacking Plataea, Athens was supreme at sea, Sparta on land; Athens had a widely scattered and weakly bound empire, Sparta's was massed in the Peloponnese, with important outposts at Athens' very door, and Athens represented Ionic democracy, Sparta Doric oligarchy. The result was that the war became not a mere conflict between two leagues, but a manifold civil war, the democratic party in each state siding with Athens, the oligarchy with Sparta, and each ready to massacre the other. As for the two principal actors in the struggle — Athens attempted by sea to devastate the coasts of the Peloponnese, and Sparta striking by land laid waste the state of Attica with the exception of the city of Athens and its long walls reaching down to the sea. In 429 Pericles, the able Athenian leader, died of the plague that ravaged the city, and two years later Athens captured Mytilene, and the Spartans and Thebans took Plataea, the most bloody outrages taking place in each conquered town. In 425 Athens seemed utterly successful; she fomented a rising in Corcyra which annihilated the pro-Spartan aristocrats; and she cap-



## PELOPONNESUS — PELTIER EFFECT

tured an entire Spartan garrison on the island of Corcyra—a terrible blow to an army whose motto was "Death or victory." Sparta sued for peace, but Cleon and the other demagogues of Athens refused. The operations in Thrace against Athens' possessions there were carried on brilliantly by Brasidas, but at Amphipolis in 422 both he and Cleon were killed. Nicias (q.v.), an aristocrat and a conservative, took the place of prominence held by Cleon at Athens and negotiated in March 421 a 50-year truce, which unfortunately did not bind the Spartan allies, and even in Athens was soon disregarded owing to the growing influence of Alcibiades (q.v.). In 420 he formed a league between Athens, Mantinea, Argos, and Elis; then planned to bring about the defeat of Sparta in the Peloponnese by means of Argos—a scheme crushed by the Spartan victory over the Argives at Mantinea (418). The unfortunate Sicilian expedition (415-13) might have succeeded had not Alcibiades been forced out of command and into the enemies' camp. As it was, it struck at Athenian maritime prestige and practically finished the war. The eight years before the actual end were marked by sudden renewed vigor on the part of Athens due to the recall of Alcibiades in 411; his victories at Abydos and Cyzicus in 408 were the last that Athens won. Then Sparta with the unlimited wealth of Cyrus as backing gained the lucky victory of Ægospotami (405), Athens was taken, and the long walls were razed (404). The story of the war is told by Thucydides (q.v.), the first great philosophical historian, whose incomplete narration is supplemented by Xenophon's 'Hellenica.' Consult the authorities under GREECE, *History*.

**Peloponnesus**, pēl-ō-pō-nē'sūs, or **Peloponnese** (Greek, "Pelops' island"), southern Greece, the peninsula now known as the Morea. Separated from the mainland by the Saronic and Corinthian gulfs, it is a mountainous region of more than 8,300 square miles, and its principal divisions in ancient times were Arcadia, in the centre, Achaia, to the north, Elis, to the west, Messenia, to the southwest, Laconia, to the southeast, and Argolis, to the northeast. There was never much trade in the Peloponnese; its people were farmers and herdsmen. Patræ (q.v.) was (and is) the only port of importance. The chief products are olives, cotton, hides, honey, wine, and currants; almost 80 per cent of the world's supply of currants comes from the Morea. The first railroad was built in 1885; now there are several. But iron ore and marble, though plentiful in Laconia, cannot be exploited for lack of transportation facilities. A regular steamship line runs from Patræ to New York. The present division of the peninsula is into nine nomes: Achaia, Corinth, Elis, Triphylia, Arcadia, Argolis, Messenia, Laconia, and Lacedæmon. For the history of the Peloponnese see GREECE. Pop. (1896) 902,181. Consult: Clarke, 'Peloponnesus, Notes of Study and Travel' (1858); Beulé, 'Etudes sur le Peloponnèse' (1875); Curtius, 'Peloponnesos' (1851-2); Leake, 'Travels in the Morea' (1830); and 'Peloponnesiaca' (1846); and Philippson, 'Der Peloponnes' (1892).

**Pelops**, pē'lōps, in Greek mythology, the son of Tantalus, king of Lydia. He became a suitor of the beautiful Hippodamia, and by conquering her father Œnomaus, king of Pisa, in

a chariot race, through the treacherous connivance of Myrtilus, the king's charioteer, obtained the bride with a kingdom. Myrtilus had been gained by an offer of half the kingdom; but Pelops, being unwilling to keep faith with him, threw him from a cliff into the sea. The drowning man cursed his murderer, which was the cause of all the misfortunes that fell upon the house of Pelops. Peloponnesus received its name from him. Of his sons, Atreus and Thyestes are most celebrated. After death Pelops received divine honors, and a temple was built to him in the grove at Olympia, the games of which place he is said to have revived.

**Pelo'ria**, in botany, the appearance of regularity of structure in the flowers of plants which normally bear irregular flowers, instances of which occur in the snap-dragon and the toad-flax, which being normally irregular, assume a symmetrical form. It seems to be the result of abnormal conditions, especially as concerns light.

**Pelot'a**, or **Jai-alai**, a Spanish game popular in Cuba, South and Central America, and latterly in certain parts of the United States. It is played both indoors and out; but requires a court or concrete floor, 200 feet long and 65 feet wide, with a front wall 36 feet square at one end and a second or rebounding wall of similar dimensions at the other end of the court. The game is played with a ball, about the size of a lawn tennis-ball and a wicker work basket fastened to the hand by means of a glove. The players number four, six, or eight, divided equally into sides or teams. The ball is bounded from basket to wall and must always be kept in motion. The game is usually of 50 points. What cricket is to England, what football and baseball are to the United States, what lacrosse and hockey are to Canada, pelota is to Spain and other Spanish-speaking countries. It is a game requiring a better eye, more speed, activity, and surer perfect control over every muscle of the body than any other sport.

**Pelotas**, pā-lō'tās, Brazil, city and port of the state of Rio Grande do Sul, 25 miles northwest of the city of Rio Grande, on the right bank of the São Gonçalo River. The bar of the embouching river has been cleared away and Pelotas has become one of the most important of Brazilian ports because of its fine harbor. The São Gonçalo makes commercial relations with Uruguay possible. The city is well built, is lighted by gas, and has street railways. Its chief industry is drying meat; there are great abattoirs near the city and 600,000 cattle or more are killed each year. Pop. about 10,000. There are many Europeans, especially Germans and Italians, in the city.

**Peltier Effect**, a phenomenon observed by M. Peltier at the place of junction of two rods of metal, when a current is made to pass through both. It is well known (see THERMO-ELECTRICITY) that heat is transformed into electricity in a thermo-electric circuit. The electric current in passing through all parts of the circuit tends to heat the conductors, so that it would seem as if the current merely carried heat from the thermo-electric junction to other parts of the circuit, effecting an equalization of temperature. The heat is transformed into electricity not only at the hot junction, but also, as Lord Kelvin has



## PELUSIUM — PEMBA

shown, at portions which have different temperatures of one or both metals. Peltier discovered that a current flowing in a circuit composed of two metallic conductors heated one junction and cooled the other, and it came to be supposed that, as in a thermo-electric circuit, the currents hitherto observed had cooled the hot and heated the cold junction in the manner observed by Peltier, the heat producing the current was wholly absorbed at the hot junction, and given out at the cold junction, diminished by radiation, and by the heat equivalent of the work done in the rest of the circuit. It has been shown by Lord Kelvin that this explanation is incomplete. When the temperature of the junction is at the "neutral point" (see THERMO-ELECTRICITY) the two metals are thermo-electrically identical, and no Peltier effect can occur, yet a current passes through a circuit when the hot junction is at the neutral point and the other is not, and therefore there must be absorption of heat somewhere else in the circuit than at the junctions. It has been proved that in a copper wire a current carries heat with it from a hot place to a cold one; whereas in an iron wire a current carries heat with it from the cold places to the hot ones, thus retarding equalization of temperature throughout the circuit. See ELECTRIC CURRENTS; ELECTRIC DIRECT CURRENT.

**Pelusium**, pĕ-lŭ'shĭ-ŭm, ancient city of Egypt, situated at the northeastern extremity of the delta of the Nile, and giving its name, which in Greek meant "mud city," to the eastern mouth of the Nile. The city of Pelusium is probably to be identified with Sin of the Bible. It was the scene of several battles, notably the defeat of Sennacherib's besieging forces owing to the fact that the night before the battle a host of field-mice made their way into the Assyrian camp and gnawed through the bowstrings; and the victory of Cambyses in 525 B.C. which put an end to the Egyptian empire.

**Pelvic Girdle.** See PELVIS.

**Pelvis** (Latin, "basin"), the bony basin formed by the haunch-bones and sacrum of vertebrates, which constitutes the arch giving support to the lower or hinder limbs. The pelvis corresponds to the shoulder-girdle of the upper or fore limbs, and forms a cavity in which several of the abdominal viscera, and organs relating to reproduction and the urinary functions, are contained and protected. The human pelvis is formed on the sides and in front by two bones, each of which is known as an os innominatum. This, the chief bone of the pelvis, although consisting of but a single bone in the adult, is in the young state composed of three distinct bones, the ilium, ischium, and pubes. These bones unite firmly about the 25th year of life to form a deep cup-shaped cavity, the cotyloid cavity or acetabulum, which receives the head of the femur or thigh-bone, and thus forms the hip-joint. To this cup the ischium and ilium each contribute two fifths of its extent, the pubes making up the remaining one fifth. The acetabulum shows on its lower surface a depression, to which the interarticular ligament of the hip-joint is fixed. From the acetabulum the ilium rises backward and upward, and constitutes the haunch, and thus forms the chief upper boun-

dary of the pelvic basin. The ischium passes backward and downward from the acetabulum, while the pubis proceeds inward and forward, and joins its fellow of the opposite side to form the front wall of the pelvis. Behind, the innominate bones articulate with the sacrum—composed of several vertebræ united together in one bone—which thus forms the posterior part of the pelvis.

The pelvis is inclined in the erect attitude of man so that the plane of its brim forms with the horizontal plane an angle of from 60° to 65°, raising the base or upper part of the sacrum about four inches above the front. The pelvis of man differs materially from that of woman, the differences having chiefly reference to the greater capacity required for the purposes of gestation. The ilia in woman are more expanded than in man, giving to the female her noticeably greater breadth, on the average about two inches, across the hips. The pelvis of woman, as a whole, is also of lighter weight than that of man. Complicated muscular attachments exist in connection with the attachment of the pelvis to the trunk, and with that of the lower limbs to the pelvis.

The pelvis varies greatly in development and perfection even in the *Mammalia*. It may be extremely rudimentary, as in whales, dugongs, and manatees. In the *Mammalia* generally the pelvis is always more elongated and narrower than in man. It is much elongated in bats and insectivorous mammals; its halves being connected at the pubis by ligament only, or being, as in many bats and in moles and shrews, wholly unconnected and separate in front. In no birds, save in the ostriches, are the pelvic halves united at the symphysis pubis. In all birds, and in the porcupine ant-eater, the acetabulum is perforated. The *Monotremata* and *Marsupialia* possess what are termed marsupial bones, attached to the front of the pelvis brim or pubes. (See MAMMALS; MARSUPIALIA; MONOTREMATA.) These bones are merely the ossified inner tendons of the external oblique muscles of the abdomen, which in kangaroos, etc., support the marsupium or pouch. The ischia are the most constantly represented elements in the mammalian pelvis. In turtles and crocodiles the disposition of the pelvis resembles that of man. In some snakes (for example, boas, pythons, etc.) a rudimentary pelvis exists. In all amphibians the ilium is invariably represented in the pelvis, and an ischium in all except *Proteus*. In fishes many variations exist in the degree of perfection of the pelvic elements. The ilium of fishes is almost invariably absent.

**Pelvic Girdle.**—In man this part of the skeleton (imperfect behind, the gap being filled by the sacrum) is formed by the two innominate bones—the haunch or hip bones. In the lower forms of animal life its construction is various. See ANATOMY; OSTEOLOGY.

**Pem'ba**, a coral island under British protection, 20 miles off the east coast of Africa, and about 40 miles northeast of Zanzibar. It is about 38 miles long, 10 miles broad, is low, well-wooded, and fertile. Chak-Chak (pop. 6,000), the principal seaport and town, stands on an inlet on the west coast. It has an export trade with Zanzibar in rice, the chief product of the island. Pemba was transferred to the



## PEMBERTON — PEMPHIGUS

British East Africa Company in 1891 by the Sultan of Zanzibar. Pop. 50,000.

**Pemberton**, pēm'bēr-tōn, **John Clifford**, American soldier: b. Philadelphia, Pa., 10 Aug. 1814; d. Penllyn, Pa., 13 July 1881. He was graduated from West Point in 1837, served against the Indians in Florida in 1837-9, and under Gen. Worth in the Mexican War. He continued in service in the army until the outbreak of the Civil War when he resigned his commission and entered the Confederate army. He was appointed lieutenant-colonel and engaged in organizing the artillery and cavalry, in which task he was eminently successful, and in February 1862 was promoted major-general with command of the department of South Carolina, Georgia, and Florida; in October of the same year he was raised to the rank of lieutenant-general, and in 1863 succeeded Gen. Dorn in the department comprising Mississippi, Tennessee, and eastern Louisiana. Here he refused co-operation with Gen. Johnston's plans and his correspondence with that general fell into the hands of Gen. Grant, who met and defeated him at Baker's Creek or Champion's Hill, and at Big Black Bridge, and later captured Vicksburg after a brave defense by Pemberton. His conduct excited severe criticism and after his exchange he resigned his commission, but in 1864 accepted the rank of lieutenant-colonel with command of the artillery defenses at Richmond and served until the end of the war. The remainder of his life was spent in retirement in Virginia and Pennsylvania.

**Pemberton**, **Max**, English novelist: b. Birmingham, England, 19 June 1863. He was educated at Cambridge and was one of the staff of 'Vanity Fair' in 1885. He was editor of 'Chums,' a boys' paper, 1892-3, and became editor of 'Cassell's Magazine' in 1896. He has published 'The Iron Pirate' (1894); 'Sea Wolves' (1894); and 'The Impregnable City' (1895), stories of adventure; 'The Little Huguenot'; 'A Puritan's Wife' (1896); 'A Gentleman's Gentleman' (1896); 'Christine of the Hills' (1897), a novel of Dalmatian life, one of his best works; 'The Garden of Swords' (1899); 'The House Under the Sea' (1902); etc.

**Pembroke**, pēm'brūk, (1) Wales, a western maritime county or shire bordering on Saint George's and the Bristol channels, and bounded east by Cardigan and Carmarthen. Area, 614 square miles. Capital, Pembroke. The county is diversified with hill and vale, attaining a height of 1,754 feet in the Precelly Hills; the coast is indented by numerous bays and fine harbors, chief of which is the celebrated Milford Haven (q.v.). Barley, oats, and potatoes are the principal agricultural products; coal is mined and slate quarried; iron and lead mining have practically ceased. The fishing industry is important. Pop. (1901) 88,749. (2) The capital of Pembroke County, Wales, on a navigable creek of Milford Haven, 40 miles west of Swansea, and 270 miles by rail west of London. Its principal industries are connected with Pembroke Dock, or Pater, 2½ miles northwest, a naval dockyard and arsenal, established in 1814. It encloses an area of 70 acres, and since 1861 has been fortified at a cost of more than \$2,500,000. Pembroke's most interesting edifice is its ruined

Norman castle dating from 1094, in which Henry VII. was born. Pop. (1901) 15,853. (3) The capital of Renfrew County, Ontario, Canada, on a southern point of Allumette Lake, an expansion of the Ottawa River, 74 miles by rail northwest of Ottawa on the Canadian Pacific and Canadian Atlantic R.R.'s. It is the see of a Roman Catholic diocese. The Muskrat River, a small affluent of the Ottawa, traverses the town and supplies water-power to the saw, grist, woolen mills, and other industrial establishments. A considerable trade in lumber is carried on. Pop. (1901) 5,156. (4) A municipality of Leinster, Ireland, suburban to Dublin, on the southeast. Pop. (1901) 25,799.

**Pembroke** (pēm'brōk) **College**, Cambridge, England, was founded in 1347, under the name of Valence-Mary, by Mary de St. Paul, widow of Aymer de Valence, Earl of Pembroke, who was killed on his wedding-day at a tilting match held in honor of the bride; she thereupon went into conventual retirement, bequeathing her estate to pious uses. King Henry VI. was so liberal a benefactor to the college as to obtain the name of a second founder. There are 29 open scholarships, varying in value from \$100 to \$400 a year, and 13 open fellowships. The buildings were greatly added to and altered between the years 1870 and 1883. The chapel, in Corinthian style, was built by Sir Christopher Wren in 1663. Among many noted alumni are Ridley, the martyr, Archbishops Grindal and Whitgift, Spenser and Gray, the poets, William Pitt (the younger), etc.

**Pembroke College**, Oxford, England, originally Broadgate's Hall, was founded in the year 1624 by James I., and obtained its name from William Herbert, Earl of Pembroke. It was endowed by the Rev. Richard Wightwick, rector of Ilsey, Berks, and by Thomas Tesdale of Glympton, Oxfordshire. The present constitution of the college, settled by ordinances of the commissioners under the statute of 1877, admits of a master, not less than 10 fellows, and of not less than 12 scholars. Some of the fellowships are at present suspended. There are in all 24 scholarships and exhibitions, the value of each being from \$300 to \$500 a year. Among its distinguished alumni are Beaumont, the dramatist, Camden, the antiquary, Sir William Blackstone, Sir Thomas Browne, Samuel Johnson, John Pym, Shenstone, and George Whitefield.

**Pem'ican**, a food preparation of the American Indians, consisting of dried buffalo or venison meat, cut into strips and dried in the sun. It was sometimes pounded and mixed with cranberries or other wild fruits and compressed in bags of rawhide. It was chiefly used on long journeys and times of war. A similar preparation made of beef is used on long Arctic expeditions.

**Pemoranes**. See RELIGIOUS SECTS.

**Pemphigus**, pēm'fī-gūs, or **Pompholyx**, an affection of the skin characterized by an eruption of large vesicles filled with serous fluid, blood, or pus, and called blebs or bullæ. The disease assumes both acute and chronic forms. In mild acute cases blebs appear in succession, continue for several days, then break, form a thin scab, and soon heal without fever



## PEN

or inflammation. In severe cases there is often much constitutional disturbance, the blebs are larger, and the scabs heal with difficulty. The general health shows impairment, fever develops, and sometimes there is troublesome itching. The chronic form differs from the acute mainly by its longer continuance. The acute chiefly affects children, and has been ascribed to dentition, errors of diet, etc.; while the chronic chiefly attacks aged persons, and is probably due to debility and impaired nutrition. The acute form usually requires only cooling medicines and diet, and mild local dressings, such as simple cerate, to protect the raw surfaces from exposure to the air. In the chronic form a nutritious diet, with the judicious use of tonics (iron, strychnine, quinine, etc.), is most commonly successful. In obstinate cases arsenic is given. Sedative local applications and continuous baths in warm water are of great importance in the treatment.

**Pen**, an instrument for writing with a fluid. Pens have been in use from very ancient times, being made and adapted to the material upon which the written characters were to be impressed. In the earliest periods tools of steel served for writing on stone or metallic plates, and such are referred to by Job in speaking of an "iron pen." For the waxen tablets of the ancients a metallic stylus was employed, one end of which was sharpened for marking, and the other was flattened for erasing the marks and smoothing the wax, hence the phrase "often turn the pen," used of careful revision, with frequent erasure and re-writing. It was also the practice in ancient times, as among the Chinese at the present day, to paint the letters with a fine hair pencil. Pens of reeds were also made at a very early period for the use of a fluid ink upon papyrus. The reed selected for this purpose is described as small and hard, and about the size of a swan's quill. It was found in Egypt and Armenia; and Cairo and Alexandria were famous markets in which it was sold. Along the shores of the Persian Gulf reeds are still collected for this use, and are distributed throughout various parts of the eastern countries, being better adapted to the ink and paper employed in these regions than any other kind of pens. They are prepared by leaving them under dung heaps for several months, which causes them to acquire a mixed black and yellow color, and a smooth and hard surface. The pith is dried up by the heat generated.

*Quill Pens.*—The introduction of paper rendered necessary pens of finer character, and quills of the goose and swan next came into use, and for extremely fine writing those of other birds, as of the crow, were found well adapted. A great trade grew up in these articles, and continued for several centuries. Poland and Russia were largely engaged in it, and immense flocks of geese were raised in those countries chiefly for their quills. In a single year St. Petersburg has furnished to England over 27,000,000 quills. Germany and the Netherlands were also large producers of goose quills. From each goose the average number of good quills obtained was only 10 or 12, though sometimes they amounted to 20. As they were plucked from the wing they were soft and tough, and covered within and without with a thin membrane. They were first sorted accord-

ing to the length and thickness of the barrel into primes, seconds, and pinions, and were then buried for a short time in hot sand, which dried the outside skin, so that it was easily scraped off, and the inner lining became shriveled and detached. This treatment was called, from having been practised in Holland, "dutching." After this the quills were hardened by dipping them into a boiling solution of alum or of diluted nitric acid, which also rendered the barrel yellow. A portion of the barbs was then stripped off, and the quills were tied in bundles for the market.

*Steel Pens.*—The immense consumption of quills led to the invention of the steel pens, which appeared first in England in 1803. They cost originally \$2 to \$3 each, although the price was reduced to 12 cents in the course of 10 years. It was not till after 1830 that steel pens began to come into extensive use, owing to improvements introduced by James Perry, Joseph Gillott, Sir Josiah Mason, and other manufacturers. The lowest-priced pens are now made almost entirely by machinery, but the finer qualities require a deal of hand labor in finishing. Sheets of steel of the best quality, about 6 feet by 18 inches, are cut into narrow strips in breadth rather more or less than twice the length of the pen, according to circumstances. These are annealed and rolled to the required thickness, and any of non-uniform thickness are rejected. The strips are passed into the hands of a girl, seated at a press, who, by means of a bed and punch corresponding, speedily cuts out pieces the shape of the pen, called blanks. The name of the firm is then stamped on the broad part of the pens. The next stage is called piercing, which is cutting out by a punch the central hole in the nib, and at this stage also the lateral slits are cut. The metal has become through the repeated rolling and stamping so hard that it is necessary to anneal it. This is effected by placing the blanks in cast-iron pots, and raising them to a red heat in a muffle-furnace, afterward leaving them to cool slowly. Up to this stage the blank is a flat piece of steel; it is now passed to the raising-press, where it is rendered concave by being pressed into a groove by a sinker. The next process is hardening, which is done by heating the pens to a red heat in an iron box or muffle, and then plunging them in oil. The process of tempering follows; and then they are scoured and cleaned by immersion in soda-water and dilute sulphuric acid successively, and by friction with sand and similar solid substances. The outside of the nib is then ground first lengthwise and then crosswise, which is done by different persons upon separate emery grinding-wheels. Next comes the most delicate operation, cutting the central split, upon the nicety of which a great part of the value of the pen depends. The pen is placed lengthwise on a chisel fixed in the bed of a hand-press similar to the others; the descending lever carries another chisel, which passes down just clearing the other with the minutest accuracy. The pens are then colored brown or blue, by being heated in a revolving metal cylinder over a charcoal stove, and removing them when the desired tint is attained; they are then varnished by means of lac dissolved in naphtha. After being dried by heat they are selected, and counted into small boxes ready for the market.



## PEN-STIPPLE — PENANCE

*Gold Pens.*—The gold pen is an American product and the world's supply is practically manufactured in New York. In 1823 John Isaac Hawkins, an American, residing in England, imbedded pieces of diamond and ruby in the points of tortoise shell pens, which were softened in water to receive the stones. The same manufacturer, hearing that bits of an extremely hard native alloy of iridium and osmium, sent by Dr. Wollaston to a penmaker to be used for points, had been returned as too hard for working, obtained these for his own experiments, and was the first to produce the famous "diamond points" soldered to gold pens. The manufacture of these pens made but slow progress, great skill, the result of long continued experiments, being necessary to produce the exact shape suited for the required elasticity of the pen, and to combine this with the proper size and form of the points. They were moreover costly as well on account of the metal employed as the labor expended in the manufacture. The right to make gold pens was purchased of Hawkins by Dr. Cleveland, an American clergyman then in England, who on his return induced Levi Brown, a watchmaker in Detroit, to undertake their manufacture. This was about the year 1835. The experiment was attended with little success. Brown removed in 1840 to New York, and there introduced the business, which gradually increased in importance as the quality of the pens was improved, and the price diminished by their more rapid production. At first the pens were cut with scissors into shape from a thin flat strip of gold, and a slit being cut in the nib a bit of iridium was soldered to each point separately, and the points were then rounded up into shape with a mallet upon a stick. The inferior pens thus made by hand sold for \$5 to \$10 each. The first machines, and almost the only important ones in use applicable to the different branches of this work, were invented by John Rendell, who systematized the process, giving to each workman his peculiar branch, and thus a nicety and certainty of good work were attained by each one which was essential to the perfection of the pen.

*Fountain Pens.*—From about the middle of the 19th century various attempts were made to construct fountain pens, that is, pens fitted with an ink reservoir from which the point is supplied by capillary or other action, but it was not till a very recent period that they were perfected sufficiently to admit of their coming into anything like widespread use. The latest improvement in the fountain pen is an automatic filler or, to be more exact, a device for filling the pen without removing the part containing the pen from the ink-reservoir, the ink being drawn through the pen, which is dipped into the well or bottle.

*The Pen Industry.*—Pens are now made in almost endless variety as regards shape and size, character of point, etc., being adapted for almost all conceivable tastes and requirements. The great centre of the manufacture is Birmingham, England, where more than 20,000,000 pens are turned out every week. The United States, France, and Germany also manufacture steel pens, and New York, as previously stated, leads in the gold pen production of the world. It has been declared that each man, woman, and child in the United States uses, on the average, four

pens a year. The same authorities also say that three of these four pens are of American make. Some idea of the growth of the pen industry may be obtained, therefore, when it is known that in 1860 nearly all the pens consumed in this country were of foreign manufacture. In 1860, Richard Esterbrook, his son Richard, and James Bromgrove founded a pen factory at Camden, N. J. The business was a success from the start, and in 1866 the firm was incorporated as the Esterbrook Steel Pen Company. Steel from which pens can be made has not yet been produced in this country. Manufacturers are unable to say whether the trouble lies in the handling of the steel or in the material itself. The steel must possess a fineness and toughness that has thus far been found in the products of England and Sweden only. Pens, therefore, can be made in England more cheaply than in the United States; but in foreign countries, where a greater amount must necessarily be charged for the American article, the latter finds a ready market, despite the fact that it must be classed as a fancy article. In 1880 not more than \$10,000 were invested in the pen industry, while in 1903 the combined capital of American manufacturers was more than \$2,000,000. Besides the Esterbrook company, prominent pen manufacturers in the United States are Miller Brothers, Meriden, Conn.; Turner & Harrison and Malpass & Company, Philadelphia; and the Eagle Pencil Company, New York.

**Pen-stipple.** See LITHOGRAPHY.

**Penance,** a theological term, signifies first, a virtue, or condition of mind; secondly an outward act or series of acts, expressive of the mental condition; thirdly,—according to the Catholic conception,—a sacrament; all having to do with the forgiveness or atonement of sin. The three various phases are not considered as independent, separate means for obtaining remission of sin, but as supplements, one of another: the penitential spirit is the primary necessity; the penitential exercise is the natural and obvious manifestation of the interior state of soul; and the sacrament is not a substitute for either the virtue or the act, but a complement of both. The necessary brevity of this article will allow only a most summary treatment of the virtue and only such mention of the penitential discipline as may come incidentally in the treatment of the main subject, the sacrament of penance.

I. "Penance," the virtue, is synonymous with "repentance," "contrition," and such other terms as express sorrow for sin as an offense against the law and the person of God. All Christian theology agrees that without repentance of heart there can be no remission of sin. But as to the precise nature of this sorrow there is dissension. According to the Augsburg Confession (Art. XII.), "Repentance consists of two parts; one is contrition or terrors stricken into the conscience through the acknowledgment of sin: the other is faith that for Christ's sake sins be forgiven." The Council of Trent, teaching the Catholic doctrine, quotes the Lutheran definition, condemns it as insufficient, and explains that for true repentance there must be not only present "contrition or terrors," with "faith," but also a look into the past and a provision for the future; there must be "sorrow of mind, a detestation of past sin, and a determination of not



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sinning for the future." (Sess. 14, ch. 4.) However, Trent recognizes a distinction between perfect and imperfect contrition; that contrition is perfect which is motivated by love of God, that is imperfect which is begotten of fear of the punishment due to sin. The former, sorrow for sin for God's sake, of itself immediately remits sin, even without sacramental absolution, provided it be accompanied by at least an implicit willingness on the part of the penitent to make use of whatever means God may have provided for the receiving of formal forgiveness. Furthermore, even by use of the sacrament, no one can possibly receive forgiveness unless he have at least the sorrow that comes from fear.

2. *The Sacrament of Penance.*—Any discussion about the existence of the sacrament may be narrowed down into an attempt to answer the question: did Jesus Christ, as the founder of a new religion, establish an institution for continuing visibly and through human instrumentality, one of the chief works of salvation, the forgiveness of sin after baptism? Anyone, it would seem, who at all admits the sacramental idea in the Christian religion—who accepts, for example, the fact of baptismal regeneration, cannot logically maintain, *a priori*, the impossibility of the existence of a sacrament for the forgiveness of post-baptismal sins.

And indeed, whether there is or is not such a sacrament, is a question of historical fact rather than of theological theory; and the answer to the question must come from an examination of historical evidences.

The scriptural texts, offered as witness of the foundation of a special "ministry of reconciliation," are three: St. Matt. xvi. 18, xviii. 18, and St. John xx. 22 and 23. In the two former passages, Christ is represented as bestowing, first upon St. Peter, and then upon all the apostles, the power of "binding" and "loosing," and as promising that their exercise of that power should be ratified in heaven. The precise meaning of these two texts is not immediately evident: it may justly enough be maintained that, taken alone, they give no certainty of a delegation of the power of forgiving sins. It has been pointed out that "to bind" and "to loose" are formulæ of rabbinical theology meaning, "to prohibit" and "to permit"; hence a mere exegesis of these texts may show only that a general legislative and judicial power was granted to the apostles. But the supplementary passage of the Fourth Gospel apparently specifies one of the ways in which the general prerogative of binding and loosing is to be exercised. St. John pictures the Lord solemnly praying over the apostles, breathing upon them in token of the imparting of the Holy Spirit, sending them forth, as He Himself had been sent forth from the Father, and transferring to them His own divine prerogative of forgiving and retaining sins.

Taking the three texts together, it can scarcely be denied that even in their narrowest significance they witness the imparting of an authority to the Christian Church to forgive and to retain sins in Christ's name.

This fact is not generally disputed. Protestants as well as Catholics maintain that the Church possesses and exercises the power of forgiving sins. The discussions have rather concerned the question, Who are the repositories

of the pardoning power, and what are the means by which it is exercised?

The Protestant party in the controversy declares that the power was bestowed not upon the apostles alone,—and hence not upon bishops and priests alone,—but upon the whole Christian Church in general; and that the church exercises its power by conveying the "good tidings" to the world, by preaching and baptizing.

Catholics answer that such theories ignore the details of the incidents recorded in the texts of St. Matthew and St. John, which show that only the apostles were present when the Lord gave the commission of binding and loosing, of forgiving and retaining; that it is extremely unlikely that so wonderful a prerogative should have been conferred indiscriminately upon all; that to say sins are forgiven only by means of preaching and baptizing is to forget the discretionary and judicial character of the process which permits "binding" as well as "loosing," "retaining" as well as "forgiving." Such, in a word, is the status of the controversy concerning the exegesis of the scriptural texts.

But all parties concerned are agreed that a further, and perhaps securer, interpretation of the Lord's words is to be sought in an examination of the history of the early Church; and, in fact, the vast bulk of modern discussion on the sacrament of penance has dealt with history rather than with exegesis. The adversaries of the Catholic position have, in this case, showed an unusual willingness to appeal from Scripture to Tradition. Catholic scholars, in turn, are no less confident of the outcome of a historical investigation of the origin of penance; but before undertaking it, they make certain provisos.

They are not loath to admit that the present very exact theology of the sacrament was by no means understood in all its details in the primitive church, and that the modern discipline of the administration of penance is the outcome of a long process of—so to say—experimentation. For explanation of the divergences between the ancient and the modern practice, and of the immense advance in certainty of theoretic understanding of the doctrine, they appeal to the principle of theological developments, claiming for the sacrament of penance the same right to legitimate evolution which is acknowledged for all other Christian institutions. Starting with the essentials once necessarily determined by Christ, namely the forgiveness of sin by men judging in His name and absolving by His authority, they are content if they can show by a recourse to historical documents that the nature of the sacrament was sufficiently clear, in its general outlines, from the beginning; that the forgiveness of sins from earliest Christian times was understood to be consequent upon sorrow of heart, acknowledgment of guilt,—either in the church publicly, or to a bishop or a priest privately, or both,—the performance of some penitential discipline, and the pronouncement of reconciliation with the church and with God, by the president of the Christian assembly, the bishop, or his delegated priest. Here, in theological terms, are contrition, confession, satisfaction, and absolution, the essentials of the sacrament. All else may vary and be doubtful, conditions and processes of administering and receiving forgiveness may change, the rela-



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tive value of the constituent parts of the sacrament may be but obscurely understood, the positive and absolute obligation of confessing may not be universally defined until late in the history of the sacrament, public manifestation of conscience may be found inexpedient, and private confession instead of being an accompaniment or preparation for public confession, may survive alone; standards of discipline regulating the receiving of penitents and the imparting of absolution may vary from the extreme of severity to the extreme of leniency: along many lines there may be only a gradually increasing certainty of doctrine and a gradually crystallizing form of discipline, but, say the Catholic apologists, provided it can be shown that in details only and not in essentials, doctrine has been clarified and discipline changed, all this involves no incompatibility with the present teaching and practice of the Church.

Such is the viewpoint from which the defenders of the sacrament look upon the historical data, of which a very short summary may here be given.

The first historical evidence of confession in the early church is in the Acts of the Apostles (xix. 18). The converted Ephesians "came confessing their sins," evidently not in secret or to God alone, but publicly in the assembly; and not in general terms only, but in some detail "declaring their deeds." And the first clearly recorded instance of the exercise of the absolving power is the "binding" and the "loosing" of the incestuous Corinthian by St. Paul (1 Cor. v. 5 and 13; 2 Cor. ii. 10).

Before the end of the first century, St. Clement of Rome is recorded as urging penance in this world, because "there can be no *confession* or repentance in the other" (Ep. 2 ad Cor. 8); and during the first half of the second century, the Didaché twice speaks of public confession in the church. Any further information concerning the nature of these confessions, whether they were liturgical or sacramental, detailed or general, is not vouchsafed by the documents. They cannot, therefore, witness anything further than the fact that there was some kind of public confession in the church of the 1st and 2d centuries.

Evidently this is meagre evidence, but explanations are given as to why it could not well be more explicit and satisfactory; first the extreme paucity of the documents of primitive Christian literature, and second the undoubted predominance in the sub-apostolic church of a spirit and tendency which precluded the possibility of much direct advertence to an institution having to do with the forgiveness of sin committed after baptism. The theory was that there should be no such sin. "He who has received remission of his sins" (in baptism) "ought not to sin any more, but live in purity," says Hermas Pastor (Comm. 4, ch. 3). The conception of the church as a community of saints, the deep-seated expectation of the second coming of the Lord, the intense realization that baptism brought with it an eternal abjuration of evil, all made the commission of sin after the first regeneration a thing almost unthinkable, and while this idealism reigned, there could be only a kind of sub-conscious attendance to the existence of the sacrament of penance, and its use, in consequence, seems to have been almost in abeyance.

To such an extent did this kind of apocalyptic spirit predominate in the Early Church, that there was an uncertainty as to the method of treating sinners who, in spite of the theoretic impossibility, did actually lapse after baptism. At first they were in some places, and perhaps even at Rome, denied readmission to the Church. A too literal acceptance of the words, "It is impossible for those who were once enlightened and have tasted of the heavenly gift . . . if they shall fall away, to be renewed unto repentance (Heb. vi. 4ff.) led to a general belief that at least some sins were beyond the pardon of the Church (see Hermas, Justin M., Dialogue, 44; Didascalia, ch. 5; Origen, De Orat. 28.) But such a misunderstanding could not last. The Pastor (150 A.D.), after recording that "some teachers maintain that there is no other repentance than that which takes place when we descended into the water and received remission of our former sins," pleads for *only one* further opportunity for repentance. (Comm. 4, n. 3.) Gradually the plea of the pastor obtained recognition, its views were adopted by Dionysius of Corinth, and Clement of Alexandria, and began to prevail, though against much opposition and some setbacks.

But alongside the movement towards a milder and saner discipline, there developed a conviction that at least the three capital crimes, murder, apostasy, and adultery, were beyond forgiveness in this world. There are indications, however, that ultimate pardon from God for such sins was not despaired of; the guilty were recommended to do penance and to pray for pardon; but the Church refused to readmit them to her communion. Around this point of discipline the battle was again waged for and against relaxation.

Tertullian, in his tract, De Pœnitentia (204 A.D.), affirms as a fact always recognized that the Church forgives sins, but maintains that repentance avails only once after baptism, there is a "second plank" of salvation after shipwreck but no third; and he not only accepts but adds to the list of "irremissible sins."

Pope Callistus (208-222 A.D.), however, following the primitive discipline observed by St. Paul, absolved adulterers, but was roundly blamed for doing so, by Tertullian, now become a Montanist. (De Pudic. ch. 1.) Still the milder discipline prevailed not only at Rome but at Carthage and Alexandria. In the latter city Origen (184-253 A.D.) frequently declares in most explicit terms the doctrine of confession to the priests, absolution and renewal of repentance.

The Decian persecution (249 A.D.) turned the discussion upon the question of the pardon and readmission of apostates. St. Cyprian, in the Council of Carthage (251 A.D.) declared the lawfulness of reinstating them, sent the reports of the proceedings to Pope Cornelius, and received his approval. Thereupon the schismatics, Novatian in Rome and Novatus at Carthage, anxious for a *casus belli*, started a reactionary movement, and maintained that apostasy and other heinous sins were unpardonable; and their followers, in the two succeeding centuries, finally went to the extremity of denying to the Church the power of forgiving any mortal sins whatever. They raised the cry—now first



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heard in Christian history—"God alone can forgive sins," and thereby first demanded of the Church a systematic theological defense of the right she had long been exercising.

The reply was ready and decisive and came from all quarters. In Spain, Pacian (4th century) answers the Novation objection almost in the words of modern theology; God alone has the right to forgive sins, but He has been pleased to delegate His right, not to the Church in general but to the bishops, and the forgiveness of sins in penance is to be compared with that in baptism. In Italy the pseudo-Augustine and St. Ambrose proclaim the same doctrine, and use the same comparison. In Africa, St. Augustine repeats the objection, and refutes it by an appeal to Matt. xvi. 18, interpreting the power of the keys as a power to forgive sins, granted primarily to Peter and his successors. In Constantinople, Gregory Nazianzen affirms the ancient and traditional rights of the bishop to forgive sins; and the Eastern Church generally was remarkable for its antagonism to the Novatian doctrine.

Thus, when the first real necessity arose, the latent theology of the sacrament came to the light, and the consensus of the Christian world was definitively expressed.

Further than this, the strife against Montanism and Novatianism elucidated not a few of the details of the doctrine: the actual necessity of the sacrament for the forgiveness of post-baptismal sin now was explicitly stated; the institution by the Lord himself was directly taught from the exegesis of the texts of St. Matthew and St. John, the designation of the bishops and priests as the legitimate possessors of the power of absolution was insisted upon, and in general, under the stimulus of opposition, the unfolding of the consciousness of the existence and the nature of a "ministry of reconciliation" went on apace.

Two questions of special interest, may perhaps best be inserted here, before mention is made of the later phases of the theological development:

1st, the origin of *private*, or *auricular confession*: Some scholars, generally non-Catholic, have thought that private confession began in the monasteries, and thence was substituted for the public discipline. Others are inclined to think that auricular confession had its origin under Leo the Great (about 445 A.D.). Neither opinion seems to have the support of the documents. The Church historians, Socrates (H. E., 5-9), and Sozomen (H. E., 7-16), narrate the abolition of the office of private confessor at Constantinople, in the year 391, but both say that in their day, private confession was already an ancient custom. Socrates is of the opinion that it dates at least from the year 251, but Sozomen declares its origin is so far back in history that he dares not venture to name a date positively. St. Cyprian (250) speaks of penitents confessing to the priests and the bishop (Ep. 58, 15), and Tertullian uses words indicating that private confession was in vogue in the beginning of the 3d century (De Pœn. x., 7 and 8); and even as far back as the first years of the 2d century there is, in St. Ignatius (ad Philad. viii.) a possible reference to the private recourse of a penitent to his bishop. And in general, indications of the practice of private confession of smaller sins, and

even of grievous sins for the purpose of receiving a preliminary judgment upon the necessity of exposing them publicly, are to be found in almost all the documents that have been cited as containing information on the ancient use of penance.

2d. The question as to the *sacramental character* of the penitential institution is evidently not to be answered by showing that there is no connection of the word *sacrament* with that of *penance* until late in the history of the Christian Church. This is admitted. But if without actually using the name, Christians believed and understood that penance was instituted by Christ, and that its purpose was to confer the grace of Christ by use of an outward form, this is sufficient to justify its title to the name *sacrament*, at least in the mind of the church which applies the name to it.

To return to the general line of the historical description: in spite of the very definite theological teachings evoked by the Novatian controversy, it must not be imagined that the entire doctrinal theory of the sacrament was everywhere adequately understood. There was still abundant room for the expression of varying opinions. St. Augustine, though in one place he seems to hint at the absolute necessity of absolution for the salvation of sinners, exclaiming, "what ruin will come upon those who depart this life unabsolved" (Ep. 180), does not, however, deny the possibility of their obtaining mercy from God. (Ep. 54.) Likewise Cyprian, refusing absolution to "deathbed penitents," has no fear that they are by his action excluded from forgiveness forever, and in fact, all through the Middle Ages, and even down to the 13th century, we still find discussions, for example, in the Decrees of Gratian, and in the "Sentences" of Peter Lombard concerning the precise purport of absolution, and its relative efficacy compared with the necessary interior contrition. Again, the Council of Chalons in the 9th century evidently considered the absolute *necessity* of confession an open question, though the Synod of Liège, in the 8th century, anticipated the fourth Lateran Council of the 15th century by commanding annual confession. In fact the dogma has, like every other, a history full of controversies, doubts, reactions, and advances, all looking to precision of theological thought and utterance.

Evidently, then, the conclusion to be drawn from any historical examination into the origin and growth of the institution of penance, must largely depend upon the acceptance or rejection of the principle of development in theology. The investigator who would expect to find at every stage of Christian history the precision and fulness of the Tridentine decrees on the sacrament of penance, or not finding them, would condemn the institution as un-Christian, will doubtless be compelled to the latter alternative; but if one is willing to admit that an institution may have been founded by Christ for continuing, in a visible, sacramental way, the forgiveness of sins, and that this institution may have undergone a natural and divinely directed development, eliminating errors, fixing truth, and finally settling into definite theological shape,—it is quite possible that to such a one the Catholic claim may seem well sustained by historical investigation. Such, at least, is the con-



## PENANG—PENCIL

tention of modern apologists for the sacrament, who recognize that their task is not so much to show that confession, absolution, and penitential satisfaction have always existed in the Church—for this is sufficiently evident,—but that the modern discipline and doctrine are a lawful evolution of the seed planted by Him who said to His apostles, "As the Father hath sent me, I also send you . . . whose sins you shall forgive they are forgiven them, whose sins you shall retain, they are retained." (St. John xx. 21-23.)

The Roman Catholic doctrine of the sacrament of penance is shared by the schismatical churches: the Greek Church, separate from the 11th century, and the Nestorians, Jacobites, and Abyssinians, separate from the 5th and 6th centuries, practise penance and hold it a sacrament.

Luther long wavered before rejecting confession and priestly absolution, as the Augsburg Confession and the Shorter Catechism testify. Even yet a limited confession is recommended in the Lutheran prayer-book, but the notion of absolution is gone. In general the reformers abolished the idea of the necessity of confession and the efficacy of absolution, though in many cases they recommended a voluntary partial manifestation of conscience. Members of the Anglican Church are coming quite generally to adopt and even to go beyond Dr. Pusey's very nearly Roman views. Some even admit the sacramental character of penance; though few, if any, have thus far considered its reception as obligatory and necessary for salvation.

Among Catholics in modern times, there has been manifest a growing tendency to a devotional use of the sacrament. The law of the fourth Lateran Council (1215) prescribing annual confession for all members of the church has merely decided the minimum of observance. The authoritative approbation of the confession of venial faults by the Council of Trent has immensely promoted the movement for frequent *confession*, and to-day the confessional is used to a great extent by the devout as a means of receiving "direction" for the conduct of the spiritual life, and all Catholics generally, whether or not conscious of grievous sin, always seek absolution before receiving the sacrament of the Eucharist. JAMES M. GILLIS, C. S. P., *St. Thomas' College, Catholic University, Washington.*

**Penang**, pē-nāng', or **Prince of Wales Island**, an island of the Straits Settlements, belonging to Great Britain, lying at the north entrance of the Straits of Malacca, off the west coast of the Malay Peninsula, from which it is separated by a channel two to five miles across. The length of the island is 14 miles; breadth, 8 miles; area, about 106 square miles. The settlement of Penang also includes Province Wellesley, a long strip of the Malay Peninsula opposite the island, 28 miles long by 8½ broad; area, about 233 square miles. The greater part of Province Wellesley is fertile plain, and the remainder, about one eleventh of the whole, consists of low wooded hills, the highest of which reaches a height of 1,843 feet. Two fifths of Penang is plain, and the rest hills—for the most part wooded—which rise to a height of 2,734 feet. The climate is hot, but healthful; bracing sea-breezes blow every day, and rain

falls every month during the year except January and February; temperature from 76° to 90° F. The rocks are granite and mica schist; the soil a rich vegetable mold. The settlement produces sugar, rice, and cocoanuts in abundance; together with coffee, cloves, areca-nuts, ginger, sweet-potatoes, pineapple, shaddock, banana, orange, lemon, plantain, mango, guava, etc. Among timber trees are the teak, dammar-pine, caoutchouc, cypress, etc. Tigers, civets, wildcats, monkeys, wild oxen, and hogs are natives, as are also pelicans, pea-fowl, adjutants (a kind of stork), and numerous species of brilliantly plumaged birds. Buffaloes and cattle are extensively raised for dairy or farm purposes, and hogs in great numbers by the Chinese for food. Goats and sheep are scarce, but poultry are plentiful. The coasts abound with fish, 20 varieties of which, chiefly caught by the Malays, are brought to the market. Tin-ore is abundant, but little wrought. Georgetown, or Penang, as it is generally called, the capital and port of the settlement, is situated on a tongue of land on the east side of the island. Pop. (1901) 94,086, principally Chinese, many of them merchants and shopkeepers. The trade carried on is important, the imports and exports having an aggregate annual value of \$100,000,000. Pop. (1901) 128,830. Penang was made over by treaty to the East India Company in 1786 by the Rajah of Queda, and in 1805 was erected into a separate presidency. Since 1867, with Singapore and Malacca, it forms a crown colony with a common governor, Penang and Malacca having each a lieutenant-governor. See STRAITS SETTLEMENTS.

**Penates**, pē-nā'tēz, in ancient Rome, were certain guardian deities of the family and state among the Romans. The images of these gods were kept in the penetralia, or central part of every house. The Lares were included among the Penates. Since Jupiter and Juno were regarded as the protectors of the family, these divinities were worshipped as Penates; and each hearth, as the symbol of domestic union, had also its Vesta. The chief Penates at Rome were those that protected the empire. See LARES.

**Pencil**, an instrument used for painting, drawing, and writing. The first pencils used by artists were probably pieces of colored earth or chalk cut into a form convenient for holding in the hand. With such instruments the monochromes, or one-colored pictures, of the Egyptians and Greeks were drawn. On the introduction of wet colors, however, delicate brushes of fine hairs were used. Pencils of this kind, and of various degrees of fineness, are now almost solely used by painters for laying on their colors; but in China and Japan they are generally employed, instead of pens, for writing. The hairs used for these pencils are obtained from the camel, badger, squirrel, sable, goat, etc. The finest pencils require very careful selection and arrangement of the hairs; their naturally fine points must all be in one direction; the central one must project the farthest, all the others receding in succession, so as to form a smooth cone terminating in a sharp point. The hairs, being selected, are bound in a little roll by a string tied tightly round their root ends; the points are also temporarily bound together. The roll is then introduced into the large end of a



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quill tube, which has been softened by moisture. As the quill dries the increased pressure caused by its contraction holds the hairs securely in their place; but the pressure should not be so great as to make the points spread apart when they are untied. For larger pencils a socket of tinplate is used instead of the quill. Black-lead pencils, for writing or drawing, are made of graphite or plumbago. See LEAD PENCILS.

**Pencil-tree**, or **Groundsels Bush**, a branching glabrous shrub (*Baccharis halimifolia*), of the order *Compositæ*, 3 to 10 feet high, common along the salt marshes and tidal rivers of the Atlantic coast. Its brightly white pappus makes it very conspicuous in autumn.

**Penck, Albrecht**, German geologist and geographer: b. Leipsic 1858. He made several careful studies of the Bavarian and Tyrolean mountains in 1880 and later traveled in the Pyrenees and in the mountains of Scotland. He served as docent at Munich for some time, and in 1885 was appointed professor of physical geography at Vienna. He edited the 'Geographische Abhandlungen' in 1886 and contributed largely to the 'Geological Journal' of Chicago. In 1892 he was made president of the commission for the study of the geography of Germany. He has written: 'Die Vergeltscherung der deutschen Alpen' (1882); 'Die Eiszeit in den Pyrenäen' (1885); 'Morphologie der Erdoberfläche' (1894); etc.

**Penco**, pān'kō. See CONCEPCION.

**Pencz, Georg**, German painter and engraver: b. Nuremberg about 1500; d. 1550. He probably was a pupil of Dürer and became a member of the Painters' Guild in 1523, but in 1524 he was tried for infidelity and compelled to leave the city, together with his friends, Sebald and Barthel Beham. He, however, returned in 1525 to the neighborhood, and in 1532 once more took up his residence in Nuremberg, being often given work by the city council. He had previously visited Rome, and in 1539 he again went there to study Raphael and the Venetian masters and while there studied the art of engraving under Marc Antonio. He ranks next to the Behams in the 'Little Masters' and some of his plates equal if not surpass those of his teacher, Antonio. Among them are 'The Taking of Carthage' (1539); 'The Six Triumphs of Petrarch'; 'Life of Christ' in 26 plates; 'Medea'; 'Vergil and the Courtesan'; 'Paris'; and several portraits, the best of which is that of John Frederick, elector of Saxony. His paintings are mostly portraits and are among the best of those in the Germanic Museum, Nuremberg. He has painted: 'Saint Jerome' (1544); 'Field Marshal Sebaldus Schirmer' (1545), both in the Germanic Museum; 'Young Man' (1534); 'The Painter Erhard Schwetzer' (1544); and his 'Wife' (1545); all in the Berlin Museum; the 'Young Man' (1543) in the Vienna Museum; and the masterly portrait of a 'Scholar' in the Karlsruhe Gallery.

**Penden'nis, The History of**, a novel by W. M. Thackeray, published in 1850. It is more simple in plot and construction than Thackeray's other novels, and is a masterly study of the character and development of one Arthur Pendennis, a hero lifelike and convincing because of his very unheroic qualities and faulty human nature. The character of Pendennis is drawn

with admirable consistency throughout, and he is perhaps the most commonplace, and the most thoroughly human, of Thackeray's men.

**Penden'tive**, in architecture, the portion of a dome-shaped vault which descends into a corner of a quadrangular opening when a ceiling of this kind is placed over a straight-sided area. In Gothic architecture the term is used to designate the portion of a groined ceiling springing from one pillar or impost, and bounded by the ridges or apices of the longitudinal and transverse vaults.

**Pen'der, Sir John**, Scottish promoter of submarine telegraphy: b. Vale of Leven, Dumbartonshire, Scotland, 1815; d. Kent, England, 7 July 1896. He was educated in the Glasgow high school, entered the counting-house of a Glasgow textile firm and in three years became its manager. He made the business his own under the firm name of J. Pender & Company, and it became one of the most important in the country, meantime accumulating for its owner an immense fortune. In 1856 he joined Cyrus W. Field (q.v.) in his projected enterprise of a submarine cable; held the office of chairman of the Anglo-American Company and risked his entire fortune in furthering the venture. Upon its completion he immediately organized companies to connect Great Britain with other parts of the world, and in 1882 66,000 miles of cable had been laid. He was knighted in 1888, sat in Parliament for Totnes in 1862-6, for the Wick burghs in 1872-85, and 1892-6, at first as a Liberal, and in his last years as a Liberal Unionist.

**Pender, William Dorsey**, American soldier: b. Edgecomb County, N. C., 6 Feb. 1834; d. Staunton, Va., 18 July 1863. He was graduated from West Point in 1854, engaged in frontier service with promotion to lieutenant in 1858, and in 1861 resigned his commission to enter the Confederate army, where he was appointed captain of artillery. He was engaged in the first battle of Bull Run, and acted as brigadier-general at the battle of Seven Pines. He received the rank of major-general in 1863 in recognition of services at the second battle of Bull Run, Winchester, Harper's Ferry, and Fredericksburg, and while leading his brigade against Seminary Ridge on the second day of the battle of Gettysburg, was mortally wounded.

**Pendleton, Edmund**, American statesman and jurist: b. Caroline County, Va., 9 Sept. 1721; d. Richmond, Va., 23 Oct. 1803. He was apprenticed in 1734 to the clerk of Caroline court, three years later became clerk of the vestry of Saint Mary's parish, and was licensed in 1741 to practise law, in which profession he soon attained eminence. In 1751 he was made justice of the peace in his native county, an office which he held until 1777, when, by an accident, he was crippled for life. Meanwhile he was developing planting interests on a large scale, grants in his name numbering nearly 10,000 acres being on record. In 1752 he was elected to the House of Burgesses, and represented his county in that legislative body without interruption until it became extinct at the outbreak of the Revolution. It is a moot question where the Virginians, who showed such initiative and constructive force in the politics of the Revolution, received the training for their



## PENDLETON

masterful role. Some have answered, with Bishop Meade, that they got their schooling in the Virginia vestry; others, like William Wirt Henry, incline to the view that they learned wisdom in the conduct of public affairs in the magistracy, acting as judge and ruler for the countryside; others still, like Rives in his 'Life of James Madison,' hold that the men of the Revolution gained their ability to steer large enterprises from the plantation, a miniature kingdom requiring executive powers of a high order. Perhaps there is truth in the contention of each of these writers; but who can doubt that it was chiefly to the debates and lusty political life of the colonial legislature that men like Pendleton, Washington, Mason, Wythe, and Henry owed their superiority in statecraft? It will be noted, however, that Pendleton enjoyed the advantage of all these converging lines of experience in public and private life. He was at once vestryman, magistrate, planter, and burgess. From each of these careers his capacious mind extracted what was best in creative precedent. Less learned than George Wythe and less magnetic than Richard Henry Lee, Pendleton displayed rare sagacity in constructing institutions, both colonial and national, in the conservative spirit so characteristic of British political instinct, working by adaptation rather than by out-of-hand invention, and following tenaciously the grooves of experience. Though he had been a member of the committee of the Virginia legislature, appointed in 1764, to draw up memorials to the king, lords, and Commons of England protesting against the proposed Stamp Act, Pendleton, the following May, opposed Patrick Henry's famous resolutions, declaring "that the General Assembly of this colony have the only sole and exclusive right and power to lay taxes." He opposed likewise as premature Henry's resolution of 1775 "that this colony be immediately put into a posture of defence." Pendleton may be regarded as the leader of the conservative party in Virginia, resisting change, but never reactionary after change had once been instituted.

In 1773 Pendleton was made a member of the Committee of Correspondence, which instantly gave a nervous system to the colonial cause. In 1774 he was elected to the first Virginia convention, which met on 1 August, to respond to the call from New England touching the Boston Port Bill. This convention took steps for a general congress, to which Pendleton was sent as a delegate. Upon the dissolution of the royal government in Virginia, by reason of the flight of Lord Dunmore from the capital at Williamsburg, he was made president of the Committee on Public Safety, which piloted the colony during the trying times from 17 Aug. 1775 to 5 July 1776, when Patrick Henry took the oath as governor of the commonwealth. Acting in this capacity, Pendleton was virtually the ruler of Virginia in this transitional period.

Pendleton presided over the conventions which met in December 1775 and May 1776, the latter framing the Virginia constitution, and directing the Virginia delegates in Congress to bring forward a motion declaring the independence of the united colonies. The resolution embodying these momentous instructions was drawn by Pendleton. In connection with

Jefferson and George Wythe, Pendleton revised the laws of Virginia in accordance with the changed political situation. As president of the court of chancery, he presided from 1779 over the court of appeals, and thus for 15 years acted as head of the Virginia judiciary. In 1788 he was elected president of the Virginia convention which ratified the Constitution of the United States. Pendleton was a Nationalist even at that early time, and was a staunch supporter of peace. When war seemed imminent with France, in 1798, he protested against fighting a sister republic. In his intuitive love of prescription, in his willingness to be pushed along the line of reform only by incontrovertible facts, and in his efficiency in carrying out the details of a policy he had strenuously opposed in debate, he is strikingly like Sir Robert Peel. Jefferson said of Pendleton: "Taken all in all, he was the ablest man in debate I ever met."

S. C. MITCHELL,  
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**Pendleton, George Hunt**, American legislator: b. Cincinnati, Ohio, 25 July 1825; d. Brussels, Belgium, 24 Nov. 1889. He was educated in Cincinnati and Heidelberg, Germany, studied law and was admitted to the bar. In 1854-5 he served in the State senate and was a member of Congress in 1856-65. Throughout the Civil War he strongly opposed the administration, and in 1864 was candidate for the vice-presidency on the Democratic ticket. In 1878 he was elected United States Senator from Ohio, and in 1882 he introduced a civil service reform bill known by his name and passed in 1883. In 1885 he was appointed by President Cleveland United States minister to Germany.

**Pendleton, Louis (Beauregard)**, American novelist: b. Tebeauville (now Waycross), Ga., 21 April 1861. He was educated in Philadelphia and among his published novels and juveniles are 'Bewitched' (1888); 'In the Wire Grass' (1889); 'King Tom and the Runaways' (1890); 'The Sons of Ham' (1895); 'Carita' (1898).

**Pendleton, William Kimbrough**, American educator: b. Louisa County, Va., 8 Sept. 1817. He received his education at the University of Virginia, and, after graduating from the law school, was admitted to the bar. He joined Alexander Campbell in founding Bethany College, becoming a professor and later president of the university. He served in the West Virginia constitutional convention and for four years was State superintendent of schools.

**Pendleton, William Nelson**, American Episcopal clergyman and soldier: b. Richmond, Va., 26 Dec. 1809; d. Lexington, Va., 15 Jan. 1883. He was graduated from West Point in 1830, served there as assistant instructor in mathematics in 1831-2, resigned from the army in 1833, engaged in teaching in Bristol College, Pa., and in Delaware College, and entered the Episcopal ministry in 1837. He established the Episcopal high-school in Alexandria, Va., in 1839 and was its principal until 1853 when he was called to the charge of a church in Lexington, Va. In 1861 he entered the Confederate army as captain of artillery, was promoted to be chief of artillery in the Army of the Shenandoah, and in 1862 received the rank of brigadier-general. He was engaged in all but three of the battles



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fought by the Army of Northern Virginia, beginning with Bull Run, was one of the commissioners appointed by General Lee to arrange terms of surrender in 1865, and then returned to his parish in Lexington, where he remained until his death. He published 'Science a Witness for the Bible' (1860).

**Pendleton, Ore.**, city, county-seat of Umatilla County; on the Umatilla River, and on the Oregon R. & T. Co. and the Washington & C. R. railroad, 35 miles southwest of Walla Walla, Wash. The city was enlarged in 1884 by the addition of 640 acres of the Umatilla Indians' reservation. It is built on both sides of the river, which is here crossed by three bridges. The river affords good water-power for manufacturing; the chief industrial establishments include flour mills, machine shops, woolen mills, and a paper mill. The city has a high school and is the seat of St. Joseph's Academy, a Roman Catholic school with elementary and secondary grades. The waterworks are under municipal ownership and control. Pop. (1890) 2,506; (1900) 4,406.

**Pendulum** (Latin, "hanging down"), a piece of physical apparatus consisting essentially of a mass of metal (known as the "bob"), suspended, by means of a rigid and inextensible rod or wire, from a fixed point or from a fixed horizontal axis, about which it can oscillate under the influence of gravity and its own inertia. It might be more generally defined as a rigid body that is subjected to a constraint which permits of no motion save one of rotation or oscillation, about a point or axis that is fixed relatively to the body and to space; the rotation or oscillation being determined by the action, upon the mass, of some force of constant magnitude and direction. In the mathematical discussion of the pendulum, it is convenient to begin with the "simple pendulum," in which the bob is conceived to be a mere material particle, and the suspending rod is assumed to be devoid of mass, and the motion is assumed to be confined to some one vertical plane passing through the point of support, and all retarding influences, such as the resistance of the air and the friction at the point of support, are neglected. The "period of oscillation" of any pendulum is defined as the time occupied by a single oscillation, counting from the instant when the pendulum is at its extreme position on one side of the vertical, to the instant when it next arrives at its extreme position on the other side of the vertical. It is easy to show that the period of oscillation of the simple pendulum, as defined above, is practically independent of the arc described by the bob, provided that arc is very small; this fact being expressed, in mathematical language, by stating that the vibrations of the simple pendulum are "isochronous," when the amplitude of the vibration is small. It may be readily shown, in fact, that the period of oscillation of a simple pendulum is given by the expression  $3.1416 B \sqrt{L/G}$ , where  $L$  is the length of the pendulum,  $G$  is the intensity of gravity (that is,  $G$  is the velocity that a freely-falling body would acquire in one second), and  $B$  is a function of the arc,  $A$ , through which the pendulum swings, in passing from one of its extreme positions to the other. The function  $B$  may be expressed in terms of  $A$  by means of a series in

which  $A$  occurs only in ascending even powers.

Thus  $B = 1 + \frac{A^2}{64} + \dots$ . When the arc,  $A$ ,

is very small, we may take  $B$  equal to unity in all cases, save those in which the highest possible refinement is required; and hence, in all ordinary work, we may take the period of oscillation of the simple pendulum to be  $3.1416 \sqrt{L/G}$ , when the amplitude of the oscillation is small. If  $L$  is expressed in feet, and  $G$  in feet per second per second, the foregoing formula gives the period of oscillation in seconds. To find the length that a simple pendulum must have, in order that its period of oscillation may be precisely one second, we have only to set the foregoing formula equal to unity, and solve the resulting equation for  $L$ . Thus we have, for

this case,  $L = \frac{G}{(3.1416)^2}$ . The value of  $G$  varies

somewhat from place to place, but if we take  $G = 32.2$  as its average value, this last formula shows that a simple pendulum, in order to have a period of oscillation of one second, must have a length of about 3.263 feet, or 39.150 inches. Any pendulum which has a period of oscillation of precisely one second is called a "seconds pendulum." The length of the seconds pendulum will evidently vary, however, with the value of  $G$  at the place at which the experiment is made.

A pendulum, when once set in vibration in a given vertical plane passing through its point of support, continues to vibrate in this same plane unless forced to depart from it by the application of some external force other than gravity. Foucault took advantage of this fact for experimentally demonstrating the rotation of the earth. In 1851 he constructed a pendulum which was approximately "simple," being composed of a heavy sphere of polished metal, suspended by a steel wire about 65 metres long. The experiment was performed under the dome of the Pantheon, at Paris. A pendulum of this sort, if set in vibration in a vertical plane at the earth's pole, would continue to vibrate in the same constant plane, while the earth rotated under it at the rate of  $360^\circ$  every 24 hours, or  $15^\circ$  every hour. The rotation of the earth would therefore become evident to the eye; though, since the observer would be rotating with the earth, it would appear to him as though the earth were stationary, and the plane of the pendulum's motion were rotating. The phenomena would be somewhat more complicated in other latitudes, however, because it is only at the poles that the direction in which gravity acts remains constant while the earth rotates. Foucault showed that when allowance is made for the changing direction of gravity, the plane of vibration of a simple pendulum, in the latitude of Paris, should appear to rotate by  $11^\circ 17' 33''$ , per sidereal hour; and when the experiment was tried with the giant pendulum that he erected in the Pantheon, the actual apparent rotation was found to agree very well with this theoretical value. Since 1851 this experiment has been tried many times; and a pendulum that is arranged, in accordance with Foucault's plan, for the purpose of demonstrating the rotation of the earth, is now known as a "Foucault pendulum."



## PENDULUM

Any pendulum whose mass is not wholly concentrated at a single point is said to be "compound." The simple pendulum is a convenient mathematical abstraction (such pendulums as Foucault's being merely close approximations to it); but we must, in strictness, regard all actual pendulums as compound. Fig. 1 represents a compound pendulum of general form, which is supposed to be vibrating in the plane of the paper, about a horizontal axis passing through *O*, which is called the "axis of suspension." If *G* is the centre of gravity of the pendulum, the foot of the perpendicular that is let fall from *G* to the axis of suspension is called the "centre of suspension." In the same straight line with *O* and *G*, there is a point *C*, called the "centre of oscillation" (or, sometimes, the "centre of percussion"), which has the following properties: (1) The time of vibration would remain unaffected, if the entire mass of the pendulum were concentrated at *C*. (2) If the pendulum were

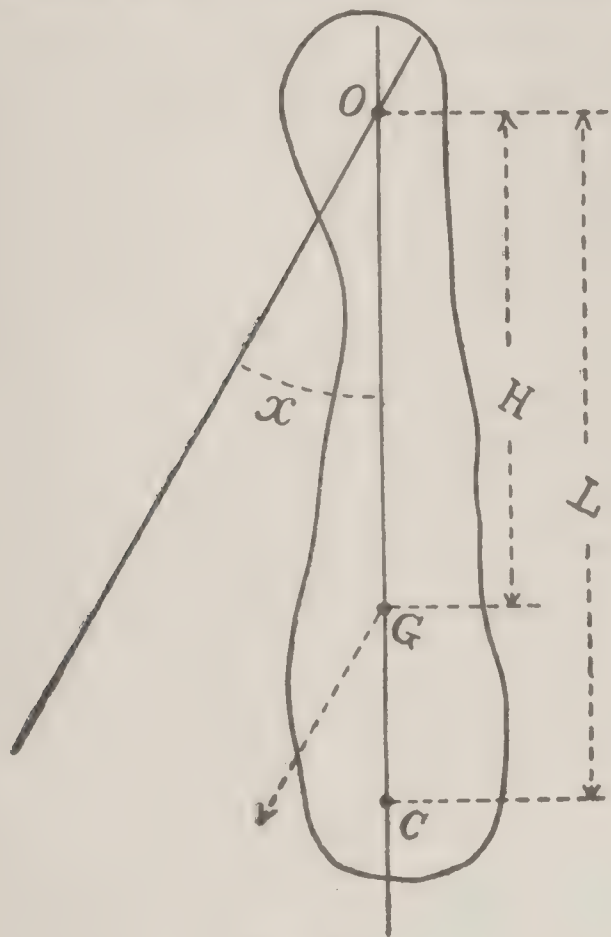


FIG. 1.

inverted, and *C* were taken as the new centre of suspension, the period of oscillation would remain unchanged. (3) The period of oscillation of the actual, compound pendulum is the same as the period of oscillation of a simple pendulum having a length *OC*; and hence *OC* is commonly called the "length of the equivalent simple pendulum." To find the position of *C*, let *H* be the distance, *OG*, from the centre of suspension to the centre of gravity, and let *K* be the radius of inertia of the pendulum (that is, its moment of inertia divided by its total mass), with respect to an axis passing through *G*, and parallel to the axis of suspension. Then the distance, *L*, from *O* to *C*, is given by the expression  $L = (H^2 + K^2)/H$ . Evidently *L* is always greater than *H*.

The length of a pendulum varies somewhat with the temperature, on account of the expansion and contraction of the material of which it is constructed. Hence in a piece of apparatus, such as an astronomical clock, in which it is important to have a pendulum execute its vibrations always in the same time, the temperature

must be kept constant, or else some compensatory device must be employed, which will eliminate the effects due to its variation. Uniformity of temperature is important in all cases, because none of the compensation methods are perfect; and clocks of precision should be kept in rooms whose temperatures vary as little as possible. In such cases it is often sufficient to make the suspending rod of the pendulum of well-seasoned

pine or fir, since the coefficient of expansion of these woods is small, and if the temperature change is also small, its effect upon the rate of the clock may become almost indistinguishable. Wooden pendulum rods are apt to be affected by changes in the hygrometric state of the air, but this can be prevented by a good coat of varnish, and the use of a suitable drying medium within the clock case. In Germany, clock pendulums are now commonly made of an alloy of nickel and steel, which is known as "invar," and which has a coefficient of expansion that is almost negligible.

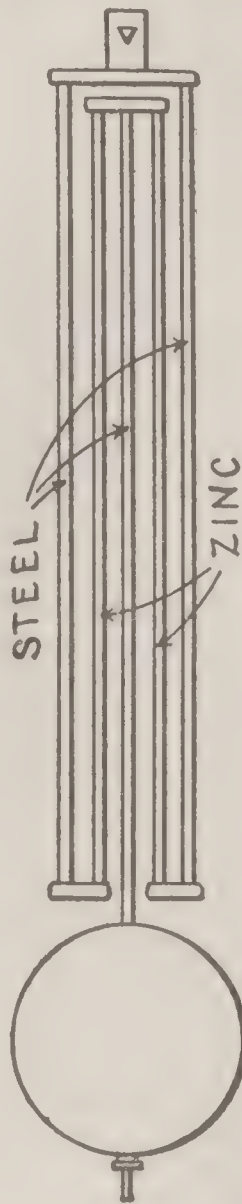


FIG. 2.

"Compensation pendulums" are those in which provision is made for the automatic elimination of the effects of changes of temperature. Of these the two commonest forms are the "gridiron" pendulum, and the mercury compensation pendulum. In the gridiron form, the bob is supported by means of a series of parallel bars, somewhat as represented, diagrammatically, in Fig. 2. In the diagram, the central bar and the two outside ones are of steel, while the intermediate ones are of zinc. If the zinc bars should expand while the steel ones remained constant in length, the bob of the pendulum would evidently be raised; and if the steel ones should expand while the zinc ones remained constant in length, the bob would be lowered. In the actual case, where a rise of temperature causes the zinc and the steel to expand simultaneously, the effects of the two metals, in displacing the bob, are therefore opposed. The effective length of the steel rods is about twice that of the zinc ones; but, on the other hand, the coefficient of expansion of zinc is about twice that of steel. On the whole, therefore, the position of the bob is not materially affected by a change of temperature.

In the mercury compensation pendulum, the supporting rod is a simple bar of steel, but the bob consists of a cylindrical glass vessel containing mercury. A rise in temperature causes the suspending rod to dilate, and this tends to lengthen the pendulum. The mercury in the bob expands at the same time, however, and the centre of gravity of the mass of mercury therefore rises. The expansion of mercury is considerably greater than that of steel, and by properly proportioning the apparatus it is possible to make the rise of the centre of gravity of the bob, due to the expansion of the mercury, sensi-



## PENEDO — PENELOPE

bly equal to the depression of the bob as a whole, due to the expansion of the supporting rod.

The fact that  $G$ , the accelerating effect of gravity, enters into the expression for the period of oscillation of the pendulum, suggests the use of this instrument for the determination of  $G$ ; and in fact it has been found that no other method of determining the intensity of gravity is comparable in accuracy with the pendulum method.

In determining the intensity of gravity by the pendulum, two general methods are followed, according as it is desired to make an "absolute" or a "relative" determination. The absolute determination is much more difficult to execute, because it necessitates the careful measurement of the length of the pendulum, and the determination of certain rather troublesome corrections. In principle it is simple enough, however, for if we knew the length of the pendulum ( $L$ ), and its period of oscillation ( $T$ ), we should merely have to substitute their values in the equation  $T = 3.1416 \sqrt{L/G}$ , and solve for  $G$ , which would be the only remaining unknown quantity. In relative determinations it is not necessary to measure the length of the pendulum (except roughly, for the purpose of making certain small corrections to the observations), the pendulum being merely vibrated in two different places, at one of which the intensity of gravity is known. If  $T_1$  and  $T_2$  are the times of oscillation in the two places, and if  $G_1$  and  $G_2$  are the corresponding intensities of gravity at these places, we have  $T_1 = 3.1416 \sqrt{L/G_1}$ , and  $T_2 = 3.1416 \sqrt{L/G_2}$ . Since  $L$  remains invariable, we find, by division,  $T_1/T_2 = \sqrt{G_2/G_1}$ ; or  $G_2 = G_1 T_1^2/T_2^2$ . Hence, as  $G_1$  is supposed to be known, and  $T_1$  and  $T_2$  have been measured, the value of  $G_2$  is also known.

Pendulums that are to be used in determining the intensity of gravity are provided with steel knife edges, which support the pendulums by resting upon agate bearing plates; the friction of the supports being reduced, by this device, almost to zero. Those which are to be used in relative determinations need not necessarily have more than one set of knife edges; but when an absolute determination is to be made, it is essential, in order to secure a high degree of accuracy, that two sets of knife edges should be provided, each being placed, as nearly as possible, at the centre of oscillation of the pendulum, relatively to the other one. If it were mechanically possible to realize this adjustment perfectly, the pendulum would vibrate with precisely the same period of oscillation, whether it were supported from one set of knife edges, or from the other one; and the distance from one of these sets to the other one would be precisely equal to the "length of the equivalent simple pendulum," which is denoted in the foregoing formulæ by  $L$ . In practice, however, it is not possible to place the knife edges so that the period of oscillation is not measurably altered by reversing the pendulum; and this fact makes it necessary to determine the period of oscillation twice,—once before reversal, and once afterward. The distance between the knife edges must then receive a small correction, in order to deduce the "length of the equivalent simple pendulum"; but this branch of the subject is too technical for treatment in the present article:

(Consult: Clarke, 'Geodesy'; also the various 'Appendices' of the United States Coast and Geodetic Survey, bearing upon pendulum work.) The use of the reversible pendulum, which is based upon Huygens' theorem that the centres of suspension and oscillation are reciprocal, is due to Captain Henry Kater, of the British Army, who first employed it in 1818, for determining the length of the seconds pendulum at London.

The "conical pendulum" is a pendulum which is supported from a fixed point, and whose motion is not confined to a single fixed plane; the name being derived from the fact that the straight line joining the centre of gravity and the centre of suspension describes a conical surface. A pendulum consisting of a spherical metal bob, supported by a flexible, inextensible string, may be used either as an approximately simple pendulum, or as a conical pendulum. Conical pendulums, modified in various ways, are used for regulating the speed of chronographs and other physical apparatus; and the common steam engine governor is also an adaptation of the principle of the conical pendulum.

The "ballistic pendulum" is an apparatus for determining the velocity of a bullet. It is suspended in the usual way from a fixed horizontal axis, and the bob consists of wood or other suitable material, weighted, when necessary, by the addition of iron or lead. The pendulum being at rest in a vertical position, the bullet is fired into the bob, and the height to which the pendulum bob rises in the initial swing is noted. The speed with which the bullet entered the bob may then be computed, if the masses of the bullet and the bob are known. The ballistic pendulum is not a very accurate instrument, partly because it takes no account of the thermal phenomena that occur when the bullet enters the bob, and partly for other reasons. It has now been almost entirely discarded, the velocities of projectiles being measured by more direct methods, that are capable of much greater precision.

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**Penedo**, pā-nā'doo, Brazil, city and port of the state of Alagoas, 70 miles southeast of Maceio, on the right bank of the São Francisco and about 30 miles from its mouth. It is an old town, having been founded about 1620; has ruins of a 17th century fort; contains several convents and schools; and now does considerable business in foodstuffs with Recife and Bahia, with which it has regular steamboat connections. There is fine fishing in the river. Pop. (estimated) 9,000.

**Penelope**, pe-něl'ō-pe, in Greek mythology, the daughter of Icarius and Peribœa of Sparta. When she reached womanhood her extraordinary beauty attracted many suitors, and her father promised to give her to the conqueror in a foot race. Odysseus (Ulysses) won the prize, but Icarius tried to persuade his daughter not to accompany Odysseus to Ithaca. The young victor allowed her to decide for herself, whereupon she covered her face with her veil to hide her blushes, thus intimating her desire to follow her husband. The fruit of the marriage was an only child, Telemachus, who was but an infant when his father sailed against Troy. During the protracted absence of Odysseus he was generally regarded as dead, and



## PENFIELD — PENINSULA CAMPAIGN OF 1862

Penelope was surrounded by a host of suitors. Some writers assert that she became the mother of Pan by Hermes or by all the suitors together; that her husband repudiated her on his return, and that she went to Sparta and thence to Mantinea, where her tomb was shown in after ages. See ODYSSEY; ULYSSES.

**Penfield, Frederic Courtland**, American diplomat: b. Connecticut 23 April 1855. He studied in Germany, entered journalism and was for five years on the editorial staff of the *Hartford Courant*. In 1885 he was appointed United States vice-consul-general at London, and in 1893-7 served as diplomatic agent and consul-general to Egypt. He has been honored by various foreign societies and has received decorations from different European governments. He has published: 'Present Day Egypt' (1899); 'Mahmoud Pasha' (1903); etc.

**Penfield, Samuel Lewis**, American mineralogist: b. Catskill, N. Y., 16 Jan. 1856; d. South Woodstock, Conn., 12 Aug. 1906. He was graduated from the Sheffield School at Yale in 1877, and became professor of mineralogy there. He was a member of the National Academy of Science, and was from 1877 an extensive contributor on the subjects of mineralogy and crystallography in the 'American Journal of Science and Art.' He was a leading authority on mineralogy. He published 'Brush-Penfield Determinative Mineralogy and Blow-Pipe Analysis' (1898).

**Penfield, William Lawrence**, American lawyer: b. Dover, Lenawee County, Mich., 2 April 1846. He was graduated from the University of Michigan in 1870, taught for two years at Adrian College, Mich., and in 1872 was admitted to the bar. He then took up the practice of law in Auburn, Ind., and in 1876 became city attorney. In 1884 he was a member of the Republican State committee; in 1888 presidential elector and electoral messenger, and delegate to the National Convention in 1892. He was judge of the 5th circuit court of Indiana 1894-7 and in the last-named year was appointed solicitor of the United States department of state. He has been counsel for the United States in international arbitration cases of the United States against San Domingo, Peru, Haiti, Nicaragua, Guatemala, and Salvador, securing awards for the United States which have amounted to over \$2,000,000. He was also appointed to represent the United States before The Hague permanent arbitration court in the controversy with Mexico over the "Pious Fund Claim of the Californias," this being the first case to be tried before this tribunal.

**Pen'guin**, a name now restricted to swimming birds forming the very distinct order *Impennes*, and family *Spheniscidæ*. Their wings are inflexible paddles, destitute of quill-feathers, and covered with a scaly integument or skin. Although useless as organs of flight, they are very effective aids in diving; and on land may be used after the fashion of fore-limbs. The hinder toe is rudimentary, or wanting in some species, and the front toes are completely webbed. On the body the feathers are scale-like and barbless, and are distributed uniformly, without naked intervals. These birds exist in immense numbers in the Antarctic seas. They occur on the South African and South American coasts,

being found in large flocks at Tierra del Fuego and on the Pacific islands, Australia, and New Zealand. They are gregarious in habits. On shore penguins have the habit of standing in long, regular lines, resembling files of soldiers drawn up in military array. Owing to the very posterior position of the legs the attitude on land is erect. The female incubates the eggs, holding them between the thighs; and they are said to carry off the eggs in the same fashion when disturbed or alarmed. The male supplies the female with food during incubation, both parents feeding the young after they are hatched. The nests are formed in the hollows of rocks, and the eggs are deposited on the thick layer of excrement, which, accumulating through long periods of time, constitutes the valued guano of commerce. The usual food consists of fishes, mollusks, etc. As a family the penguins represent, in the southern seas, the auks of the northern and Arctic regions. There are three principal genera: *Aptenodytes* with *A. patagonica*, the king penguin; *Eudyptes* with *E. chryscome*, the crested penguin; and *Spheniscus*, with *S. demersus*, the well-known Cape penguin. Consult: Moseley, 'A Naturalist on the Challenger'; Buller, 'Birds of New Zealand'; and the writings of Antarctic explorers.

**Penhallow, pěn-höl'ō, Samuel**, American colonist and historian: b. St. Mavon, Cornwall, England, 2 July 1665; d. Portsmouth, N. H., 2 Dec. 1726. He came to New England in 1686, and finally settled in Portsmouth where he amassed a considerable property and gained much influence in government affairs. After holding several offices he was appointed a justice of the superior court of judicature in 1714, and in 1717 became chief justice, which office he held until his death. His work as a historian is of much value, has been several times republished, and is considered the most authentic history of the period in existence. It was first published under the title 'Narrative of the Indian Wars of New England from 1703-1726' (1725-6).

**Pen'ick, Charles Clifton**, American Protestant Episcopal bishop: b. Charlotte County, Va., 9 Dec. 1843. He was educated at Hampden-Sidney College, studied theology at Fairfax Seminary, Alexandria, Va. He took priest's orders in the Episcopal Church in 1870 and in 1877 was consecrated missionary bishop of Cape Palma, West Africa. He resigned in 1883 and has since had charge of various parishes.

**Peninsula Campaign of 1862, The**. There was a sharp difference of opinion between President Lincoln and Gen. McClellan, commanding the Army of the United States, as to the most advisable route by which to conduct the campaign against Richmond. The President, sustained by some of his veteran military advisers, preferred a direct march on Manassas Junction, and thence by the most practicable route southward, at all times keeping the army in position covering Washington, while McClellan insisted upon transporting the Army of the Potomac, 110,000 to 140,000 men, to the vicinity of Fort Monroe and thence up the York Peninsula. The President, 8 March 1862, reluctantly yielded to the plan of campaign urged by McClellan, upon condition that a sufficient force should be left at and near Washington to insure its safety, that



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not more than 50,000 men should be moved to the new base until the navigation of the Potomac from Washington to Chesapeake Bay should be free from the Confederate batteries, and that the movement should begin as early as 18 March. The day after the issue of this order the Confederates evacuated their positions at Centreville and Manassas, in front of Washington, and abandoned their batteries on the Potomac. As McClellan proposed to take the field with the Army of the Potomac, he was relieved from command of all other military departments. The Army of the Potomac, under the President's order, was organized into five corps: the First, Gen. McDowell; Second, Gen. Sumner; Third, Gen. Heintzelman; Fourth, Gen. Keyes; Fifth, Gen. Banks. Banks was charged with the care of the Shenandoah Valley, the Upper Potomac, and the positions of Manassas Junction and Centreville, and Gen. Wadsworth had command of the troops garrisoning Washington. The campaign began 17 March by the embarkation of two divisions of the Third corps, which were landed at Fort Monroe and placed in position on the roads leading to Newport News and Yorktown. Other divisions followed, and McClellan in person reached Fort Monroe on the afternoon of 2 April, and reported that he had ready to move about 58,000 men and 100 guns.

On the 4th the movement began, Heintzelman's corps on Yorktown, Keyes' on its left. On the morning of the 6th Heintzelman was stopped by the Confederate works at Yorktown, and on the left Keyes was checked by a small battery on the line of Warwick River. The Confederates, under Gen. J. B. Magruder, held a line across the Peninsula, from the mouths of the Warwick River and Deep Creek, on James River, to Yorktown, on York River. The line, about 12 miles in length, was covered a great part of the distance by boggy and difficult swamps, and quite well fortified by redoubts at the road crossings, and was held 4 April by 11,000 men. The existence of the line was a surprise to McClellan, who knew that Yorktown was fortified, but had no knowledge of the line extending from that place to the James, and his movement on Yorktown was predicated on the belief that he could turn it by his left. It was a part of McClellan's plan, also, that McDowell's First corps should turn Yorktown by the right, by landing at Gloucester Point, north of York River, but on the 5th he was notified by the adjutant-general of the army, that McDowell had been withheld from his control to defend Washington, as it was claimed that McClellan had not complied with the President's condition to make Washington secure, and McDowell was necessary to that security. McClellan protested and urged that McCall's and Franklin's divisions of McDowell's corps should be sent him, and a few days later the President ordered Franklin's division to report to him, which it did on the 20th. Meanwhile McClellan had begun a regular siege of Yorktown, and apparently gave up all idea of breaking the Warwick line at any point, though strongly urged by the President to do so. He reconnoitered the line and, 16 April, had an engagement at Lee's Mill (q.v.), which only the more strongly confirmed him in the prosecution of a regular scientific siege. Batteries were constructed, and heavy guns put in position (see

YORKTOWN, SIEGE OF), and he was about to open fire when, on the morning of 4 May, it was discovered that during the day and night preceding the Confederates had abandoned the place very deliberately and marched for Williamsburg and Richmond. McClellan started in pursuit, but not until noon did his troops get on the road, McClellan remaining at Yorktown to superintend the loading of Franklin's division on transports for the purpose of ascending York River, landing opposite West Point, and attacking the Confederates in flank. The Confederate rear-guard was overtaken by the Union advance at Williamsburg, and a severe engagement ensued on the 5th.

Franklin did not get off from Yorktown until the 6th, reaching Eltham Landing above West Point, at 1 P.M., where he disembarked his troops and awaited orders. The greater part of the Confederate army was already beyond striking distance, but to protect its trains, a division attacked Franklin on the morning of the 7th and engaged him until 3 P.M., when it withdrew. Stoneman's cavalry opened communication with Franklin at Eltham's Landing, and the Army of the Potomac marched from Williamsburg on the 8th, passing through Barhamsville, Roper's Church, and New Kent Court House, headquarters being established at Cumberland, on the south bank of the Pamunkey, on the 15th, and on the 16th at White House, where a permanent depot was organized. Gen. Joseph E. Johnston, commanding the Confederate army, since 17 April, had halted but 22 miles from Williamsburg until 15 May, when, hearing that the Merrimac had been destroyed and James River opened to the Union gunboats as far as Drewry's Bluff, he crossed the Chickahominy, and on the 17th encamped his army about three miles from Richmond. At McClellan's request the President ordered an expedition up James River, which was checked at Fort Darling, and Commodore Rodgers suggested to McClellan a land expedition to co-operate with the navy in the capture of that work, but McClellan preferred to delay the matter until after he should have crossed the Chickahominy. Meanwhile, by taking from Sumner, Heintzelman, and Keyes each a division, McClellan had organized two additional corps and given command of them to Gens. Fitz-John Porter and Franklin. On the 21st his army was drawn up on the Chickahominy, facing Richmond, which was but 7 to 12 miles distant. Soon after the battle of Williamsburg (q.v.) McClellan's call for reinforcements became earnest and persistent; he reported that he had not more than 80,000 men, and that the enemy had many more. The President finally concluded to send McDowell overland from Fredericksburg, with 40,000 men and 100 guns, to co-operate with McClellan by coming in on his right, but in no case to uncover Washington. McDowell was to have marched on 26 May, and to clear his way McClellan ordered Gen. Fitz-John Porter, with about 12,000 men, to drive from the vicinity of Hanover Court House, 14 miles north of Richmond, a considerable body of the enemy, under Gens. Anderson and Branch, and to destroy the bridges over the South Anna and Pamunkey rivers and cut the railroad connecting Richmond directly with northern Virginia. Porter started from New Bridge on the



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Chickahominy on the morning of the 27th, with a division of infantry, some regular cavalry and artillery, and at the same time Col. G. K. Warren, with a brigade, moved from Old Church on a road running parallel to the Pamunkey. Porter engaged and defeated Branch at Hanover Court House (q.v.), destroyed some of the bridges on the railroad, and returned to his old camps. But McDowell did not join McClellan. When his head of column had marched but a short distance out of Fredericksburg his entire movement southward was suspended, and he was sent westward against "Stonewall" Jackson in the Shenandoah Valley (q.v.). Meanwhile the corps of Keyes and Heintzelman had crossed the Chickahominy, Keyes' advance taking position at Seven Pines, on the main road leading to Richmond, about five miles from the city. Heintzelman was in rear, and the three corps of Sumner, Franklin, and Porter were on the north bank of the Chickahominy. On 31 May McClellan reported a strength of 126,089 officers and men present, with 280 field guns. At the same time the Confederate army defending Richmond numbered about 58,000 men. Johnston, with about 32,000 of these attacked the two Union corps south of the Chickahominy on the 31st, driving them back some distance, when he was checked by Sumner, who had crossed the Chickahominy and struck his left. During the closing hours of the engagement Johnston was severely wounded, and Gen. G. W. Smith succeeded to his command. On the morning of 1 June the battle was renewed, and it ended with the success of the Union troops, who gained the ground lost the previous day. This battle is known as that of Fair Oaks, or Seven Pines (q.v.). At noon of 1 June Gen. R. E. Lee assumed command of the Confederate army, and at night he ordered its withdrawal to the camps near Richmond, which was done by daybreak, next day.

For nearly a month both armies remained inactive, each strengthening its position, Gen. Lee bringing up troops from every possible quarter until late in June, when, including Jackson's command, he had 80,762 men. McClellan had received McCalls' division of McDowell's corps as a reinforcement, and had 92,500 men. On 25 June Porter was on the right of the line, north of the Chickahominy, the four corps of Franklin, Sumner, Heintzelman, and Keyes south of it, and on that day, preparatory to a general movement on Richmond, an advance was made in front of Seven Pines, which brought on the battle of Oak Grove (q.v.), with no material result; but it marked the beginning of the "Seven days' Battle" (q.v.). "Stonewall" Jackson had now been brought from the Shenandoah Valley, and 26 June Lee crossed the Chickahominy with the greater part of his army to turn McClellan's right, cut him off from his base at White House, and force him to retreat down the peninsula. Lee attacked McCall's division at Mechanicsville or Beaver Dam Creek (see MECHANICSVILLE, BATTLE OF), and was signally defeated. On the 27th McCall fell back, and Lee, advancing and joined by Jackson, fell upon Porter's corps at Gaines' Mill (q.v.), inflicting upon it and Slocum's division of Franklin's corps a bloody defeat. That night McClellan came to a determination, which he had had under consideration, to retreat to James River; his trains were put on the road to cross

White Oak Swamp, and move to Haxall's Landing, and Porter's corps recrossed the Chickahominy and followed. The bridges across the Chickahominy were destroyed. Fortunately for McClellan, Gen. Lee did not correctly understand his movement on the 28th, and he pressed it, withdrawing his right, under cover of his left, which remained in the works fronting Richmond, preventing Gen. Magruder from getting any knowledge of what was going on. Late in the afternoon and night of the 28th Lee came to the conclusion that McClellan was retreating to James River, but gave no order for pursuit until the morning of the 29th, when Longstreet, A. P. Hill, D. H. Hill, and Jackson were ordered to recross to the south side of the Chickahominy, and Gen. Magruder, who discovered by sunrise that the works in his front had been abandoned by Sumner and Heintzelman, was ordered to pursue by the Williamsburg road, and Gen. Huger by the Charles City road. At 9 A.M. Magruder overtook Sumner at Peach Orchard or Allen's Farm (q.v.), and a battle resulted, in which Magruder was checked, and after which Sumner fell back to Savage Station (q.v.), where he was again attacked by Magruder late in the afternoon, and held ground until dark, when he fell back across White Oak Swamp, and with Franklin and Heintzelman prepared to dispute the Confederate advance. Lee now concentrated for a heavy blow to cut McClellan's army in two and destroy it. He threw his divisions upon Sumner, Franklin, and Heintzelman on the 30th, at Glendale (q.v.), was unsuccessful, and next morning (1 July) the Army of the Potomac was in position at Malvern Hill, on the James. Lee followed, and in the afternoon attacked and was repulsed with great loss. McClellan was urged to retreat no farther, but he abandoned Malvern Hill during the night, and by morning of 2 July his head of column was at Harrison's Landing. The Confederates did not come up to his position until the morning of the 4th. Lee thought it not judicious to make an attack, and on the 8th marched the main body of his army back to the vicinity of Richmond, and the Peninsula Campaign was ended. The Union loss in the campaign was 16,600 killed and wounded, and 7,500 captured or missing. The Confederate loss was 27,000 killed and wounded, and 2,000 captured or missing. In both armies the sick-list was very large, and many died. Consult: 'Official Records,' Vol. XI.; 'McClellan's Own Story'; Michie, 'Life of McClellan'; Webb, 'The Peninsula'; Swinton, 'The Army of the Potomac'; Barnard, 'The Peninsula Campaign'; Compté de Paris, 'History of the Civil War,' Vol. II.; Walker, 'History of the Second Army Corps'; Powell, 'History of the Fifth Army Corps'; Fitzhugh Lee, 'Life of Gen. Lee'; Allan, 'History of the Army of Northern Virginia'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. II.

E. A. CARMAN.

**Peninsular State**, a name applied to Florida on account of its shape.

**Peninsular War, The**, sometimes called the War of Spanish (or Portuguese) Independence, a series of important campaigns 1808-13 against Napoleon in the Iberian peninsula, his opponents being the English, Spanish, and



## PENITENTIAL PSALMS — PENN

Portuguese. Canning was a firm believer in the utilization of aroused national feeling against Napoleon in states invaded by the French. Such a feeling had sprung up in Spain in 1808, when Ferdinand, Prince of Asturias, having received the crown of Spain by the abdication of Charles IV., his father, ceded it to Napoleon, who gave it to Joseph Bonaparte 6 June 1808. In spite of brave opposition, the French king entered Madrid 14 July; but six days later three French divisions were forced to surrender, guerrilla warfare increased in force, and Spain showed the first successful national resistance to Napoleon. But before this, by the aid of Charles IV., when he was still king of Spain, a French army under Junot had entered Portugal, and a Portuguese rising followed that in Spain. The provisional government of the insurgents asked help from England, so that, at the close of the year 1808, the future Duke of Wellington had defeated the French at Rorica and at Vimeiro 21 August, Junot by the Convention of Cintra, 30 August, had promised to evacuate Portugal; and, in fine, Canning's policy had proved successful enough to justify itself thoroughly. The campaign in Spain in 1809 was opened by Napoleon himself at Madrid, and all looked gloomy for Spain until July, when Wellington, having dislodged from Portugal a fresh French army under Soult, invaded Spain and won the victory of Talavera de la Reina, 28 July, which effected little because of inadequate support in the field and at home so that the latter part of the year, like the former, was a monotonous series of French successes over untrained Spanish troops. The third year of the war (1810) was taken up by the attempts of the French armies to complete their conquest of Spain and to drive Wellington from his fortifications at Torres Vedras; but Masséna was forced early in 1811 to retire from Portugal to Spain. He was pursued and defeated by Wellington at Fuentes de Onoro 5 May 1811. On 16 May Portugal was again emptied of French troops by Beresford's victory over Soult at Albuera. In central Spain the French suffered from guerrilla attacks and only in the east, where Suchet controlled Valencia and Aragon, were they successful. In 1812, the year that saw the grand army wrecked in Russia, Wellington completely defeated Marmont at Salamanca 22 July, and Joseph Bonaparte left Madrid, which was occupied by the English 12 August. However, the French held Burgos, and Suchet was still invincible. But the French armies in Spain were weakened by the demands of the German campaign of 1813. Wellington broke communications with Paris, at Vitoria 21 June defeated Jourdan—a victory which left Suchet entirely unprotected and forced him to retire—and 31 August stormed San Sebastian, thus breaking the last vestige of French power in Spain and making his way into France itself. There he was equally successful at Saint Palais 15 February, and at Vic-en-Bigorre 19 February, and was still maneuvering against Suchet when word came of Napoleon's abdication. Consult: Napier, 'History of the War in the Peninsula' (1828-40); Arceche y Moro, 'Guerra de la independencia' (1868-1901); Shand, 'The War in the Peninsula' (1898); and Oman, 'History of the Peninsular War' (1902).

**Peniten'tial Psalms**, seven psalms in which repentance is expressed and pardon asked of God. In the Authorized Version they are: 6, 32 (Latin numeration 31), 38 (L. N. 37), 51 (L. N. 50), 130 (L. N. 129), and 143 (L. N. 142). In the Roman Catholic Church they are used on solemn occasions, and Pope Innocent III. (1198-1216) ordered their recitation in Lent. Pius V. (1566-72) appointed the Fridays in Lent as proper days for this exercise. We are told that Saint Augustine when he was dying caused these Psalms to be written out on the wall facing his bed, and their classification and name are of great antiquity. In the Anglican Church they are appointed to be used in the services for Ash Wednesday. The Prayer Book direction to that effect having been inserted in the revision of 1662.

**Peniten'tiary**, a word employed in the early Church to designate the priest whose office was to pass judgment upon sins of special gravity and difficulty, such as the three "mortal crimes," namely, idolatry, adultery, and murder, committed after baptism, and to impose an appropriate penance. The office was abolished in the East by Nectarius, patriarch of Constantinople, during the reign of Theodosius. It still exists in the Roman Catholic Church where penitentiaries are of varied rank. The cardinal grand penitentiary presides over tribunal of penitentiaries at Rome, as a sort of chief justice of the ecclesiastical supreme court. Penitentiary priests are special ecclesiastical officers appointed by the pope to hear confessions in the three patriarchal churches, of the Vatican, the Lateran, and Santa Maria Maggiore. The Council of Trent decreed that every bishop should establish in his cathedral church a penitentiary priest who must be either a doctor, master, or licentiate in theology or canon law and not under 40 years of age. His office is to consider and determine especial cases of absolution or dispensation referred to him.

**Penitentiary**, a prison. See PRISON.

**Penjamo**, pān'hā-mō, Mexico, town in the state of Guanajuato, 35 miles northeast of the Valle de Santiago, in a valley on the right of the Rio de Leon and on the Guadalajara railroad. It was the birthplace of Hidalgo. Pop. (1895) 7,558.

**Penn, John**, American colonial governor, grandson of William Penn (q.v.): b. London, England, 14 July 1729; d. Philadelphia, Pa., 10 Feb. 1795. He was educated in the University at Geneva, came to Philadelphia in 1753, and served in the provincial council until after Braddock's defeat, when he left the colony. He returned as lieutenant-governor in 1763, and his administration was much disturbed by troubles with the Indians, with whom he finally succeeded in forming the treaty of Fort Stanwix in 1768. He was absent in England in 1771-3, but returned with full power as governor, and during the early portion of the Revolutionary period endeavored to steer a middle course, but in 1775 his council was supplanted by the committee of safety. He was imprisoned for a time in 1777-8, but was released after a few months; the family was allowed £130,000 by the legislature for lands transferred to the possession of the State, and the British government granted to them an annuity of £4,000, which has only recently been commuted. Consult: 'Pennsylvania Archives';



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Sheperd, 'Proprietary Government in Pennsylvania.'

**Penn, John**, American legislator: b. Caroline County, Va., 1741; d. North Carolina September 1788. He studied law, was admitted to the bar in 1762 and became a successful practitioner, attaining a reputation for eloquence and ability. In 1774 he removed to Greenville County, N. C., and in 1775 was elected to the Continental Congress, where he signed the Declaration of Independence in 1776. He was re-elected in 1777-9 and upon the invasion of Lord Cornwallis Penn was placed in charge of the affairs of the State with power nearly that of a dictator; he performed the difficult duties of his trust with much credit, and in 1784 was made receiver of taxes for North Carolina. This office he resigned after a month, and retired to private life.

**Penn, Richard**, English colonial governor, grandson of William Penn: b. England 1735; d. Richmond, Surrey, England, 27 May 1811. He was educated at St. John's College, Cambridge, accompanied his brother, John Penn (q.v.), to Pennsylvania in 1763 and in 1764 became a member of the Provincial Congress. In 1771-3, during his brother's absence in England, he was lieutenant-governor of the colony, where he was very popular. At the outbreak of the Revolution he sympathized openly with the colonists, and in 1775 went to England with a petition for various concessions. In 1784-1808 he sat in Parliament, after which he retired to private life.

**Penn, Thomas**, English colonial proprietor in America, son of William Penn: b. London, England, 8 March 1702; d. there 21 March 1775. He was invested with power of attorney by his brothers John and Richard, and came to Pennsylvania in 1732 to look after the interests of their immense estate. He was a member of the provincial council and remained in the colony until 1741. When the disputes concerning boundaries and taxation were settled Thomas and his brother Richard (John having bequeathed his interest to the former on his death in 1746), were in possession of a feudal estate of 25,000,000 acres with over 200,000 inhabitants.

**Penn, Sir William**, English admiral: b. Bristol, England, 1621; d. Wanstead, Essex, England, 16 Sept. 1670. He early entered the navy and served with rapid promotion. In 1649 he was vice-admiral of the Irish fleet, and in 1652 held the same office in the fleet under Admiral Robert Blake. To him was due, in a great measure, the victory off Portsmouth in February 1653. At the termination of the war with Holland, Penn determined to desert Cromwell, and accordingly offered his allegiance and his fleet to the Stuarts. Charles could not then dispose of the fleet and advised him to continue in the service of the Commonwealth until an opportunity favorable to their plans should arise. In 1654 he was appointed general and commander-in-chief of the expedition which in 1655 wrested Jamaica from the Spaniards, and on his return was imprisoned in the Tower, charged with having absented himself from his charge without leave. Upon his release he retired to his estate in Munster and there remained until the eve of the Restoration. In 1660 he was knighted and made a commissioner in the navy;

his possession of certain Irish estates was confirmed by the king in 1665, and in that year as captain-commander under the Duke of York he won the victory over the Dutch off Lowestoft. He held no further command afloat, but was connected with the naval office until his death.

**Penn, William**, founder of Pennsylvania: b. London 14 Oct. 1644; d. Ruscombe, Berkshire, 30 July 1718. His father was Admiral Sir William Penn, who had a remarkably successful career in the British Navy. His mother was a Dutch lady, Margaret Jasper. While the Admiral was off on the seas, his wife and little boy resided on one of his estates at Wanstead in Essex. William Penn went to school at Chigwell, near by, where he was apparently under influences largely Puritan. At the age of 11 a strong religious conviction came suddenly upon him. "He had the strongest conviction of the being of a God and that the soul of man was capable of enjoying communication with him," an experience which profoundly influenced his future life.

His boyhood days were lived during the Protectorate. The Admiral, after receiving honors and riches from Cromwell, had so timed his change of loyalty as to gather in a good share of the rewards distributed at the time of the Restoration. He was in a condition to send his son to the most aristocratic of Oxford Colleges, and at the age of nearly 16, in the year 1660, William Penn became a "Gentleman-Commoner of Christ Church." The boy was evidently tinged with puritanism; the prayer-book and the surplice savored of papacy, and he joined a little company of students in religious worship not authorized by the Established Church. An Oxford Quaker, Thomas Loe, spoke with power in the city and Penn came under his influence. The results were not exactly Quakerly, however, for in company with a friend, he forcibly tore from the backs of fellow students the "popish rags," as surplices were called by the zealous puritans of the day.

For this he left college, whether by the action of the authorities or not does not clearly appear. He went to his home and announced himself a Quaker. He was now a manly youth of 18, handsome in appearance, and of unusual intelligence. His father had intended him for a high career in the state, and no news could have been more unwelcome than this. True to his convictions, he adopted the speech and manners of the sect and attended their meetings. Exile from his home simply aroused his determination. His father's friends interceded for him, pointing out that one might rather be proud of a son who eschewed the frivolity and immorality of fashionable society of the days of Charles II. He was sent abroad, first to Paris, where he entered partially into the circle of fashion; thence to Naumur, the Protestant college, where he laid the foundation of that extensive knowledge of patristic literature so much in evidence in his future writings; thence to Italy, where he received a letter from his father calling him home. The trip had produced its effect and the signs of the Quaker had disappeared.

He was then sent by his father to manage his large Irish estates. He joined the expedition to put down an insurrection in Carrickfergus, and procured for himself a suit of armor, in which he seems to have been painted. The



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picture shows a handsome youth, with hair parted in the middle and long dark locks. His martial ardor was of short duration. Thomas Loe again crossed his path in Cork and Penn became a Quaker never more to falter. He was soon imprisoned with his fellows, and this was but the beginning of many and severe confinements which lasted at intervals through his life. His influence soon secured his release. His father was angered by his "thee" and "thou," which the Quakers had adopted as the language of equality, and his refusal to doff the hat, then a symbol of reverence or worship, and drove him from his house. In time they were reconciled and the Admiral on his death-bed endorsed the course of his son.

Penn began immediately to preach and to enter into the theological controversy of his time. His supposed unsoundness on the Calvinistic interpretations of the day got him into the Tower. "My prison shall be my grave," he said to the Bishop of London, who asked him to recant as the price of liberty, "before I will budge a jot. For I owe obedience of the Conscience to no mortal man." He was soon discharged. 'Truth Exalted,' in 1668, was his first important publication; then followed, in the same year, 'The Sandy Foundation Shaken,' 'Innocency with her open Face,' and the most noted and valuable of his works, a book breathing the noblest spirit of Christianity, written in prison, 'No Cross, No Crown.'

In 1670 he was again arrested under the Conventicle Acts. His trial is noted in the records of English jurisprudence. With a friend, William Mead, they were brought before the Court, upon an illegal indictment and insufficient evidence. Penn conducted the defense and the jury brought in a verdict of *not guilty*. The judge was infuriated and endeavored to browbeat them into another decision, when Penn appeared as their champion, and so enheartened them by his exhortations to firmness that they stood their ground and settled for all time the independence of juries within their proper limitations. His next important work, 'A Seasonable Caveat against Papacy' (1670), brought out a principle, further elaborated in 'Great Case of Liberty of Conscience' (1671), which now became one of his guiding standards of life, universal toleration, which soon developed into perfect religious liberty. The last work was written in prison. On his release he made a trip to Holland and Germany, preaching the gospel.

He took advantage of a little surcease from jails to marry, in his 28th year, Gulielma Maria Springett, daughter of Sir William Springett, a woman of great beauty and sweetness. A declaration of indulgence for dissenters issued by Charles II., in 1672, now made his life easier, and with an ample estate, he settled at Rickmansworth, in Hertfordshire. He was active for a few years in preaching his doctrine through England by tongue and pen. The indulgence was soon revoked and Penn began the work in which we find him engaged largely through life, of securing releases, by his influence at Court, for his suffering friends. In 1675 he wrote a 'Treatise on Oaths,' explaining why Quakers refused to take them. Another soon followed, 'England's Present Interests Considered,' a work devoted to showing the history and progress of civil liberty in the kingdom.

In 1675 his thoughts were first seriously turned to America. Lord Berkeley and Sir George Carteret, who had received from the Duke of York the promise of New Jersey, sold the western half to two Quakers, John Fenwick and Edward Byllinge. They had some difficulty between themselves in the settlement of their relative claims and asked William Penn to arbitrate the matter. Byllinge, afterward becoming embarrassed, transferred to Penn and two others his interest for the benefit of the creditors. West New Jersey was opened for sale and the persecuted Quakers found there a haven of rest. Penn wrote to Richard Hartshorne, a settler whom he appointed his agent, "We lay a foundation for after ages to understand their liberty as men and Christians, that they may not be brought in bondage but by their own consent; for we put the power in the people." The colony prospered greatly under the management of Penn and his friends. In company with George Fox, Robert Barclay and others, in 1677, Penn paid a religious visit to Holland and Germany. Here he made a convert of the Princess Elizabeth Palatine, granddaughter of James I., a woman of great intelligence, learning and spirituality, who became a devoted adherent and correspondent. More important, historically, however, he began that acquaintance with the Rhine Valley which resulted in a great emigration of its inhabitants to Pennsylvania, in the following century. His journal of the trip is among his printed works. When he returned he found persecution breaking out anew, many of his friends in jail and their estates confiscated. The plea was that the Papists were intended to be the sufferers and the Quakers were drawn in incidentally. Penn published a plea for liberty, even for Papists—a sentiment which, in that day, required no small courage—and gave rise to a report, from which he afterward suffered greatly, that he was a Jesuit in disguise. In 1679 he wrote an 'Address to Protestants of all Persuasions,' to promote general morality, also an address to William, Prince of Orange, on behalf of certain dissenters in Holland. He also became interested in political affairs, identified himself with the Whig party and worked in behalf of the Parliamentary candidacy of the republican Algernon Sidney. He enjoyed great favor at court. His rank, wealth, courteous manners and strong personality gave him much influence, while his Quaker customs and speech seem to have been regarded with good-natured tolerance. This influence he continually exerted for the aid of his suffering brethren and his advocacy of his favorite doctrine of universal toleration. The rest of the life of Penn belongs largely to the history of Pennsylvania. Before entering on this it is well to mention a few of the principal writings of the following years. 'Examination of Liberty Spiritual' appeared in 1681; 'Persuasive to Moderation,' in 1686; 'Fruits of Solitude,' in 1692, being a perfect treasury of wise advice, so that it has recently sprung into fresh popularity in England and in America, having been a favorite of Robert Louis Stevenson; and about the same time a comprehensive 'Essay towards the Present and Future Peace of Europe,' being a suggestion for an international parliament which has been the basis of a movement culminating in the Hague tribunal; 'Rise and Progress of the People Called Quakers,' in 1695; 'Primitive Christian-





Very Cordially  
Yours  
J. W. L. P. M.







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ity Reviewed,<sup>9</sup> in 1696. His preaching whether in England or America was incessant. His influence at court, strong under Charles II., was ascendant under James II., suffered an eclipse under William and Mary, and recovered itself under Anne.

He had inherited from his father a claim of £16,000 against Charles II. for money loaned and services rendered. In 1680 he asked the payment of this claim in lands in America. The king was willing to be so easily released from a troublesome debt and to satisfy an influential friend. Penn saw an opportunity, for which his New Jersey experience had prepared him, to found a Christian commonwealth devoted to liberty, peace and justice, and to secure a place of rest for his persecuted co-religionists. The deed was signed on 4 March 1681. It made William Penn governor and proprietor of a vast tract, intended to be three degrees in latitude and five in longitude. He could sell the land on his own terms and to whom he would. He could fix the government, make the laws—subject to the assent of the freemen—appoint magistrates and judges, levy taxes, control the military forces and grant pardons and reprieves, though in all these powers the crown reserved a veto. He now went to work with great energy to settle his colony. A few Dutch and Swedes were already on the banks of the Delaware and some English Quakers had drifted over from West Jersey, while the Indians roamed the woods. He addressed these inhabitants, promising them, "You shall be governed by laws of your own making," and sent out his cousin, William Markham, as his deputy. The impossibility of laying out the province in accordance with the terms of the royal grant became manifest as soon as a few latitudes were taken and the long controversy between Penn and Lord Baltimore, continued by their heirs, was not settled for nearly a century. It interfered sadly with Penn's plans for living in his province, and produced bickerings and hard feeling, at times verging on war.

He pushed sales with vigor and immediately the colonists began to arrive. But the subject on which his heart was most set was the "Frame of Government." His first "frame" was extreme republicanism. He abolished primogeniture, gave all the power to the people to initiate and repeal laws, reserving no veto for himself. All taxes were to be collected by law, the courts were to be open to all and no oaths required; penalties were to be light, capital punishment abolished except for murder; prisons were to be work-houses and all children taught a useful trade. All who professed faith in Jesus Christ were to be eligible to office and all who confessed an almighty God were to have free exercise of their worship. This "frame" showed the working of Penn's mind and probably better expressed his ideas of government than those which followed. In some respects it was modified, but to the one feature of wide religious liberty he adhered with tenacity in the face of considerable opposition. He had pleaded for it when a member of a persecuted sect, as the ruler of a state he would be true to its teachings. Leaving behind a beautiful letter to his wife and children, he sailed for America. On the 27th of October 1682 he landed at New Castle. This was also his territory, for the Duke of York had transferred to him the land of the

present State of Delaware. Stopping at Chester, he went leisurely up the river to the new city of Philadelphia, then partly laid out, and the scene of great building activity.

The celebrated treaty with the Indians was probably made in the summer of 1683. Penn was continually meeting tribes, buying land and cementing friendships. His fairness and liberality won their hearts. At various times he bought all of southeastern Pennsylvania, in sections stretching from "creek" to "creek" and running up into the country a distance measured by the length of one or two days' walk. One of these treaties was held at Shackamaxon (now Kensington) and has been immortalized by West on canvas and Voltaire in print. Penn spent nearly two years in Pennsylvania. He met legislatures and preached in the Quaker meetings, sold land in the country and developed his city, settled disputes and established courts, and hospitably entertained white and red men. The claims of Maryland were being pressed in London and on 12 Aug. 1684 he embarked for England, expecting to make a brief stay and to bring his family permanently to Pennsylvania.

James II., the great friend of Penn and his father, came to the throne shortly after his arrival and Penn strove to use his influence for persecuted dissenters. As this would embrace Roman Catholics, James at first assented, but political measures demanded the re-enactment of the offending measures and Penn became a courtly intercessor for all sorts of favors. This lasted till the revolution of 1688, except for a second religious visit to Holland and Germany. Upon the accession of William and Mary, conditions radically changed. All friends of the Stuarts were suspects. Twice Penn was arrested on charges of treasonable correspondence with the banished king and twice acquitted. After each release he began to make preparations to return to Pennsylvania, where his presence was greatly needed to compose the factional differences which had arisen. On his return from the funeral of George Fox, in 1690, he heard that he had been accused again by one Fuller, whom the Parliament afterward pronounced "a cheat," and that a warrant was out against him. He might have gone to America, but he would not under suspicion. He allowed the vessels to sail without him and went into hiding in London. This condition lasted about three years. Various treatises issued from his pen. His friends found him to converse and his opponents to argue theological points, but technically he could not be found by the king's officers. Finally, in 1693, three lords presented his case to King William, giving the assurance that there were no real charges against him. An examination was had and Penn was set at liberty. In the mean time his wife had died. The province and the territories, as Pennsylvania and Delaware were respectively called, were demanding separation from each other, and an apostate Quaker, named George Keith, was making an ecclesiastical and political turmoil. In 1692, to add to his other troubles, his executive authority was taken away and given to Benjamin Fletcher, governor of New York, who was totally out of sympathy with the people of the province. Upon Penn's release, his powers were returned to him. In 1696, he married Hannah Callowhill of Bristol. This was followed by three years of undisturbed ministerial labors



## PENN COLLEGE — PENNALISM

which drew around him great crowds of all kinds of people. Finally, on 9 Sept. 1699, he fulfilled his long delayed plan and sailed for America with his family, intending to make it his permanent home.

When in the country before, he had built on his estate at Pennsbury, Bucks County, on the banks of the Delaware, a house of some size. This he now furnished with elegance and made his abode. It was, however, so far from Philadelphia that he found it more convenient to spend his time mainly in that city. He busied himself with affairs of state and church and the effect of his personal force and wisdom was soon felt in a more wholesome and united feeling in the little colony. But before two years had expired, a movement in England to annex all the proprietary governments to the crown seemed to demand his presence there. Prior to his sailing he gave the colony a new constitution under which it prospered for 75 years, till the Revolution. He chartered the city of Philadelphia and its principal school, he eloquently urged the politicians to stop their petty quarrels and unite for the good of the state, and leaving his interests largely in the hands of James Logan, on the 3d of November 1701, he and his wife sailed to England, never again to see their colony. The following 10 years of Penn's life were years of disappointment, due largely to his own failure to judge character. His appointees to the position of deputy governor were thoroughly unsuited to the task and fomented trouble in the colony, which was fanned by an opposing leader, named David Lloyd. Except in so far as they made Penn's life miserable, they belong rather to the history of the province than to his biography. Still more serious in its personal effects was the financial difficulty incurred by his trust in his tricky steward. Claim after claim was made and allowed without investigation, until finally his whole interest in the province was mortgaged. Finally, rather than pay the fraudulent demand, he allowed himself to be taken to a debtor's prison, where he remained nine months. The matter was compromised by his friends and the claims pared down and discharged.

A little gleam of comfort came over his declining years. His colony, in 1710, came to its right mind, placed his friends in power, and showed its appreciation of his sacrifices for them. During the colonial days ever afterward his name was held in highest honor. The most serious of his financial difficulties were past, and yet his great fortune was gone. He was seriously contemplating selling his interests in Pennsylvania to the crown, when, on 4 October, in the midst of a letter to Logan, a paralytic stroke came upon him. He lingered with gradually decreasing mental powers, but with a composed mind, till 1718, when on 30 July he died in his 74th year. Consult: 'Memoirs,' edited by Clarkson (1813); biographies by Janney (1852), Dixon (new ed. 1852), Stoughton (1882); Hodges (1901); and Buell (1904); also Webb, 'The Penns and Pennington' (1867); Fisher, 'The True William Penn' (1900).

ISAAC SHARPLESS,  
*President of Haverford College, Haverford, Pa.*

**Penn College**, located at Oskaloosa, Iowa, under the control of the Friends. In 1866 the Society of Friends made an agreement with

the Spring Creek Union College Association by which they had a right to conduct the affairs of the college in accordance with the principles of their society, and in 1873 Spring Creek Union College became Penn College. Four collegiate courses are offered, classical, classical-biblical, scientific, and philosophical, for the completion of which the degrees of A.B., B.S., and Ph.B. are conferred; there is also provision for graduate work, and a preparatory department. The college is coeducational. In 1903 the library contained 5,000 volumes; the grounds and buildings were valued at over \$51,000; the amount of the productive funds was \$100,000; the annual income \$33,000. The students numbered 366, and the faculty 15.

**Penn vs. Baltimore**, in American history, a case involving the boundaries between Penn's and Lord Baltimore's land grants from the English crown. Penn obtained a new grant in 1682 from the Duke of York, reaching into Delaware and Maryland; also a letter from the king requesting Baltimore to hasten the adjustment of the boundary. The case was taken to London and decided in Penn's favor. A compromise was arranged in 1732, and enforced by the court of chancery in 1760, in accordance with which a line was run by Mason and Dixon, fixing the boundary in 1766.

**Penn Yan**, pěn yǎn', N. Y., village, county-seat of Yates County; on Keuka Lake at its outlet, and on the Fall Brook and the Northern Central R.R.'s; 55 miles southwest of Syracuse. It was first settled in 1800, and the village was incorporated in 1833. As some of the settlers were from Pennsylvania, while others were known as "New England Yankees," discussion arose as to the name of the village, but both parties were finally satisfied by the adoption of the present name, Penn Yan, made up from the first syllables of Pennsylvania and Yankee. It has daily steamboat connection with Hammondsport at the head of the lake, and is the trade centre of the largest grape growing region in the Eastern States. The lake outlet affords water-power for mechanical industries; and the manufactures include lumber, flour, grape-baskets, paper, carriages, and machinery. It contains the Penn Yan Academy, which is a public high-school, free to all residents of the district, and a Roman Catholic parish school. Pop. (1890) 4,254; (1900) 4,650.

**Pennacook** (pěn'a-kūk) **Indians**, an American confederacy of New England tribes of the Algonquin family, who formerly resided in New Hampshire, Massachusetts, and southern Maine. They made numerous early treaties with the English, but later their alliances were with the French. In 1660 their number was estimated at 6,000. In 1670 smallpox and disease reduced this number to 1,500. Several of the Pennacook tribes joined in the King Philip's war of 1675. The remnants of the race now reside at Saint Francis, Quebec Province, Canada.

**Pen'nalism**, the system of torments and impositions to which the elder students (Schoristen) in German Protestant universities used to subject the younger ones, called *Pennales* (pen-cases), afterward foxes, *Neovisti*, *cæci* (blind), *vituli* (calves), *innocentes* (guileless), *imperfecti*, *Galli domestici*, *dominastri*, etc. This abuse was carried to a great extent; and books written



## PENNAMITE WAR—PENNSYLVANIA

200 years ago exhibit its real barbarism. Whatever the pennals possessed, they had to give up to the schorists, who compelled them to do the most menial services, made laughing-stocks of them, beat and ill-treated them, and all this had to be endured without complaint for one year, when the ceremony of deposition followed. This consisted of a series of symbolical trials (knocking off horns previously put on the pennal's head, combing his hair with a rake, etc.), indicating generally the purgation from impurity and consecration to an intellectual life. In 1661 and 1663 the German empire enacted laws against pennalism in Jena, Frankfurt, Rostock, Wittenberg, and later in Leipsic and Giessen. It is said that pennalism originated in the Italian universities (Bologna, etc.), which is very probable, as the students at these universities kept together in "nations," in order to protect each other, and young students went with recommendations to the senior of those nations. Among mechanics, apprentices and young journeymen were subjected to similar discipline. Others derive these practices from the chapters of the clergy, among whom every new canon was obliged to pay a certain sum for a banquet on his entrance.

**Pen'namite War.** See WYOMING CONTROVERSY; PENNSYLVANIA, *History, Connecticut Claim*.

**Pennant, pen'ant, Thomas**, English naturalist: b. Downing, Flintshire, Wales, 14 June 1726; d. there 16 Dec. 1798. He was educated at Oxford, and early made a specialty of the study of minerals and fossils, first attracting attention by an account of an earthquake felt in Flintshire in 1750, which was published in the 'Philosophical Transactions' in 1856. He made scientific tours of the British Isles of which he published accounts, and in 1767 was elected a member of the Royal Society. Though not a profound scholar he acquired a considerable reputation as a naturalist. Among his works are: 'British Zoology' (1766); 'Genera of Birds' (1773); 'Arctic Zoology' (1786); 'The Literary Life of the late Thomas Pennant, Esq. By Himself' (1793); 'History of the Parishes of Whiteford and Holywell' (1796); 'Outlines of the Globe' (1798-1800); etc.

**Pennant**, the name given a small flag or banner. In the navy a long, narrow piece of bunting is worn at the mast-heads of vessels.

**Pennant's Marten.** See MARTEN.

**Pennatu'lidæ**, a family of alcyonarian coral-polyps; the sea-pens (q.v.).

**Pennell, pën'el, Henry Cholmondeley**, English poet and sportsman: b. 1837. After serving in various departments of the admiralty, he was selected in 1875 to carry out commercial reforms for the Khedive of Egypt, and was subsequently appointed director-general of interior commerce. Among his well-known books of verse are 'Puck on Pegasus' (1861); 'The Crescent' (1866); 'The Muses of Mayfair' (1874); 'From Grave to Gay' (1885). On angling and ichthyology he has written among other works 'The Angler-Naturalist' (1864); 'The Book of the Pike' (1866); 'Fishing Gossip' (1867); 'The Modern Practical Angler' (1873); two volumes in the 'Badminton Library,'—'Salmon and Trout' and 'Pike and Other Coarse Fish' (1885); 'The Sporting Fish of Great Britain' (1886); etc.

**Pennell, Joseph**, American etcher and illustrator: b. Philadelphia 4 July 1860. He studied in the Pennsylvania School of Industrial Art and the Pennsylvania Academy, began illustrating for the 'Century Magazine' in 1881, and has been a frequent contributor to it and similar magazines every since. He executed an important series of etchings to accompany the papers on Italian life, by W. D. Howells, and also a long series on English cathedrals published in conjunction with Mrs. Schuyler Van Rensselaer's book on that subject. He has also illustrated several books of travels written by his wife, Elizabeth Robins Pennell, and is himself the author of an important work on 'Pen Drawing and Pen Draughtsmen' (1889), besides the following: 'The Jew at Home' (1892); an introduction on the art of the illustrator to Vièrge's 'Pablo de Segovia' (1893); 'Modern Illustration' (1895); 'The Illustration of Books' (1896); 'The Alhambra' (1896); 'The Work of Charles Keane' (1897); 'Lithography and Lithographers.' He has been lecturer on illustration at the Slade School of Art, University College, London, and at the Royal College of Art, South Kensington.

**Pennsylvania** (the "Keystone State") is the southernmost of the group of North Atlantic States. The sobriquet, Keystone State, was appropriately given to the commonwealth which stood in the centre of the arch formed by the original 13 States. Its area (land surface only) is 44,985 square miles. In general outline Pennsylvania is a rectangle, having one irregular side formed by the Delaware River, and a triangular projection at its northwestern corner extending northward to the shore of Lake Erie. The segment of a circle with a radius of 10 miles drawn from the court-house at New Castle, Del., cuts a small piece from its southeastern corner. Pennsylvania is 158 miles wide between two parallels of latitude, constituting its northern and southern boundaries, and 302 miles long, measured from the Ohio State line to either of two points on the Delaware, one opposite Port Jervis, N. Y., and the other at Bordentown, N. J., where the river makes its two far eastward bends. Pennsylvania adjoins New York on the north, New York and New Jersey on the east, Delaware, Maryland, and West Virginia on the south, and West Virginia and Ohio on the west. The population in 1900 according to the census was 6,302,115 (No. 2 in U. S.), of whom 6,141,664 were white and 156,845 negro.

**Topography.**—The ridge of the Alleghanies divides the State into two nearly equal parts, popularly known as Eastern and Western Pennsylvania. About one fourth of the surface is a plateau of an average elevation of nearly 2,000 feet above sea-level, comprising the tier of counties abutting on the northwestern slope of the Alleghanies and the northernmost two tiers of counties from the Delaware to Lake Erie. The plateau descends gradually southward and westward into Ohio. Between the Alleghanies and the Blue or North Mountain range and filling the central part of the State is a complexity of interlocked ridges and valleys curving in parallel lines from the southern boundary north-eastwardly. At the foot of the steep wall of the North Mountain, like a moat before a



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fortress, lies the "Great Valley" of the early settlers, which extends from the Hudson River to central Alabama and is known by many names; in Virginia as the Shenandoah, in New Jersey as the Kittatinny, and in Pennsylvania as the Lehigh, Lebanon or Cumberland Valley. It is from 10 to 20 miles wide (in this State), and is limited on the southeast by the South Mountain range. Through the break in this range between Harrisburg and Reading the Great Valley merges into the open country of the southeast. All the ridges of the Appalachian system undergo a considerable lowering before entering the State. The Catskills of New York with summits exceeding 4,000 feet become in Pennsylvania the Pocono Plateau with no elevations greater than 2,000 feet; the Blue Ridge of Kentucky with peaks reaching an altitude of 7,000 feet enters this State as the South Mountain range, which scarcely anywhere attains the height of 2,000 feet and disappears entirely a little to the west of Harrisburg. It rises again in a ridge of not over 1,000 feet high at Reading, and, passing into New Jersey, becomes the highlands of the Hudson with summits of 3,000 feet. Only a few knobs of the Alleghanies rise to an altitude of 2,700 to 2,800 feet and the North Mountain range, with its narrow, rocky crest, is of the almost perfectly uniform height of 2,000 feet. While destitute of high mountains the surface of the State is everywhere more or less hilly. The southeastern quarter of the State, though but little above sea-level, is a rolling country, and the western section is deeply furrowed by water courses and broken by short ridges. Western Pennsylvania contains two distinct ranges, Laurel Hill and Chestnut Ridge, running parallel from southwest to northeast about 10 miles apart and enclosing the Ligonier Valley.

*Rivers.*—The table-land of central and northern Pennsylvania forms the water parting. A small quantity of the rainfall is drained southward through the Potomac, and a still smaller part is carried away northward by the Genesee River into Lake Ontario. The three great drainage systems are those of the Ohio, the Susquehanna, and the Delaware. Beginning with the Water Gap in the Pocono Plateau the otherwise unbroken wall of the North Mountain is pierced by five gateways through which flow, in the order named, the Delaware, the Lehigh, the Schuylkill, the Swatara and the Susquehanna. The Delaware drains only three northeastern counties of the State, the Lehigh enters the former river at Easton, after draining parts of Carbon and Monroe counties and passing in its course the conical mountain at Mauch Chunk, one of the most familiar landmarks of the country. The Schuylkill drains the remainder of lower anthracite regions and joins the Delaware at Philadelphia. The Brandywine, the lowest of the Delaware's tributaries, may be here mentioned for its historic interest. It flows through the Chester Valley in Pennsylvania and debouches at Wilmington, Del. The Swatara is an inconsiderable stream, but its water gap is like the others mentioned. The Susquehanna divides at Sunbury into two main branches, which spread their watery tentacles over the whole country from the Mohawk Valley in New York to Cambria County in western Pennsylvania. Ascending the North Branch 50

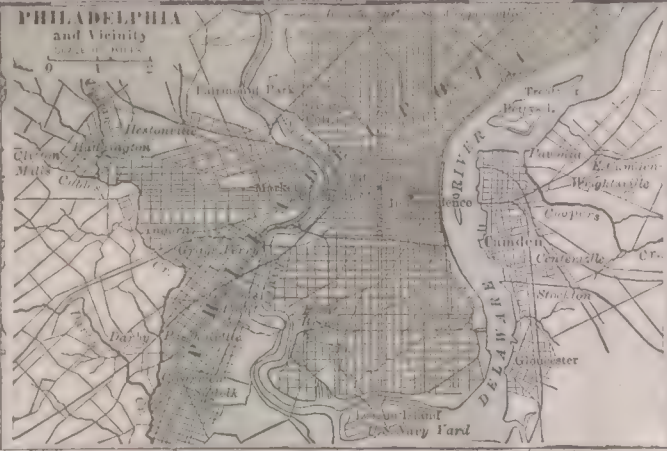
miles, one enters the Valley of Wyoming through another grand mountain gate. Central Pennsylvania is drained mainly by the Juniata, the largest tributary of the Susquehanna and the most picturesque river in the State, winding through this topographical labyrinth, now laughing in the sunlight of a broad valley and then rushing darkly between frowning and overhanging cliffs. The drainage system of Western Pennsylvania is constituted of the Allegheny and the Monongahela and their affluents. The former flows mainly southwest and southeast, and at Pittsburg is joined by the latter, which rises in Virginia and has a northward course of 80 miles within the State, the united streams forming the Ohio. The Conemaugh, which collects the waters of the highlands west of the Allegheny at Johnstown, and the Youghiogheny, which, like the Monongahela, rises in Virginia, cut through the Laurel Hill range, and, after crossing the Ligonier Valley, break in similar fashion through Chestnut Ridge; the four gorges each rising almost vertically 1,200 to 1,300 feet from the river beds to the mountain tops. The Conemaugh and Loyalhanna unite at Saltsburg, forming the Kiskiminetas, which joins the Allegheny at Freeport; the Youghiogheny joins the Monongahela at McKeesport.

*Climate.*—The climate of southeastern Pennsylvania is comparatively mild; zero weather is of rare occurrence. The Alleghanies act as a wind break and protect the eastern valley from the northwestern cold waves. The lower Delaware is often filled with ice, mostly drift ice from above and, though navigation is sometimes impeded, it is never closed. Above Philadelphia the river is frozen solid about once in four or five years. The cold spell is usually broken by one or two midwinter thaws. The summer temperature of southeastern Pennsylvania is often above 90° F. in the middle of the day and the humidity makes the heat very oppressive. The winters in the central and northern mountain regions are quite rigorous, but the summer temperature is more moderate than that of the southeastern part of the State, owing to the elevation and comparative dryness of the atmosphere. The western part of the State has the climate common to the Lower Lake regions. From observations taken at the Agricultural Experiment Station in Centre County for 16 years (1866–1902) the annual rainfall ranged from 30.28 to 43.88 inches. The average monthly temperatures for January ran from 18° to 36.60° F., and the average for July from 65.40° to 76.16°.

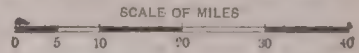
*Geology.*—The geological division of the State coincides with the popular geographical division thereof into Eastern and Western Pennsylvania; the ridge of the Alleghanies being the divisional line. Western Pennsylvania belongs to the geological province of the Mississippi Valley, and is one vast field of bituminous coal, overlaid and underlaid by Carboniferous sandstone and conglomerate. The uppermost and most valuable of the bituminous coal measures is the Pittsburg; and from the outlying remnants of the same found on the Broad Top Mountain and in Maryland, and also from the identification of the Pittsburg with one or two of the deposits of anthracite in northeastern Pennsylvania, it has been conjectured that this coal had its origin in a growth of swamp vege-



L A K E E R I E



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Population of places is indicated by  
different lettering, thus:  
150,000 and over.....PHILADELPHIA  
100,000 to 150,000.....Scranton  
25,000 to 100,000.....Reading  
5,000 to 25,000.....Lancaster  
Smaller Places.....Gibson  
Railroads.....  
State Capitals shown thus.....  
County Seats shown thus.....









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tation almost co-extensive with the State. The original northern limit of the Pittsburgh bed in the direction of Lake Erie is now undeterminable, for the whole Allegheny Valley and the upper Susquehanna Valley has been denuded of the same by those slow but potent levelers, frost and rain, though the middle and lower coal measures in these regions have been preserved. Going northward, the middle and lower beds consecutively disappear, until only patches of the lowest workable deposits maintain a precarious existence on the highest land; and in the extreme north the old red sandstone of the Catskill (Devonian) formation, which underlies the Carboniferous sandstone, is exposed in broad bands along all the water-courses. Eastern Pennsylvania belongs to the geological province of the Atlantic seaboard and is partly a region of mountains of Devonian and Silurian age and partly an open country of the still older Cambrian and Archæan periods. A broad continuous belt of Jurassic-Triassic brownstone and trap crosses the latter from west to east, and Cretaceous rocks underlie a narrow strip along the Delaware, below Trenton. A sheet of glacial drift covers the northern part of the State down to a line drawn from Belvidere, N. J., to Olean, N. Y., and curving from the latter place through Warren, Venango, and Beaver counties to a point on the western State line, a few miles north of the point of exit of the Ohio River. On the Pocono plateau, in the northeastern section of the State, the old red Catskill sandstone occupies nearly the entire surface. Within a deep trough in the otherwise horizontal outspread of the Catskill formation lie the anthracite deposits of Luzerne County, the best preserved in the State; for so deep is this trough that not only the lower and middle measures and the measure identified with the Pittsburgh have been saved, but there are still higher coal beds, and above these remnants of still higher rocks, containing Permian fossils found elsewhere in the State only in its extreme southwestern corner. The coal beds of the lower anthracite region lie in a series of parallel folds and rise steeply to the soil at their edges; the inclination of one bed being opposite to that of the bed in the next pocket. An arch described in the direction of an ascending seam and down again in the direction of descent of the next following would rise thousands of feet in air; and this aerial arch would represent the amount of erosion which the strata underlying the coal and the coal measures themselves have undergone. It is estimated that only one ton in a hundred of the original deposits of anthracite has been preserved. Another illustration of the stupendous changes wrought in the topography of Pennsylvania by the frosts and rains of ages is found in the region of the Alleghanies. Wherever the Carboniferous formations (which once covered the entire surface of the State) have been preserved in geological basins, there are the mountain ridges of to-day; where these formations were arched they have been eroded away and their places taken by the valleys of the present time. The Catskill sandstone crops out beneath the Carboniferous escarpment of the Alleghanies on the western side of the Nittany Valley, for instance, in a bold bluff. The same formation is recognizable with an oppo-

site dip on the Broad Top, 20 miles to the east. The lower Devonian and Silurian rocks crop out in their regular order on the flanks of both mountains, and in the valley between; and an arch connecting the old red sandstone bluff with the same formation on the Broad Top would reach an altitude of 21,760 feet at its keystone line, if the measured thickness of the sandstone itself and of the underlying strata be added together. If to these one should add the thickness of the overlaying Carboniferous strata, up to and including the Pittsburgh coal bed (which has been preserved on the Broad Top), the total height of these primordial mountains, which have been dissolved in the weathering process of millions of years, would appear to have been over five miles.

*Mineral Resources.*—The greatest of Pennsylvania's mineral resources is coal. It contains the largest deposits of anthracite (and the richest in fixed carbon) mined anywhere in the whole world. The production of this variety of coal was 59,905,951 tons in 1901, which in the opinion of the Chief of the Bureau of Mines is nearly the highest attainable. His estimate of the maximum quantity that can be produced is 300,000 tons per day; and the number of full working days in the mines averages about 200 per year. There are other than mechanical reasons which make a large increase in the output of anthracite in the future unlikely. When mineral fuel was first substituted for charcoal in the blast furnaces only anthracite was used, and for many years the quantity of bituminous coal so employed was relatively small. Since 1875 this relation has been gradually reversed. In 1880 bituminous coal and coke pig iron constituted 35 per cent of the total production; in 1890 it was 61 per cent and in 1900 over 76 per cent of the total. In the making of steam for motive power in the manufacturing and transporting industries and in the production of illuminating gas, bituminous coal has to a great extent supplanted anthracite; and the use of the latter is being more and more limited to household purposes. The comparative hardness of anthracite, and the consequent higher cost of mining it, contribute also to restricting the consumption thereof. The average price of anthracite at the mouth of the pit is about \$2 per ton. Bituminous coal costs about half as much, subject, of course, to fluctuations of price. The most important of the bituminous coal measures of the State is the Pittsburgh in Fayette, Westmoreland, Allegheny and Indiana counties. The bed varies in thickness between 6 and 12 feet, and in the quantity of fixed carbon from 59 to 64 per cent. The production of bituminous coal in Pennsylvania in 1901 averaged 375,000 tons per day worked, which could easily have been increased to 450,000 tons, in fact, under stimulus of the larger demand for bituminous caused by the shortage of anthracite, resulting from the long strike in 1902, the production of the former reached an average of 447,720 tons for each of the 220 $\frac{2}{3}$  working days; or 98,796,866 tons for the year. As a coke producer the State ranks even higher relatively than as a coal producer. It is credited in the report on minerals of the United States Geological Survey for 1902 with 55 per cent of the entire coal output of the country, but it contributes from 65 to 70 per cent of the coke. The product amounted to 14,355,917 short tons in



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1901, the value whereof approximates \$2 a ton, but varies 25 cents or more either way. Conneville is the centre of production. Oil was first struck in the vicinity where Titusville now stands, on 29 Aug. 1859. Within the next few years hundreds of wells were drilled in the Oil Creek region. The wildly speculative character of the business in its booming days is reflected in the range of prices of petroleum from \$19.25 a barrel in January 1860 to 10 cents a barrel in January 1862. Though the first oil fields have become exhausted others have been successively discovered and worked, and the annual output of the State, about 13,000,000 barrels (No. 3 in U. S.) is still more than one fifth of the total product of the country. In recent years the price of crude oil has ranged from \$1 to \$1.66 per barrel. Natural gas to the value of \$12,688,161 was produced in Pennsylvania in 1901, being nearly twice the value of the next largest producing State and very nearly half of the total product of the United States. The value of this product is increasing and not so much because of the new discoveries in the southwest of the State or a rise in prices (the increase in general prices not having been great) as because of the enlargement of lines and the installation of compressors. Since the discovery and development of the Lake Superior and Alabama iron mines this State has lost its pre-eminent position as a producer of iron ore; its annual output, however, has reached a total (in 1901) of over 1,000,000 long tons (No. 4 in U. S.), and after Minnesota and Michigan, with a combined output of over 20,000,000 long tons, and Alabama, with over 2,800,000 long tons—the production of Pennsylvania is next highest. The total value of building stone quarried in this State (1901) was \$10,772,288 (No. 1 in U. S.), classified as follows: limestone, \$5,081,387 (No. 1 in U. S.); slate, \$2,984,264 (No. 2 in U. S.), and sandstone (including bluestone), \$2,063,082 (No. 2 in U. S.). Marble, trap rock and granite make up the rest. Of the total \$1,172,915 consisted of crushed stone for ballast, concrete and road material. Portland cement, though in a sense an artificial product, consisting of a mixture of calciferous stone or marl and silicious earths pulverized and calcined, can be successfully and profitably produced only in localities where minerals containing the required ingredients are found in adequate quantity. The region between Cementown in Lehigh and Siegfried's Bridge in Northampton County, Pa., and Phillipsburg, N. J., is the chief centre of cement production in the United States. The output of the entire country amounted to 85,000 barrels in 1882, nearly all of which was produced in this region. In 1901 the output of the whole country had grown to 12,711,225 barrels, of which number 8,595,340 barrels, or more than two thirds came from this district. The production of the Pennsylvania fields exclusively was 6,873,203 barrels, 55 per cent of the entire product of the United States, valued at approximately \$1 per barrel. The production of Portland cement in this country is now practically equal to the domestic consumption.

*Forest Products.*—Until 1876, when the supply of white pine in this State had become nearly exhausted by the wasteful methods which marked the decade ended in 1870, the timber of Pennsylvania was accounted one of the most

valuable of its natural resources. As early as 1810 there were sawed in the State 73,847,640 feet of lumber. Since 1838 Williamsport has been, as it still is, the centre of the lumber industry. Hemlock, once despised, has become the principal variety of timber now cut in this State and constitutes 73 per cent of the entire product of lumber. Hemlock is still found in considerable quantities in northern Pennsylvania, though its exhaustion would be a matter of only a short time if the measures adopted to prevent and discourage waste should fail. Oak, white pine, poplar and spruce rank next to hemlock in importance in the order named. The value of the lumber and timber products of the State in 1900 (No. 4 in U. S.) was \$35,749,965; which represents an increase of \$6,661,995 over that of 1890. Of the four saw-mills in the United States which produced more than 100,000,000 feet, board measure, in 1900, this State contained one. Since 1901, when the Forestry Department was created and the Reservation Commission was authorized to purchase land "that the State ought to possess for forestry preservation," 572,222 acres of mountain land have been acquired or are in process of acquisition and of being made into inalienable State Reservations. The protection of forests from fires caused by negligence has been the object of considerable legislation, and timber culture is being encouraged by large rebates from taxes.

*Agriculture.*—The soil of the State, except in the mountains, is everywhere fertile, and even where least adapted to agriculture is suitable for grazing. The southeastern part is excellent for growing cereals. The total farm acreage has not increased greatly since 1850, but the number of farms has grown over 75 per cent and the value of farm property has doubled. The total value of the same in 1900 was \$1,051,629,173, of which \$898,272,750 represented land improvements and buildings—being 45 per cent of the entire assessed value of real property in the State. Implements and machinery were worth nearly \$51,000,000 and live stock \$102,500,000. The principal farm crops are cereals, 40 per cent, hay and forage 29.5 per cent, vegetables 12.5 per cent, fruits and nuts (including 24,000,000 bushels of apples) 7.9 per cent. The total value of farm products in 1899 was \$207,895,600, whereof \$57,043,770 was fed to live stock. Expenditures for the hire of labor during the same year were \$16,647,730 and for fertilizers \$4,685,920. Of the 224,248 farms, 153,031 were cultivated by their owners.

*Dairy Products.*—Dairy products constitute a large proportion of the total output of the farms of Pennsylvania; their value in 1890 was \$35,860,110 (No. 2 in U. S.), and they consisted of 487,033,818 gallons of milk (No. 2 in U. S.), 74,221,085 pounds of butter (No. 2 in U. S.), and 857,167 pounds of cheese. On 1 June 1900 there were on the farms of the State 10,553,106 chickens over three months old (No. 8 in U. S.), and poultry of the value of \$7,151,243 (No. 5 in U. S.) had been raised in 1899. The eggs produced numbered 67,038,180 dozens (No. 6 in U. S.) and were valued at \$9,080,725 (No. 3 in U. S.).

*Live Stock.*—The live stock on farms and ranges include 421,323 calves under one year old, 531,751 steers, heifers, farrow cows and bulls and 943,773 dairy cows, the value of the latter





1. The Delaware Water Gap, from the New Jersey side.  
2. A view of Gettysburg from Cemetery Ridge.







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being \$29,141,562, and of all neat cattle \$43,003,191. Horses to the number of 590,981, including 28,547 colts less than one year old, were valued at \$40,948,827; sheep, including 571,583 lambs under one year old, to the number of 1,531,066, valued at \$4,642,606, and swine 1,107,981 in number and valued at \$5,830,295. Besides the foregoing there were kept in barns, stables and inclosures not on ranges 78,301 milch cows and 220,255 horses. The farms of the State which derive their principal income from live-stock constitute one third of the whole number.

*Fisheries.*—The most valuable fisheries of Pennsylvania are the shad and sturgeon fisheries of the Delaware. The Susquehanna, once famous for its shad, has been depleted by the employment of fish baskets, the building of dams and other injurious and wasteful practices. The catch of shad in the Delaware averages in value \$500,000 a year; that of the Susquehanna does not exceed \$30,000 in the best years and is generally much lower.

*Manufactures.*—From a very early period Pennsylvania has held the first rank as an iron producer in America. According to a publication dated 1692 a small quantity of iron had even then been made in the colony; in 1727 it exported 274 tons of pig iron to England and in 1756 it was spoken of as the most advanced of American colonies in regard to its iron works. Berks County was the earliest seat of the industry, where Thomas Rutter, apparently a German, erected a forge on Manatawny Creek, three miles above Pottstown, in 1716. Beginning with 1788 the industry was developed to a considerable degree in the Juniata Valley and in 1790 a blast furnace was erected in Fayette County, which remained the main source of supply of the Ohio and Mississippi valleys for many years. Not until 1859 was the manufacture of pig iron successfully established at Pittsburg, although that city had produced considerable quantities of steel since 1813. The tremendous growth of the industry, however, dates from 1867. Allegheny County now produces 50 per cent of the pig iron and 65 per cent of the steel manufactured in this State. The pig iron produced in the State in 1901 amounted to 7,364,295 gross tons, and the realized value thereof was \$106,883,000; the production of rolled iron and steel in the same year was 8,668,337 gross tons and valued (excluding that of the tinplate works) at \$298,284,259. The production of tin and iron plate, an industry developed since 1890, was \$17,025,338 in 1901. The comparative value of the entire output of the steel and iron of the State in 1890 and 1900 was \$264,571,624 and \$434,445,200 (U. S. Census), an increase of 64.2 per cent. The second in importance in the industries of the State is the manufacture of textile fabrics, its output of silk, woolen, worsted, and cotton fabrics of all kinds amounting in value in 1890 to \$134,001,269, and in 1900 to \$158,782,087 (No. 2 in U. S.). Pennsylvania ranks first in the production of carpets with 48 per cent of the entire product of the country, second in the production of silk (principally "throwing" and pile fabrics) with 29 per cent of the total, second in the manufacture of knit goods with 23 per cent of the total, second in the manufacture of worsteds with 35.7 per cent, and second in the man-

ufacture of woolen goods with 17.7 per cent of the total. The German colonists of 1683 are credited with having introduced the manufacture of hosiery in this country; in 1810 there were manufactured in the State 107,508 pairs of stockings; in 1858 there were 700 hand frame in operation, and, indeed, the making of hosiery and other knit goods was a household industry in Germantown and vicinity down to quite recent times. The exhaustion of the hemlock forests of southeastern New York some years after the Civil War caused the tanners to turn their attention to central and northern Pennsylvania, and a great development of the leather industry followed; in 1900 the State ranked first in the tanning and finishing of leather, with products valued at \$55,615,000 or 27.3 per cent of the whole product of the country. This State has also long led all others in the manufacture of glass, having produced 51.8 per cent of the total in 1870 and \$22,011,130 worth or 38.9 per cent of the vastly larger total in 1900. The industry is carried on chiefly in the region of Pittsburg, stimulated by the abundant supply of coal and natural gas, of fire-clay suitable for furnaces and the glass sand of unexcelled quality found in Fayette and Juniata counties. The first glass house west of the Alleghenies was built in 1797 by Albert Gallatin at New Geneva on the Monongahela River. In the foundry and machine shop industries Pennsylvania has always ranked high among the States; more than half the total number of locomotives built in the United States in 1900 were built in this State. In the production of metal working and of pumping machinery Pennsylvania held the second place. The foundry and machine shop products of the State were valued in that year at \$127,292,440, nearly twice the value of the annual product ten years previously. Next to the Clyde in Scotland the Delaware is now the greatest shipbuilding centre in the world. In the construction of steel and iron vessels Pennsylvania ranks first in the United States. The industry is confined to the vicinity of Philadelphia, the output of three yards in this city and Chester in 1900 was valued at \$14,085,395, and more of the steel ships built for the new navy have been constructed here than at any other point. The total value of the manufactures of Pennsylvania in 1900 (hand trades excluded) was \$1,834,790,860, produced in 52,185 establishments. The capital employed was \$1,551,548,712; the land and buildings devoted to manufactures (not including rented property) were valued at \$375,804,375; salaries, \$48,605,173; wages, \$332,072,670; rent and other expenses, \$134,344,269; cost of material used, \$1,042,434,599. The output of the workshops of Pennsylvania increased in value during the decade 1890-1900 by more than half a billion. The above total includes the output of newspapers, books and other publications and of lumber, coke and cement, which are classified in this article as forest and mineral products. Besides those already mentioned the chief articles of manufacture produced in the State to the value of ten million or more in the last census year were: Boots and shoes (factory made), \$13,235,933; cheese, butter and condensed milk (factory product), \$10,290,006; chemicals, \$13,034,384; men's clothing (factory product), \$23,389,043; women's, \$11,694,580; electrical apparatus and supplies, \$19,112,665; flour and grist



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mill products, \$36,639,423; iron and steel pipe, \$15,383,693; architectural and ornamental iron work, \$10,434,292; malt liquors, \$29,162,743; paints, \$9,137,970; refined petroleum, \$34,977,706; paper and wood pulp, \$12,267,900; refined sugar, \$36,163,817; cigars and cigarettes, \$31,483,141; fresh meat and slaughter-house products, \$25,238,772.

*Commerce and Navigation.*—The Allegheny and the Monongahela are both navigable about 60 miles from their junction at Pittsburg, the latter by the aid of locks and slackwater basins. The Ohio from the earliest times and down to the beginning of the railroad era was the high-road of immigration from the East to the Mississippi Valley and continues to be a busy thoroughfare of steamboat traffic. The Delaware is navigable from the sea to Trenton and has great depth along the water front of Philadelphia. The shoals in its lower course have been removed, a channel 25 feet deep at mean low water has been dredged to the sea and a further deepening of the same to 35 feet is projected. The Schuylkill is navigable for large vessels about six miles from its mouth at Girard Point, Philadelphia, and for steamboats (with the aid of dams and locks) as far as Reading. The water of the Delaware does not become brackish until some distance below Wilmington, Del.; Philadelphia, therefore, is unique in the possession of a deep fresh water harbor within easy access from the ocean. The tonnage of vessels, domestic and foreign, entered and cleared at the port of Philadelphia in 1902, was 1,926,641 and 1,945,287 tons, respectively (No. 3 in U. S.). Most of the canals of the State have fallen into disuse, the Delaware and Raritan Canal and the Delaware and Chesapeake Canal, however, afford interior water communication with New York and the East on the one hand and Baltimore and the South on the other. The frontage of the State on Lake Erie lays open to its inhabitants the commerce of the Great Lakes. There are 148 steam railway companies operating lines in Pennsylvania; the greater part of the carrying business is conducted, however, by twelve railways whose names and mileage within the State are as follows: the Baltimore and Ohio, 644.80 miles; the Buffalo, Rochester and Pittsburg, 289.64 miles; the Central Railroad of New Jersey, 266.94 miles; the Delaware, Lackawanna and Western, 206.92 miles; the Erie, 503.19 miles; the Lake Shore and Michigan Southern 102.49 miles; the Lehigh Valley, 631.37 miles; the New York Central and Hudson River, 502.07 miles; the Northern Central, 27.46 miles; the Pennsylvania, 2,979.96 miles; the Pennsylvania Company, 291.78 miles; the Philadelphia and Reading, 954.85 miles; and the Pittsburg, Cincinnati, Chicago and Saint Louis, only 79.22 miles. Of the foregoing the Northern Central, the Pennsylvania Company and the Pittsburg, Cincinnati, Chicago and St. Louis form part of the Pennsylvania system. The Central of New Jersey, the Delaware, Lackawanna and Western, the Erie, the Lehigh Valley and the Philadelphia and Reading carry practically all the product of the anthracite mines to market. The total railway mileage of the State is 10,393 miles; in 1860 it was 2,598 miles. There were on 1 Jan. 1903 over 2,500 miles of electric railways in the State. There has been a great extension of interurban trolley systems in recent years; con-

tinuous lines are in operation, affording means of communication northward from Chester and Philadelphia to Bethlehem, Scranton, Easton and the Water Gap, and connections can be made via Trenton to New York and the Eastern States.

*Banking.*—According to the report of the Comptroller of the Currency for 1906 the banking statistics were as follows: National banks, 698; their paid in capital was \$104,656,000; the resources aggregated \$1,096,442,452.75; the surplus fund was \$107,417,204.63; and the total amount of individual deposits was \$578,574,358.37. The State banks numbered 125; capital, \$12,640,350; aggregate resources, \$159,137,114; surplus fund, \$13,826,650; and deposits, \$126,906,089; loan and trust companies, 314; total resources, \$701,473,051; paid in capital stock, \$97,302,703; surplus fund, \$98,883,847; and individual deposits, \$396,233,209; private banks, 14; capital stock, \$484,600; total resources, \$5,579,185; surplus fund, \$494,934; deposits, \$4,355,370; mutual and stock savings banks, 13; capital stock only, \$10,200; resources, \$164,120,445; surplus, including capital, \$11,709,342; and total deposits, \$149,963,236. The savings bank depositors numbered 441,092, and the average deposit amounted to \$339.98. The clearing-house transactions for 1906 (year ending 30 Sept.) were \$7,553,273,999 for Philadelphia, \$2,630,996,408 for Pittsburg, and \$103,900,554 for Scranton. Building and Loan Associations, which originated in Pennsylvania, are popular institutions for the investment of savings. According to the latest printed report of the State Commissioners of Banking, the number of these societies in 1900 were 1,155, exclusive of foreign associations doing business in the State. The number of shareholders was 281,980 and the number of shares in force at the end of the year 1,963,911. The amount due the shareholders, secured principally by real estate loans and stock loans, was \$110,493,510.31, made up in chief by the following items: On account of unmatured stock of current series, \$93,595,292.88; on account of full paid stock, \$3,479,329.76, and undivided profits, \$7,462,959.55. The number of shares borrowed on was 568,101 and the number of homes built or purchased during the year 7,185.

*State Finances and Government.*—The assessed value of real estate in Pennsylvania is \$2,766,829,685. The revenues of the State, however, are derived mainly from taxes on corporate stock and net earnings. Exclusive of \$3,128,513.63, being the proceeds of United States bonds sold by the Treasurer, the receipts for the fiscal year ended 30 Nov. 1902 amounted to \$22,947,890.65, of which \$1,364,825.46 was paid in taxes by banks, trust companies and other financial institutions; \$885,754.88 by foreign insurance companies; \$7,048,345.82 was received from other corporations, and \$1,065,845.79 from bonuses on charters. Taxes on personal property and collateral inheritances, receipts from licenses, official fees and miscellaneous special taxes made up the rest. Three fourths of the receipts from personal taxes are refunded to the counties, the amount thus refunded in 1902 having been \$2,566,917.12. Real estate is not taxed for State purposes. There is practically no State debt; \$4,672,500 was the total funded debt at the date of the latest available financial report, and this was almost entirely covered by cash and other assets of the sinking fund. The outstanding debent-



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tures do not mature until 1912; but it has been the custom to purchase them from time to time in the open market at a premium, the purchases for 1902 having amounted to \$2,250,000 approximately. Pennsylvania's delegation in the Congress of the United States is composed of 2 Senators and 32 Representatives. The administration of the State's business and the execution of the laws is distributed between the executive department and numerous boards and commissions. The executive department consists of the governor, lieutenant-governor, secretary of state, attorney-general, auditor-general, state treasurer, secretary of internal affairs, and superintendent of public instruction. The governor, lieutenant-governor, auditor-general, treasurer and secretary of internal affairs are elected; the secretary of state, attorney-general and heads of other departments and commissions are appointed. The governor, whose term is four years, and who is not eligible for re-election, is invested with the veto and pardoning power. The former may be exercised with respect to single items of appropriation bills. No pardon can be granted by the governor except on recommendation of the lieutenant-governor, secretary of state, attorney-general and secretary of internal affairs, or any three of them; these officials constituting the Board of Pardons. The governor may refuse a pardon notwithstanding the recommendation of the Board. The General Assembly consists of two branches, the Senate and House of Representatives, and meets biennially in the odd numbered years, at Harrisburg, which since 1810 has been the capital. The Senators, 50 in number, are elected for four years in such manner that the terms of one half the number expire every second year. The House contains 204 members elected for a term of two years. The compensation to members of the General Assembly is \$1,500 and 20 cents mileage for the regular biennial session and \$500, besides mileage, for any extraordinary or special session. The Judiciary is composed of the supreme court, the superior court, an intermediate court of appeals and the county courts. The supreme court has original jurisdiction in cases of injunction when a corporation is a defendant, and the judges thereof are *ex officio* justices of oyer and terminer; ordinarily, however, courts of oyer and terminer and quarter sessions are held by county judges, who also preside over orphans' courts, and as judges of common pleas have jurisdiction in the first instance over all civil actions. The expenses of government including \$732,655.67 on account of the Judiciary, but exclusive of salaries and mileage of the legislators, amounted in 1902 to \$2,171,149.41.

*Population.*—In 1900 out of a total population of 6,302,115, 156,845 were negroes, 1,639 Indians and 1,927 Mongolians. Classified by nativity 5,316,865 of the population, or 74.4 per cent, are native born; 61.7 per cent, or 3,885,386, are of native parentage; 31.1 per cent, or 1,961,307 were born of foreign parents, and 7.2 per cent, or 455,422, were of mixed parentage, native and foreign. The most numerous foreign born are German, including German, Austrian and Swiss, 286,652, followed in their order by Irish 205,909, English, Scotch and Welsh 180,670, and Italian 66,605. Of the native born 4,820,800 are born within the State. There is an excess of a

little over one and one half per cent of males in the population, the relative number of the two sexes being 3,204,541 males and 3,097,574 females. About two-fifths, or 2,853,505 live in country districts, that is, outside of incorporated cities, boroughs or villages having 2,500 or more inhabitants; 73 per cent of farm families own their homes, while in the case of urban families the conditions are reversed, 65.6 per cent paying rent. The total number of persons engaged in gainful pursuits is approximately 2,500,000, divided according to occupations as follows: in manufacturing 724,551, in the anthracite collieries 147,849, in the bituminous coal mines and at the coke ovens 115,729. Agricultural pursuits, including dairy farming, occupy 341,712, while 454,846 are engaged in trade and transportation. The number engaged in professional service is 103,011, in the hand trades 82,250, either as proprietors or as wage earners, and 484,000 are employed in domestic and other personal service. The growth of population by decennial periods is indicated below:

1790.....	434,373	1850.....	2,311,786
1800.....	602,265	1860.....	2,906,215
1810.....	810,091	1870.....	3,521,951
1820.....	1,049,458	1880.....	4,282,891
1830.....	1,348,233	1890.....	5,258,014
1840.....	1,724,033	1900.....	6,302,115

In density of population Pennsylvania takes the sixth place in the Union, being 140 to the square mile. The State is divided into sixty-seven (67) counties. Special legislation for cities is not permitted under the present Constitution, but under the guise of a general law Philadelphia has a charter of its own and special provision is made for the government of Allegheny, Pittsburg and Scranton. The cities of the State are divided into three classes, according to population. Philadelphia alone answers the requirements of a city of the first class and Allegheny, Pittsburg and Scranton those of cities of the second class. The more important cities of the third class with their population, according to the census of 1900, are: Allentown 35,416, Altoona 38,973, Chester 33,988, Easton 25,238, Erie 52,733, Harrisburg 50,167, Johnstown 35,936, Lancaster 41,459, McKeesport 34,227, Newcastle 28,339, Reading 78,961, Wilkesbarre 51,721, Williamsport 28,757, and York 33,708. Local elections for city, town and borough officers are held on the third Tuesday of February; State officers are chosen at the general elections in November. The total vote polled at the last Presidential election was 1,173,210, distributed as follows: Republican 712,665, Democratic 434,232, Prohibitionist 27,908; the rest were cast for the Labor, Socialist and People's party candidates. The male population of voting age was 1,817,239, of whom 1,330,099 were native born and 234,709 naturalized foreigners. Citizenship, payment of a tax and residence within the State, county and election precinct for stated periods are prerequisites to the right to vote.

*Charities and Correctional Institutions.*—Provision is made for the care of the criminal, indigent, insane and other defective and dependent persons in numerous State institutions under the general supervision of the Board of Public Charities. The correctional institutions, aside from the county jails, are the Eastern and Western Penitentiaries, the former at Philadelphia and the latter at Allegheny; the Industrial Reformatory at Huntingdon and the Reform



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School at Morganza. The Philadelphia House of Refuge, the male department whereof is at Glen Mills, Delaware county, though a local institution, receives State aid and accepts commitments from all counties. The separate system, which requires the segregation of prisoners during working hours as well as at night, prevails at the Eastern Penitentiary, where the system was originated; the Western Penitentiary is managed on the congregate system. The contract system was abolished by law in 1881, and the inmates of prisons and reformatories are required to be employed "in behalf of the State" or "in behalf of such institutions." The penitentiaries are supported in part by appropriations from the State treasury for salaries, repairs and incidental expenses, \$50,000 for the Eastern and \$80,000 for the Western. The other needed revenues are derived from the labor of convicts, profits of manufacturing, payments by the United States for the support of Federal prisoners and by the counties to make good any deficiency of support by labor of their convicts. The convict inmates of all correctional institutions, work houses, county jails, and the Industrial Reformatory at date of latest published official report was 2,156, besides 1,251, the average population of the Eastern, and 992 the average in the Western Penitentiary. The State hospitals for the insane, five in number, are located at Harrisburg, Danville, Norristown, Dixmont and Warren; there is also a State Asylum for the chronic able-bodied insane at Wernersville. The appropriations on this account for the year 1902 amounted to \$958,737.68. The statistics of the insane as given in the latest published report of the Committee on Lunacy show that on 30 Sept. 1899 the State hospitals contained 6,076 inmates, the State Asylum 791; the Training School for the Feeble-minded 4, county and municipal hospitals and almshouses 3,256, the penitentiaries 15, county jails 2 and private hospitals and sanitariums 730, the total being 10,025. Of these 3,165, nearly 21 per cent were foreign born. The Training School for Feeble-minded Children at Polk, Venango County, has a capacity of 1,042, a population somewhat greater, and annual receipts approximating \$200,000. Locally controlled and private institutions for the deaf and dumb, the blind and the mentally deficient receive upwards of \$400,000 per year from the State; homes for children, for the aged and friendless receive annually nearly \$100,000 and the State contributions to private hospitals amounted in 1902 to \$969,988. The unsystematic, haphazard manner in which these appropriations are distributed and the multiplication of applicants for State bounty lay open the present method to just criticism. The consolidation and reformation of the county jails on the lines of the British Prison Act of 1877 is earnestly recommended by the Board of Public Charities and the subject deserves more attention than it has received from the Legislature. The five State hospitals for injured miners—one in the anthracite region, one in the middle and three in the bituminous coal fields—and the Soldiers' and Sailors' Home at Erie complete the list of State charitable institutions.

*Education.*—The system of public instruction of the State dates from 1834, when the Common School law was passed. The system is under the direction of the State Superintendent. There

are (1 June 1903) 2,545 school districts, each generally comprising a township. The directors of the district appoint teachers and assess the local school rates; they also elect the County Superintendent who fixes the qualifications and conducts the examination of teachers. The more important of the third class cities have their own Superintendents and the great cities have autonomous systems under local Boards of Education. The total number of district schools in the State is 30,349, whereof 18,510 are graded schools; the whole number of teachers is 31,449 and the whole number of enrolled pupils 1,193,669—the average in daily attendance being 883,669. The constitution of 1873 requires the General Assembly to appropriate not less than \$1,000,000 a year to the use of the common schools, the sum appropriated for the School year ended 2 June 1903, was \$5,525,000 and this has become the customary amount. Manual training has become a feature of prime importance in public instruction in Pennsylvania. The compulsory law has been in operation only a few years but its effect is visible in the increasing attendance. The State is divided into 13 normal school districts each comprising several counties and each having a State Normal School. These schools are additional to the high schools maintained by the Boards of Education of the greater cities. Latterly township high schools have been established in a number of districts. Appropriations in aid of the latter amounted to \$25,000 and for free tuition of students in the State Normal Schools to \$200,000 in 1903. The salaries paid to teachers in all public schools in this year footed up to \$12,552,491 and the cost of text-books provided free was \$856,795. The total expenditures for the year amounted to \$24,354,888.23 or \$20.40 per capita of enrolled pupils. The estimated value of school property is \$68,523,701.44.

The Pennsylvania State College is one of the "land grant" colleges, founded under the act of Congress of 1862. It grew out of the Farmers' High School of Pennsylvania, established in 1855; its name was changed to the Agricultural College of Pennsylvania in 1862, when the income of the national land grants was appropriated to its use. In 1874 its scope was enlarged to provide "a liberal and practical education" in the arts and sciences and it received its present name. It has 49 instructors; the number of students is 602 (11 female) not including 1,800 correspondence students and 34 special in agriculture, and the value of its grounds, buildings, apparatus and library in Centre County is \$975,000. The U. S. Agricultural Experiment Station in Pennsylvania is by law a department of the State College. There are in the State 16 theological seminaries with 624 students, 7 medical colleges, with 2,596 students, 2 colleges of pharmacy with 630 students; 5 dental colleges with 1,343 students and 3 law schools with 577 students. The names of the private collegiate institutions in the State and religious denomination, if any, appear in table at top of next page.

The students in the collegiate departments of these institutions number 4,539 males and 1,207 females. At end of school year 1 June 1902, there were 27,138 students in private schools and academies, 2,268 in manual training and trade schools, 6,939 in business colleges, and 4,794 in collegiate and other institutions for orphans.



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Name of Institution	Denomination
Allegheny College, co-ed.....	Methodist-Episcopal.
Bryn Mawr, female.....	
Bucknell University, co-ed.....	Baptist.
Dickinson College, co-ed.....	Methodist-Episcopal.
Franklin and Marshall College.	Reformed Ch. in U. S.
Geneva College, co-ed.....	Reformed Pres.
Grove City College, co-ed.....	
Haverford College .....	Friends.
Lafayette College .....	Presbyterian.
Lebanon Valley College, co-ed..	United Brethren.
Lehigh University .....	
Moravian College and Theolog- ical Seminary.....	Moravian.
Muhlenberg College .....	Lutheran.
Pennsylvania College, co-ed....	Lutheran.
Pennsylvania Military College..	
St. Vincent College and Sem- inary .....	Roman Catholic.
Susquehanna University, co-ed.	Lutheran.
Swarthmore College, co-ed.....	Friends.
Thiel College, co-ed.....	Evangelical-Lutheran.
University of Pennsylvania, co-ed .....	
Ursinus College, co-ed.....	Reformed Church.
Villanova College .....	Roman Catholic.
Washington and Jefferson Col- lege .....	Presbyterian.
Waynesburg College, co-ed.....	Cumberland Pres.
Western University of Pennsyl- vania, co-ed.....	
Westminster College, co-ed.....	United Presbyterian.
Wilson Female College.....	Presbyterian.

*Newspapers and Other Publications.*—In 1900 there were in Pennsylvania 1,795 establishments engaged in printing and publishing with 16,991 wage-earners and products valued at \$36,455,629 (No. 2 in U. S.). The increase in value of the product compared with 1890 was \$2,047,136. The first printing press in the State was erected at Philadelphia in 1686, the first paper mill in the United States was established at Germantown in 1693. Franklin in 1787 stated that he was interested in the establishment of 18 and that there were then in operation 48 such mills in the State. In the middle of the 18th century there were some lively political wars of words carried on in the province and pamphlets were as numerous here as sermons in New England. In 1810 it was estimated that half a million volumes were printed annually at Philadelphia and for half a century after the Revolution as it had been for half a century before, this city was undoubtedly first in the printing industry, and the first daily paper in the United States was established here in 1784. By 1810 the number of newspapers had increased to 73, of which 8 were dailies—a larger number than published in any other city of the country at that time. The number of periodical publications in the State at present is 1,352 divided as follows: Daily, 201; tri-weekly, 6; semi-weekly, 29; weekly, 879; bi-weekly, 4; semi-monthly, 10; monthly, 204; bi-monthly, 7, and quarterly 12.

*Church Statistics.*—The latest complete reports on church organizations are those of Mr. H. K. Carroll, forming part of the United States census of 1890. According to these the religious bodies of the State included 1,726,640 communicants or members, being 32.84 per cent of the population. There were 9,624 church edifices with a seating capacity of over 3,000,000 and the total value of church property was \$85,917,370. The principal organizations with their membership and value of ecclesiastical property are enumerated in the following table:

DENOMINATION	Organi- zations	Member- ship	Property
Baptist, Regular .....	634	83,122	\$ 5,984,322
Catholic, Roman .....	654	551,577	10,068,770
Congregational .....	108	9,818	672,588
Disciples of Christ.....	125	12,007	533,147
Dunkards .....	134	14,194	354,008
Evangelical Association..	662	42,379	1,590,605
Friends, 4 bodies.....	108	13,627	1,841,050
Jews, Reformed .....	18	5,582	552,500
Lutheran, Gen'l Synod..	596	78,938	3,672,650
Lutheran, Gen'l Council.	616	124,163	4,933,355
Lutheran, Synod Confer.	26	6,559	284,915
Mennonites .....	188	16,077	366,606
Methodist Episcopal ....	2,042	222,886	12,642,104
Methodist, Protestant ...	172	10,081	641,575
Moravian .....	14	4,308	340,400
Presbyterian .....	939	161,386	15,491,680
Presbyterian, United ...	281	39,204	2,552,450
Protestant Episcopal ....	369	57,360	10,854,131
Reformed .....	762	122,944	5,299,828
United Brethren in Christ.	526	33,951	1,086,135

HISTORY.

*The Swedes Colony.*—The earliest settle-ments of white men on the western shore of the Delaware River were those of the Swedes. Though Henry Hudson, in the service of the Dutch East India Company, had turned the prow of the Half Moon into Delaware Bay in 1609; though Cornelius May, a Dutch navigator, in 1616 explored the bay and river, giving his own name to one and the name of a Frisian town (Hindlopen) to the other of the outer capes; though the Dutch West India Company in 1623 formally took possession of South River, now the Delaware, built Fort Nassau on the present site of Gloucester, N. J., and, later on, Fort Beversrede on the Schuylkill—the Dutch came merely as traders. The Swedes were real col-onists. Gustavus Adolphus, the Swedish cham-pion of Protestantism in Germany, is believed to have entertained a rather large scheme of colonization in America; but the King's preoc-cupation by his contest with the German Em-peror hindered the development of the plan, and his death at Lützen ended it. In a more modest form the project was taken up by Chancellor Oxenstierna and in December 1637 two small vessels filled with Swedes and Finns set sail for America. The expedition was led by Peter Minuit, who had been Director General in the plantation of New Amsterdam. Heedless of the protests of either of the English in Virginia or the Dutch in New Netherlands, the doughty Peter proceeded to build a fort on the present site of Wilmington and buy from the Indians all the west shore of the South River from Bombay Hook to the Schuylkill. He was drowned in the West Indies in the following year and was succeeded by one Hollander, who brought an-other ship load of colonists and enlarged the boundaries by purchasing the west bank up to Trenton Falls. In 1642 came Johan Printz, with two war ships and an armed transport and fortified with a commission to administer justice, maintain the Lutheran religion and defend New Sweden against all comers. Printz, who was a native of Holstein, appears to have been a per-son of distinction. He had been a lieutenant colonel in the Swedish service and lived to be-come a general. He was accompanied by 54 German families, mainly from Pommerania. He strengthened Fort Christina (Wilmington) and established another, armed with cannon, on Tini-cum Island; where he also erected for himself



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a mansion and pleasure house and built a yacht. The settlers cultivated tobacco, wheat, rye and barley; they raised cattle and had a flourishing mill on Cobb's Creek. Fort Casimer, which Peter Stuyvesant had established in the locality where New Castle, Del., now stands (in order to overawe the Swedes), was captured by Printz and enlarged. At last, in 1655, while Governor Printz was absent from the Colony, the Dutch sent an overwhelming force of 750 men down from New Amsterdam and the Swedes capitulated. The colony henceforward shared the vicissitudes of New Netherlands; it was captured by the British in 1664, recaptured by the Dutch 10 years later, and finally ceded to Great Britain by the treaty of peace signed February 1675, when it was annexed to the domains of the Duke of York in America. The Colony included about 200 families and, a few years before the arrival of Penn, received some accessions from the English Quakers who had begun to settle in West Jersey in 1675. "The Three Lower Counties on the Delaware" were transferred to William Penn by the Duke of York in 1681 and were attached to Pennsylvania until 1701, when Penn consented to a separate Assembly for the "Territory," by which name the Counties became known. The social and political relations between "Territory" and "Province," however, continued most intimate, even after the separation; it was not unusual for the residents of one Colony to sit in the legislature of and to occupy high official positions in the other down to Revolutionary times, when the "Territory" became the State of Delaware.

*Penn's Experiment in Government.*—"This day my country was confirmed to me under the great seal of England, by the name of Pennsylvania," wrote Penn, in a letter of date 5 March 1681 (the charter bears date March 11th). He had proposed to name it New Wales, "being as this a pretty, hilly country"; and when this was objected to, he suggested Sylvania. "They added Penn to it," he continued; "and though I much opposed it and went to the King to have it struck out, he said it was past, and would take it upon him; nor could twenty guineas move the under Secretary to vary the name; for I feared lest it should be looked on as a vanity in me and not as respect in the king, as it truly was, to my father." The charter, which was granted partly in extinguishment of a debt due from the King (Charles II.) to Admiral Penn, the father of the first proprietor, conveyed a tract lying between the 40th and 43d parallels of north latitude and extending from the Delaware River westward five degrees of longitude. Beside making Penn the sole and absolute proprietor of the land it invested him with power to frame the laws, subject to the consent of the freemen, to appoint judges and other officers, impose taxes, suppress piracy and levy troops. To the British Parliament was reserved the right to lay imposts and to the Privy Council Committee on Trade and Plantations the right to annul provincial laws, which were required to be submitted to that body within five years after enactment. The Proprietor thus had an absolutely free hand for half a decade, at least, to conduct his "holy experiment." To the men of the tail end of the 17th century, still in the throes of a sanguinary religious conflict which had devastated Europe for more than 150 years, the idea of founding a

state without an established church, and wherein all creeds were to be placed on a footing of complete equality, must have appeared as hare-brained as do the tenets of scientific nihilism to the average citizen of our times. The notion of establishing in a howling wilderness an unarmed community, conscientiously obedient to the doctrine of non-resistance, must have seemed a manifestation of insanity. What could be expected of such a community but that it would be annihilated by its savage neighbors or be wrecked by internal anarchy? But nothing daunted Penn proceeded with framing a constitution for his colony. His magnetic personality had enabled him to smooth out differences and preserve harmony in the intensely individualistic sect to which he belonged and he doubtless imagined he could sway a Quaker Assembly with like success. His expectations to permanently reside in and to personally superintend the upbuilding of his model State were doomed to be disappointed, however. He arrived at New Castle in the ship *Welcome* on 27 Oct. 1682, and in less than two years he was called back to England by the state of the controversy over the Maryland boundary. Political and financial complications detained him there until 1699. His departure was the signal for the outbreak of dissensions. Penn's first "Frame of Government" was a compound of feudal, monarchical, aristocratic and democratic elements. The Proprietor was the lord paramount of the soil and all the colonists were his tenants; he claimed the right not only to appoint the judges but of organizing the courts; the Assembly had the power to assent to or reject proposed laws, but the initiative in legislation as well as supreme judicial and administrative authority was vested in the council, which was thus a copy in miniature of the British House of Lords and Privy Council rolled into one. The Assembly chafed under the restrictions placed upon its action. It could not inaugurate but it could frustrate legislation. It impeached its speaker for no apparent reason than that he was more reasonable than "the witless zealots" who made "a monkey-house of Mr. Penn's Assembly"—the quotations are from a letter of Penn's deputy, Governor Blackwell. A clerical adventurer named Keith about this time was threatening to cause a schism in the Quaker brotherhood and the colony resounded with shrill invectives from the orthodox—for Keith, though a man of no principles, was eloquent and had no equal in this respect in the province. Penn's friend, James II., the former Duke of York, had been deposed and William of Orange had succeeded to the throne. William well understood for what purpose his enemy Louis XIV. had sent Frontenac back to Canada in 1691 invested with vice-regal powers; he determined to put the colonies in a condition to effectively defend themselves. Colonel Blackwell, an old Cromwellian soldier, whom Penn had appointed his deputy, perhaps with such a contingency in view, was unable to extract a penny of money from the Assembly for military purposes. Two commissioners sent to Pennsylvania from New York at King William's command reported that the colony was prepared neither against an Indian attack from the west nor against the French privateers who infested the estuary of the Delaware. To the foremost warrior of that warlike age this seemed a trifling with fate. The



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Proprietary charter was revoked in 1692 and Governor Fletcher of New York, instructed to take over the direction of affairs in Pennsylvania. On giving his promise to the Privy Council to "provide for the safety and security" of the colony, to transmit to the Assembly the king's orders, and on expressing his assurance that the colony would "supply such quotas of men and defray such part of the charges as his majesty might deem necessary to preserve his dominions in North America," Penn was reinstated in his Proprietorship in 1694. During his second brief term of residence in the colony, from 1699 to 1701, Penn urged and secured the passage of laws to suppress piracy and contraband trade, a subtle distinction between police and military measures enabling him to reconcile his conscience to these enactments. He could not, however, prevail over himself to advocate the warlike policy imposed upon him by royal command; and his promise remained unfulfilled. A second, and probably final, revocation of his charter being impending Penn hurried back to England, as the event proved, never to return. By the sudden death of King William the charter was saved; but the Assembly had been made to dimly comprehend that it represented a polity and not a denomination and, on the renewal of war with France in Queen Anne's time, voted money to the use of her gracious majesty—to be sure, with an artless effort to conceal the purpose for which it was granted. Less consideration was shown for the founder. "O, Pennsylvania, what hast thou cost me?" wrote Penn in 1705. "Above £30,000 more than I ever got, two hazardous and fatiguing voyages and my son's soul." The reference is to William Penn, Jr., a scapegrace, whose escapades had scandalized sober Philadelphia and who died shortly after a brief and boisterous career as member of the Pennsylvania Council.

Though pecuniary profit was the last thing considered by Penn, it certainly was not an unreasonable expectation that the colony would afford him an income commensurate with the sacrifices he had made. He had expended over £50,000, the greater part of his patrimony, in establishing the same. The quit rent demanded for land was low, but the payments were spasmodic; the receivers were derided and occasionally maltreated. The sales of land up to 1710 amounted to 91,000 acres, bringing a total of £10,640. But the Assembly exhibited supreme indifference to Penn in his financial distress. When reminded by the Proprietor that he had received no support from the colony for 20 years an excise tax was ordered in 1700 for his benefit; but the year after the income therefrom was directed to be paid into the public treasury. Disillusioned, and harassed by the fear that he would leave his family ruined, Penn entered into negotiations with the crown to surrender his Proprietary rights. A stroke of paralysis prevented the consummation of the agreement.

*A Quaker Republic.*—But the experiment in Quaker government was not wholly a failure. The last act of Penn before leaving the colony in 1701 was the promulgation of a new constitution. The Assembly became the sole law-making power, the Council an appointive advisory and executive body; the Proprietor resumed the right of veto, which he had in the beginning and of his own free will renounced. David Lloyd, a

Welsh Quaker, the best lawyer in the province, assumed the leadership of the popular party. An unscrupulous politician, a lover of power and a persistent personal enemy of William Penn; but in him the Assembly found its master. Whatever else may be said to the discredit of David Lloyd it cannot be denied that he was an uncompromising democrat and made the Assembly a workable political machine. Governor Evans (1704–9) spoke truly when he said that "the proceedings of the Assembly from the beginning of the century indicated a purpose to reverse the methods of government according to the English Constitution and to establish one more nearly resembling a republic in its stead." When the House assumed the right to prorogue itself at will it became practically the most independent legislative body in the British empire. Although the veto of the Proprietor or his deputy governor was absolute, the Assembly, holding the purse-strings of the Province, was in the end able to get anything it seriously desired. As for the right of the Privy Council or their Lordships of the Board of Trade to annul provincial laws, the Assembly could, if it would, re-enact them; when they would stand good until again repealed—and this expedient the House did not hesitate to employ on occasions. After a struggle of nearly a quarter century between the Assembly on the one side and the Proprietaries and the British Privy Council on the other, over the organization of the colonial judiciary, the courts were finally organized (in 1722) substantially as first proposed by the House. The county courts, or courts of common pleas, were made the main depositories of judicial power; all cases, civil and criminal, were triable in the first instance by tribunals of the vicinity in which the cause of action arose. No provincial imitation of the English King's Bench could send forth a Jeffreys to hold bloody assizes, the local courts were not to be dominated by certiorari, mandamus and quo warranto, and their proceedings were reviewable, generally speaking, only on appeal of one of the parties to an action. The attempt to undermine the Quaker democracy by requiring all public functionaries to take oaths of office, and by compelling jurors and witnesses in judicial proceedings to be sworn, ended in failure, although the victory in this case involved a sacrifice of Penn's mild penal code. The scruples of the Quaker juries, however, continued to give assurance against the taking of human life as a penalty for petty crimes. "It is our great happiness," said Andrew Hamilton, Speaker of the Assembly in 1739, "that instead of triennial assemblies, a privilege which several other colonies have in vain endeavored to obtain, ours are annual and for that reason less liable to be practised upon or corrupted. We sit upon our own adjournments when we please and as long as we think necessary and are not to be sent a-packing in the middle of a debate and disabled from representing our just grievances to our gracious sovereign. . . . We have no officers but what are necessary . . . and those generally elected by the people or appointed by their representatives. Other colonies swarm with unnecessary officers nominated by the governors, who make it a main part of their care to support them notwithstanding their oppressions. . . . Our foreign trade and shipping are free from all imposts except those small duties payable



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by the law of Great Britain. The taxes we pay for carrying on the public service are inconsiderable, for the sole power of raising and *disposing* money is lodged in the Assembly, who appoint their own treasurer and to them alone is he accountable. Such is our happy state as to civil rights." In the constitution of 1701, as in all the previous "Frames of Government" Penn had given the foremost place to the proviso for the unconditional equality of all religious creeds. The proviso was esteemed rather lightly by the Assembly; they had "liberty enough for Englishmen," and some would have preferred to disqualify all but Quakers. Even Penn's secretary, Thomas Logan, wrote to him that "most of us do not value it at so many pence." Penn was ahead of his times, but liberty of conscience was doubtless one of his most beneficent legacies to the colony. Another, of the utmost advantage, was his Indian policy. Firmly convinced that the natives could be won by justice, he would permit no land to be opened to settlement without consent of the aboriginal occupants. In several instances the claims of five or six tribes asserting title to territory acquired by the Proprietary from one of them, were successively satisfied. The famous treaty of Shackamaxon, however, involved more than a mere land purchase. In Penn's description of Pennsylvania he says: "We have agreed that in all differences between us, six of each side shall end the matter"; and from this and the Indian traditions it may be inferred that the compact was an arbitration treaty. Governor Byrd, of Virginia, who certainly could be suspected of no predilections in favor of Quakers, in 1734 put his testimony on this subject in writing thus: "The truth is they have observed exact Justice with all the natives bordering on them . . . which has saved them from many wars and massacres, wherein the other colonies have been indiscreetly involved." In this manner Penn and the Quakers contributed much to the security of the American frontier; as for Pennsylvania, down to Braddock's defeat, "she scarcely knew an alarm." Peace, abundance and religious and civil liberty were blessings which few if any other communities of that era enjoyed. Small wonder that the Colony grew with unparalleled rapidity; it would have been strange if it had not. Within 20 years of the first settlement the province contained nearly 25,000 white settlers, besides 6,000 Indians and nearly as many negroes. By 1750 its capital city was the market centre for a population of probably 150,000. In 1823 about 85 vessels entered the port; its imports amounted in value to £16,000 and its exports to £90,000. By 1852 the ships annually visiting the port numbered 453, and its foreign trade had grown in value to £320,000.

*German and Other Foreign Accessions.*—From the first the Quaker community received non-English accessions. A company of Friends of Welsh nationality bought large tracts of land west of the Schuylkill. Such names as Merion, Bryn Mawr, Radnor and Gwynned still proclaim the Welsh origin of these townships. The sale of land within their "Barony" to others than Welshmen evoked protests from them and their meetings performed nearly all the functions of government, even ordering such matters as the establishment of ferries and the erection of line fences. But the purpose, if it ever ex-

isted, of permanently maintaining a Welsh empire in imperio was soon abandoned. Their leading men almost immediately took active parts in the political life of the province. The same vessel which brought over the Welsh in 1683 carried Francis Daniel Pastorius, the founder of Germantown and a signer, perhaps the originator, of the first American petition for the abolition of slavery. Pastorius and his company were German Quakers. The Mennonites had been hounded up and down the country from Lake Geneva to the North Sea for a century, when, falling in with Penn's missionaries and encouraged by letters from Pastorius, a party of them, headed by William Rittinghuysen, set out for Pennsylvania in 1688, joined the Germantown colony and were followed in time by nearly the whole body of the sect. To the Dunkers, who came to Germantown in 1719, belonged Cristopher Sauer, the printer of the first Bible in America in a European language. The Moravians, adherents of the pre-Lutheran reformer John Huss, had become almost annihilated in the religious wars of the 17th century. A remnant of the sect were given asylum on the estate of Count Zinzendorf in Silesia. This refuge was called Herrenhut (Shelter of the Lord) an almost literal translation into German of the name Bethlehem. Their noble protector found the means of transporting the Moravians to America. Georgia, their first stopping place, was abandoned for the more congenial surroundings of Pennsylvania; and here they were joined by Count Zinzendorf in 1734, who publicly renounced his title of nobility and led his little band to a new Bethlehem on the Lehigh. The Moravians, who were men of deep learning and refined manners, attained considerable success in their efforts to civilize their Indian neighbors and to instil into their more backward kinsmen higher ideals of living.

All told the Germans in Pennsylvania in 1710 did not exceed 3,000 in number. Beginning with that year a tide of immigration set in which was to impress upon a large section of the commonwealth characteristics that have persisted to the present day. The Palatines, as they have been called without sufficient regard for historical accuracy, were not the victims of religious bigotry; they belonged to regularly established churches, the Reformed and the Lutheran—wherefore they were called "church people" to distinguish them from the "Sects." The cause of their emigration *en masse* is obscure. The devastation of their homes by Swedes and Imperialists, by the armies of Louis XIV. and his German, English and Dutch foes, who for nearly a century had made their country a battle ground; the hard winter of 1708-9 and inducements believed to have been held forth by the government of Queen Anne—all these probably contributed to the result. In 1709 from 12,000 to 15,000 of these wretched and half-famished people were gathered in London, sustained by public and private charity. Many died, a few returned to Germany, others were scattered to various parts of England; about 3,000 became settled in Ireland and a nearly equal number were given passage to America. The uncouth and destitute wanderers were looked upon with disfavor by the authorities at Philadelphia; they did not long trouble the latter with their presence, however, but pressing



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beyond the tracts occupied by the Quakers they took up lands mostly in Berks and Lancaster counties and in the Lebanon and Lehigh valleys, where their skill in husbandry soon made them fairly prosperous and contented. The German immigration into Pennsylvania exceeded in number all others in colonial times; in the year 1749 alone 12,000 landed at Philadelphia. "I remember," wrote Franklin in 1753, "when they modestly declined intermeddling in our elections, but now they come in droves and carry all before them. Of the six printing houses in the province two are entirely German, two half German half English and but two entirely English. They have one German newspaper and one half-German. Advertisements intended to be general are now printed in Dutch and English. The signs in our streets have inscriptions in both languages and in some places only German. They begin of late to make all their bonds and other legal instruments in their own language, which are allowed good by our courts. . . . and I suppose in a few years interpreters will be needed in the Assembly to tell the one half of our legislators what the other half say." At the outbreak of the Revolution the population of the State was about 300,000, and Franklin's remark that it consisted one third of Quakers, one third of Germans and one third of miscellaneous and refractory elements, was substantially correct. By this time the Swedes and Welsh had been merged with the English-speaking population; but the so-called Palatines constituted a seemingly impermeable mass. In the Revolutionary period they, conjointly with the Scotch-Irish Presbyterians, dominated the government. During the first quarter of the 19th century, and even later, the Germans held the balance of power in Pennsylvania politics, a fact to which the succession of early State governors with German names bears witness. Even at the present day many of the inhabitants of the German belt can speak no other tongue than "Pennsylvania Dutch"; and in a recent sensational criminal trial, when some of the witnesses were unable to give their testimony in any other language, neither judge nor jury nor the prosecutor nor counsel for defense required the services of an interpreter.

*The Era of Franklin.*—The sons of Penn by his second marriage were in almost every respect the opposites of their father. They had abjured Quakerism and entered the Church of England; they possessed none of his intellectual gifts and were parsimonious and grasping. Thomas Penn, who succeeded to the Proprietorship by right of primogeniture, inaugurated his career by cheating the friendly Delawares. The latter had ceded a tract of land to the west of the Delaware River, extending from the latitude of Trenton northward as far as a man could walk in a day and a half; the new Proprietor caused the distance to be measured off in a 36-hour relay race by two trained athletes. This transaction became known in history as the "Walking Purchase." The quarrel was further embittered when the Delawares, who had threatened to defend their homes, were ordered off the land by their suzerains—the Six Nations of the Iroquois Confederacy—to whom the Proprietors appealed. The colony now for the first time had a vindictive and savage foe on its frontier. Pennsylvania was but little affected by the third of

the wars between France and Great Britain, in which the American colonies were more or less involved and which broke out in 1744. There was some apprehension from privateers in Philadelphia, and Franklin's appeal in his pamphlet, 'Plain Truths,' roused the people who were not Quakers to organize a volunteer force and to build and equip a fort on the river just below the city; there was some desultory fighting in the Indian borderland; Thomas Penn's deputy proclaimed the Delawares and Shawnees public enemies and magnanimously offered rewards for Indian scalps. The intelligence of the New England militia's expedition to Louisburg seemed like news from another continent. The Assembly remained unmoved by Franklin's terrible description of a defenseless community, "subject to the wanton and unbridled rage, rapine and lust of negroes, mulattoes and others, the vilest of mankind," such as constituted the crews of privateering vessels in those times. Many Quakers resigned their seats, however, and surrendered other official positions, being unwilling to serve under a government which had committed the sin of declaring war. The peace of 1748 endured only for a short time. The decisive conflict between France and England for colonial empire in America was drawing near. The Seven Years' war, in which Frederick of Prussia earned his title "the Great" and in which England under Pitt gained Canada and India, began in Europe in 1755; in America the gravity of the situation was recognized two years earlier. At the Congress of Albany in 1754 the Pennsylvania Assembly was represented by Samuel Norris and Benjamin Franklin; the Proprietary by John Penn. One of the main objects of the Congress was to deter the Six Nations, hitherto the strongest bulwark against the savage allies of France, from casting their lot with the enemies of the English settlers. That at such a time, when the American colonies were preparing to defend their very existence, the Proprietors should have imperiled all for private gain seems incredible, but such was the fact. In the "Western Purchase," which was consummated at the Albany conference, the Indians were deceived into conceding their favorite and jealously guarded hunting grounds, the boundaries being described by the compass, which they did not understand. Part of the Iroquois openly espoused the French cause; the remainder became lukewarm and unreliable friends. The disaster of Braddock threw the undefended colony open to the murderous onset of its now numerous native enemies. In the fall of 1755 the savages, after overrunning the outlying settlements, pressed through the passes of the Blue Mountains on the heels of the fleeing British regulars. Every post brought to the Council at Philadelphia heartrending appeals for help; the Assembly and the governor, acting under instructions from the Proprietary, were deadlocked; no money bills could be passed. Troops of frontiersmen rode through the city threateningly brandishing their weapons; a party of Germans laid the corpses of their countrymen, scalped within 65 miles of the capital, at the door of the State House. The Quaker peace policy was denounced in unmeasured terms from the backwoods pulpits. On this occasion, however, the Assembly was unquestionably in the right. It had voted money to aid Massachusetts



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in the expedition to Cape Breton and, the grant having been vetoed, it had adopted the suggestion of Franklin to draw upon the Loan Office, as it had a right to do without the consent of the executive. There was not a stiver in the treasury of that institution, but an issue of interest-bearing bills of credit payable in a year served the purpose. The Assembly was prepared to levy a tax to provide for the defense of the province, but the governor's instructions from the Proprietary were to sign no supply bills unless the estates of the latter should be expressly exempted from taxation. "He who would purchase present security at the cost of essential liberty," insisted Franklin on the other side, "deserved neither security nor liberty"; and so the deadlock continued until late in the fall of 1755. Intimidated at last by the indignation aroused in England by the reports of their meanness the Proprietors agreed to "donate" £5,000, approximately their share of the proposed levy. Under the pressure of necessity the Assembly yielded the point, voted the money and left the Proprietary estates untaxed. A volunteer regiment was speedily recruited by Franklin, who proceeded to the frontier with part of his force to supervise the construction of a line of forts. Blackened ruins everywhere told their fearful tale. The savages had not even spared their own kin; Gnadenhut, a settlement of Indians who had been civilized and Christianized by the Moravians, had been wiped out. The Moravians, themselves, though relieved from military service by special act of Parliament, were found by Franklin to be "in good posture for defense." The trouble subsided gradually during 1756; the voluntary organization of the Scotch-Irish frontiersmen into companies of rangers had a good effect; the destruction of Kittanning in January 1757, by the Pennsylvania levies compelled the hostile Indians to retire behind the guns of Fort Du Quesne. A treaty of amity was concluded later in the year with the Delawares and Iroquois at Easton, and the Ohio Indians were persuaded by Moravian missionaries to give up the war. The French dismantled and abandoned their stronghold; when rebuilt it became Fort Pitt. So far as Pennsylvania was concerned the conflict was ended. There was to be a tragic epilogue to the French wars, however. Peace had scarcely been concluded between France and Great Britain in 1762 when the American frontier was again ablaze and the scalping parties of Pontiac ravaged all Pennsylvania west of the Susquehanna. Eight fortified outposts fell in a single day, though Fort Pitt was saved by Colonel Bouquet, who proved a better soldier than Braddock. Maddened by fear and by their sufferings a body of Scotch-Irish rangers, the "Paxton Boys," so named for the principal settlement of their vicinity, fell upon the remnant of the Conestoga tribe—some 20 harmless people, who eked out a miserable existence by weaving baskets and binding brooms. Every man, woman and child of them was butchered. The expressions of horror in Philadelphia over the deed of blood evoked recriminations from the backwoods Presbyterians; treating with the heathen instead of exterminating them was pronounced ungodly, and the calamities which had come upon the province were declared to have been visitations in punishment of the sinful and irreligious policy. Here was a contrast, indeed, with the Quaker point

of view. When the Moravian Indians, for better security, had been removed to Philadelphia the "Paxton Boys," swollen by rumor to an army, swooped down on the city, vowing to annihilate the red-skinned Ishmaelites as well as anybody who dared defend them. In the excitement several hundred young Quakers joined the defenders, musket in hand. The affair fizzled out. It was Franklin again who relieved the situation. He interviewed the rioters, received their petition and induced them to disperse. But the backwoodsmen were able to point out the inconsistency of those who would fly to arms to protect Indian "heathen" and leave Christian white men exposed to the rapine of wolfish savages. With the return of peace the quarrel with the Proprietary once more came to the fore. It was discovered that the "donation" of £5,000 was to be paid in dribblets as money could be extracted from tenants whose quit rents were in arrear. The Proprietors at last shut off all remonstrances by announcing in advance that none would be received. This filled the measure. They had reserved the best land for speculative purposes, yet required property thus held for private gain to be relieved of all burdens, as though it were public domain. They would contribute nothing to the defense of the province, including their own possessions; yet they would not consent to a law to establish a militia unless they should have the appointing of the officers and thus control the force. They had constituted themselves as a non-resident and irresponsible cabal, whose secret instructions their deputy, the Governor, was under bonds to carry out, and now they denied the right of petition, one of the most valued privileges secured to free-born Englishmen by the Bill of Rights. The question submitted to the electors by the Assembly in 1764, whether the King should not be requested to take over the government of Pennsylvania as a crown colony, was answered affirmatively after the hottest political campaign the province had ever known. Franklin was defeated of re-election, but he was commissioned to present a petition of the Assembly to above effect to the King's Council in London. The petition was duly presented, but was not pressed, other and graver issues having meanwhile arisen; but the revolt against the Proprietary was a premonition of the coming revolution.

*Boundary Controversies.*—Colonel Markham, Penn's first deputy, had scarcely arrived at New Castle in 1681 when he became involved in a boundary dispute with Lord Baltimore. The 40th parallel, named in the royal charter as the southern boundary of Pennsylvania, was supposed to be the latitude of New Castle, but to the consternation of Markham and the gratification of Baltimore it was found that the 40th degree ran to the north of the site of Philadelphia. The Proprietor of Maryland also claimed title to all the western bank of the Delaware River up to his northern line. But a reservation in the Maryland charter, which excluded lands "previously settled," saved the three southern counties for Penn—the Swedes' colony being held to constitute a previous settlement within the meaning of the grant. On other points the position of Lord Baltimore was apparently impregnable. He sent an armed force into the peninsula and established a fort on the Susquehanna near Columbia. At this point his



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proceedings were stayed by the Privy Council, but not until 1763, when it had been located and surveyed by two English surveyors, Mason and Dixon, was the divisional line between Maryland and Pennsylvania definitely fixed. It follows lat.  $39^{\circ} 43' 26.3''$  N. The Virginia claim, founded in part on the vaguely worded charter of that colony, had a more substantial basis in the grant by George II. in 1749 to the Ohio Company of 500,000 acres on the "Forks of the Ohio" for the purpose of establishing a settlement as a barrier to the French. The Company and the Proprietors arranged a *modus vivendi*, however, and the action of Lord Dunmore, Governor of Virginia, who assumed control of nearly the whole of Westmoreland County, caused Fort Pitt to be rebuilt, and on 25 April 1774 issued a proclamation commanding the militia to "repel the insults of Pennsylvania" and the inhabitants to decline payment of quit rents for land "freely given" by Virginia, was evidently intended to provoke dissensions between the colonies then falling into line in united opposition to the British crown. In 1779 the differences between Pennsylvania and Virginia were amicably settled by a joint commission. David Rittenhouse, who was commissioned by Governor John Penn to locate the northern boundary line in 1775, fixed a mark on the Delaware River in lat.  $42^{\circ}$  N. for its starting point. The line was surveyed to Lake Erie in 1786 and 1787 pursuant to acts of the legislatures of both States and confirmed in 1789. The "Erie Triangle" formed part of the claims of both Massachusetts and New York in the Northwest Territory, which they ceded to the United States in 1781 and 1785, respectively. The triangle was thereupon purchased from Congress by Pennsylvania and the transaction was confirmed in a deed or warrant signed by President Washington in 1792. The Connecticut Claim had for its basis Yankee cheek and the Connecticut charter of 1662, which purported to grant to the Governor and Company the territory bounded on the east by Narragansett Bay, on the north by Massachusetts and "with this breadth stretching westward to the South Sea," that is, the Pacific Ocean. A settlement of boundaries had been arranged with the authorities of New York before 1683; but the intervention of a few thousand square miles of neutral territory was not enough, in the opinion of the calculating New Englanders, to prevent their territory from taking up its march across the continent on the further side of New York. Certain citizens of Windham County, Conn., in 1753 petitioned the General Court to organize them as the Susquehanna Company and give them a quit claim of 16 square miles of land on both sides of the Susquehanna River. The plan was approved and an inflow of settlers from Connecticut to the new country in the Wyoming Valley almost immediately began. The company was joined by the most prominent people in Connecticut; it bolstered up its title with purchases from the Indians, 10,000 square miles of which were laid out into shares, townships were surveyed and mills and cabins built. The war of Pontiac caused the suspension of operations for a time but in 1769 when "Forty Fort" was built, five townships created, each five miles square, and each offered to forty settlers who would defend the same, the Proprietors of Pennsylvania

took notice of the proceedings. They in turn leased lands to settlers who would agree to defend them and the manors of Stoke and Sunbury were established. Now began what is known as "the Pennamite and Yankee war." The Pennsylvania garrison at Wilkesbarre was besieged by the Yankees. "Forty Fort" was stormed by the Pennamites. Alternately the latter were imprisoned in the New England forts and the New Englanders, taken by sheriffs' posses, locked up in Philadelphia. The Pennsylvania Assembly refused to interfere because the disturbances did not affect the general government and the inhabitants of Wyoming continued to extend their settlement, passing laws, collecting taxes and even establishing a militia. The Connecticut legislature in 1773 resolved to support the colony. The Proprietary, so stingy when the protection of settlers from Indian war parties was required, readily enough found means to defend its land titles. But when Governor Penn, in December 1775, sent an armed force of 500 men to dispossess the trespassers, and the latter had repulsed the invaders at Nanticoke with loss of life on both sides, the Continental Congress was moved to interfere. The combatants were directed to desist from hostilities until a legal determination of the dispute could be had. On petition of the Supreme Executive Council of Pennsylvania, Congress, in 1782, nominated commissioners who decided that Connecticut had no claim to the territory. Connecticut acquiesced in 1800.

*The New Commonwealth.*—At the outbreak of the Revolution there was not anywhere in America a legislative body more democratic and more firmly opposed to the tyrannic exercise of royal prerogatives than was the Pennsylvania Assembly. It promptly elected delegates to the Continental Congress, and voted money to aid Massachusetts in the conflict with the royal army. It went as far in resistance as Quaker scruples against war and violence would permit and had, rather reluctantly, consented to the appointment of a Committee of Safety (of which Franklin became president), empowered to call the people to arms. Government by Quaker meeting, however, would no longer serve. When Congress early in 1776 passed a resolution advising the colonies not so provided to organize governments fitted to meet present exigencies the Committee of Safety prescribed qualifications for electors, whereby all "enemies of liberty" were disfranchised, and ordered a Constitutional Convention. The convention met on 15 July, declared the existing government unfit, adopted a Constitution, and submitted the same to the Assembly, which, uttering a feeble protest, adjourned on 16 September, never to meet again. The convention as a "Council of Safety" assumed the whole political power of the province. The Quakers as a body withdrew from public affairs. They were, rather unjustly, however, included with the Tories. They were certainly guilty of no disloyalty, they bore without complaint the heavy burdens imposed by the revolutionary Council of Safety on noncombatants and many of the younger men, undeterred by the fear of being "disowned" by the disciplinary meetings, joined the Revolutionary army. From 1776 to the end of the war Pennsylvania was Washington's base of operations; from hence he executed his raids into New Jersey and marched



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down to victory at Yorktown. Except during the occupation of the city by the British, under General Howe, from the fall of 1777 to the summer of 1778, the Continental Congress sat in Philadelphia. The Paoli massacre, the bivouac of the Continental army under Washington at Valley Forge and the reign of the mob following the withdrawal of General Howe, were the most stirring military and political events of the Revolution in Pennsylvania save one—the tragedy of Wyoming. The annihilation of the Connecticut settlement in 1778, while the able-bodied men were absent serving in the ranks of the Continental army, was the crowning infamy of British rule in America. The outrage was terribly avenged in 1779 when three thousand men under General Sullivan marched into the country of the Six Nations, who with some English soldiers had committed the atrocity, and broke their power for mischief for all time. The first Constitution of the Commonwealth adopted in 1776 created a legislature, the General Assembly, consisting of a single House like the provincial Assembly. The prejudices of the time against concentrated power were reflected in the institution of a plural executive, the Supreme Executive Council. A Council of Censors, to be elected once in seven years, and empowered to order impeachments, to rectify injustice in the levy of taxes and to direct the repeal of improper laws, was to act as a curb on possible legislative, executive and judicial tyranny. The General Assembly thus tied could accomplish little. It secured from the Proprietors in 1779, for a consideration of £130,000, a transfer of their property, exclusive of their manors and private estates, some of which belong to the Penn family to this day; in 1780 a law was passed giving freedom to all children born of slaves after that date; it procured, by rather questionable methods, to be sure, the ratification by Pennsylvania of the Federal Constitution on 12 Dec. 1787, within three months after its submission to the States, and by this prompt action probably saved it from defeat. The "Frame of Government," however, proved unworkable, and on 2 Sept. 1790 a new State Constitution, modeled on the recently adopted Constitution of the United States, was formally proclaimed. Thomas Mifflin, a "fighting Quaker" and a Democrat, became the first Governor of the State. He was twice re-elected, serving until December 1799. During his term occurred the "Whiskey Rebellion" (q.v.) and the "Hot Water War." The latter, a mere tumult in the German counties, was caused by a misunderstanding of the nature of the House tax ordered by Congress in 1798 and by the harangues of John Fries, an itinerant auctioneer with a stentorian voice and a gift of repartee, which nearly cost him his neck. The "traitor" was pardoned by Washington. The discovery of the utility of anthracite as fuel led to the canalization of the Lehigh River in 1818, and this and the improvement of the navigation of the Schuylkill in 1825, with a view to bringing the product of the lower coal fields to market, gave the impetus to the construction of State works on a scale which, for those times, was colossal. The ridge of the Alleghanies seemed to have been created for the purpose of thwarting the people, but they would not be balked. The rivers which could not be

made navigable were to be paralleled by canals and were to be connected one with the other so that continuous water communication should be established between Eastern Pennsylvania, Central New York and the Mississippi Valley. The main line to the West was to run by way of the Juniata, the Conemaugh and a portage railway, whereby boats were to be lifted over the intervening mountain. Before 1829 the State owned 450 miles of canals and had expended \$6,000,000 in construction. The works undoubtedly had a beneficent effect; they increased traffic and thus promoted the public welfare. But they exercised a corrupting influence in politics and nearly bankrupted the State. By 1840 the Commonwealth owned 726 miles of railways and canals, which had cost \$26,500,000, and 200 miles were under construction; the entire income from them was required or had been pledged to pay interest on the debt incurred, and State stocks had become "an unsalable drug in the market." The State had been made the victim of gross frauds by contractors; the principle of short tenures and rotation in office applied to surveyors, engineers, etc., was not conducive to efficient and economical management; the most profitable branch of the business, the carriage of passengers, was farmed out to private corporations, especially created for that purpose by pliant legislators. The total receipts from the public works from 1830 to 1859 amounted to \$32,270,712.55; the expenditures were \$30,400,433.07. The debt of the State, before rock bottom was reached, amounted to nearly \$41,000,000. The works were finally sold, the main line to the Pennsylvania Railroad in 1856, nearly all the rest in 1857—the State realizing about \$11,000,000 from the sale. The deliberate verdict of the people on State ownership was expressed in the Constitutional Amendment of 1857, forbidding partnerships between the Commonwealth and transportation, banking and other companies, and limiting the borrowing powers of the Legislature to \$750,000. Down to 1860 Pennsylvania was naturally a Democratic State, though by a small majority; and the Whigs occasionally controlled the Government—sometimes through coalitions, as with the Anti-Masons in 1835 and the "Know-Nothings" in 1854. "As goes Pennsylvania so goes the Union," had been a maxim in American politics for two generations, and when Andrew J. Curtin, the first Republican Governor, was elected in October 1860, by a majority of 30,000, the supporters of Lincoln were justified in their hope, to be realized a month later, that they would carry the country. Six days after the bombardment of Fort Sumter two regiments of Pennsylvania troops marched into Washington—the first to arrive in defense of the national capital. The first call for volunteers in the Civil War was responded to by nearly twice the 75,000 required, and Governor Curtin was enabled to organize a reserve of eleven regiments besides the fourteen which constituted the quota of the State. Altogether Pennsylvania contributed 362,284 men to the Union armies, exclusive of militia. The State was thrice invaded; the invasions of 1862 and 1864 were mere raids, but it was "the high tide of the Confederacy" which rolled into the Cumberland Valley in July 1863 and was forced back at Gettysburg. Among the Generals who commanded in that three days' battle Geary, Han-



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cock, Meade and Reynolds were natives of the State.

Since the Civil War the history of the Commonwealth has been mainly the history of its industries and commerce. A new Constitution was adopted in 1873, which effected many important changes, chiefly in the restriction of the powers of the Legislature and of common carriers. The abuses which had grown out of special legislation and the passage of "omnibus" bills were enjoined with searching minuteness; municipal and other corporations were thereafter to be organized only under general laws, and a whole article, containing 33 sections and many sub-sections, was devoted to an enumeration of the things which the General Assembly should not be permitted to do. Railroads and canal companies were forbidden to make any "undue or unreasonable" discrimination in rates or in the furnishing of cars or motive power; to own, lease or control competing and parallel lines or to engage in manufacturing, mining or other business except that of transportation—the convention anticipated the Inter-State Commerce law by more than ten years. The financial panic of 1873 and the succeeding years of industrial stagnation were attended, as are all crises in human history, by serious social disturbance. The story of the reign of terror instituted in the anthracite regions by the "Molly Maguires" (q.v.) in 1873 pertains to the history of crime rather than of industry, and the "Mol-lies" were a sprout from foreign soil. The Railway Riots of July 1877, which centred in Pittsburgh, cannot be dismissed, however, as having been manifestations of imported lawlessness. The local authorities displayed lamentable weakness in permitting the mob to grow to dangerous dimensions; they were guilty of something worse than negligence if the testimony that the militia were fired on from a police station be credible. In 1892 again forcible methods to prevent a reduction of wages plunged a part of the Commonwealth into a state bordering on civil war when the military and the striking steel workers confronted one another at Homestead. But contempt for the law may be shown in other manner than by the commission of crimes of violence. The secret traffic agreement, which was a most potent factor in the upbuilding of the oil monopoly, was in direct conflict with the Constitutional provision against unfair preferences by carriers; the combination of the anthracite mining and carrying companies circumvents, if it does not violate, the letter and spirit of the Constitution of 1873. The great strike of the anthracite miners in 1902 disclosed the progressive perfection attained in the organization of the labor unions; indeed, in the extreme hostility shown by the coal operators to the United Mine Workers one might perceive a recognition by the former of the strength of an alliance for mutual aid between their own employees and those of their rivals in the bituminous coal fields. The consent of the parties to arbitration, though reluctantly given, was an acknowledgment of the superior rights of the general community, which monopolistic combinations, whether of laborers or capitalists, must be made to respect. Since 1860 Pennsylvania has been overwhelmingly Republican. There is the highest official authority for the statement that the Commonwealth "has no ills worth mentioning." There were

political evils, plenty of them, in the good old times and such as exist are, perhaps, no greater and no more incurable than those which have been grappled with and remedied in other days. The long continuance in power of one party, whose managers feel secure against effective criticism through their command over majorities counted by the hundred thousand, is no doubt an evil in itself. Under such conditions a really healthy political life is impossible. Broadly speaking, the community has advanced steadily ethically as well as materially, but the course of human progress has eddies and cross currents here as elsewhere. Experience, as Franklin remarked, keeps a dear school, but the lessons of this hard task-mistress, once they have been thoroughly mastered, are as likely to be heeded in the future as they have been in the past.

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STEPHEN PFEIL,

*Editorial Staff, 'Philadelphia Record.'*

**Pennsylvania College**, located at Gettysburg, Pa. It was chartered in 1832 under the auspices of the Lutheran Synod of Pennsylvania. In 1850 the charter was modified to incorporate Franklin and Marshall College, and the Franklin professorship was endowed by the funds thus obtained. When in 1863 Pennsylvania was threatened with invasion a company formed mainly of students of the college was the first to respond to the call for volunteers and became Company A of the 26th Emergency Regiment. Though this took away the majority of the students the college remained in session until the day of the battle of Gettysburg. The college buildings were used for hospital purposes, and it is estimated that they sheltered at least 500 wounded Confederates.

The college offers two regular courses, classical and scientific, leading respectively to the degrees of A.B. and B.S.; a teacher's course is also given in the spring term; and provision is made for special work for those who are not candidates for a degree, and for graduate work leading to the degree of Ph.D. There is also a pre-



## PENNSYLVANIA COLLEGE, WOMEN—PENNSYLVANIA RAILROAD

paratory department. The work of the Junior and Senior years is partially elective. In 1888 all departments of the college were opened to women, the preparatory department being already open to them; there is no women's dormitory, however, and the number entering is small. The buildings include (1904) two dormitories, Recitation Hall (containing the library), the chapel, the chemical laboratory, the astronomical observatory and the gymnasium. The library contains over 26,000 volumes, including the regular college library and the libraries of the two literary societies. In 1904 the annual income was \$28,091; the students numbered 281, and the faculty 15.

**Pennsylvania College for Women**, located at Pittsburg, Pa. It was founded in 1869 under the auspices of the Presbyterian Church. The collegiate department offers a classical and a literary course and confers the degrees of A.B. and B.L. Instruction is given in music and art, and there is also a preparatory department. In 1903, the grounds and buildings were valued at over \$150,000; the annual income was \$40,000. The library contained 3,000 volumes; the students numbered 200, and the faculty 25.

**Pennsylvania Dutch.** See GERMANS IN THE UNITED STATES; GERMAN LANGUAGE.

**Pennsylvania-German Society**, an association organized 15 April 1891, at Lancaster, Pa., to collect, preserve and publish letters, papers and documents relating to the Pennsylvania-Germans in America. The members must be direct descendants of early German, Holland or Swiss emigrants to the colony of Pennsylvania. There are now 400 members. Meetings are held annually.

**Pennsylvania Germans.** See GERMANS IN THE UNITED STATES.

**Pennsylvania Historical Society.** See HISTORICAL SOCIETIES IN THE UNITED STATES.

**Pennsylvania Railroad Company, The**, the incorporate name of one of the great transportation systems of the United States. It controls and operates the network of railroads, east of Pittsburg and having its centre in the State of Pennsylvania. A second corporation organized in 1871, with a present capitalization of \$80,000,000, is called the Pennsylvania Company and controls and operates the railroads of the system west of Pittsburg. The railway, ferry, canal and other transportation lines, owned, operated, or controlled by, or affiliated in interest with, the Pennsylvania Railroad System have an aggregate mileage as follows: East of Pittsburg, 5,822 miles; west of Pittsburg, 4,739; making a total of 10,561 miles. The company owns and operates directly, east of Pittsburg, a total mileage of 3,729.30, in four divisions as follows:

The Pennsylvania Railroad Division.....	1,777.68
The United Railroads of New Jersey Division— Railroads and Ferries.....	475.61
Delaware and Raritan Canal.....	66.00
The Philadelphia and Erie Railroad Division...	599.30
The Buffalo and Allegheny Valley Division....	810.71
Total.....	3,729.30

The first named division is composed of the original parent lines of railroad, several of which had their beginning in the early half of

the 19th century. In 1826 the Pennsylvania legislature granted a charter to the Columbia, Lancaster & Philadelphia Railroad Company. In 1832, among other roads incorporated were the Harrisburg and Portsmouth, the Strasburg Railroad, and the Philadelphia and Trenton. In 1833 the Columbia Railroad was built.

*Early History.*—On 13 April 1846, an act to incorporate the Pennsylvania Railroad Company was passed by the State legislature. The capital of the company was fixed at \$7,500,000. The company was authorized to build a road to connect with the Harrisburg, Portsmouth, Mount Joy and Lancaster Railroad, and to construct a line to Pittsburg or any other place in the county of Allegheny, or to the town of Erie. On 25 Feb. 1847 Governor Shunk granted a charter of the company. The grading of the first 20 miles of road west of Harrisburg was under contract 16 July 1847 and 40 miles additional on 26 November. On 1 Sept. 1849 the first division, extending from Harrisburg to Lewistown, a distance of 61 miles, was opened to travel. On 15 Feb. 1854 cars were run through from Philadelphia to Pittsburg. In 1861 the Harrisburg and Lancaster Railroad was leased by the Pennsylvania Company for 999 years, which gave the corporation the ownership of the through line from Philadelphia to Pittsburg.

*Civil War Period.*—J. Edgar Thomson, the chief engineer of the company, under whose direction the road was built, was elected president of the company 2 Feb. 1852. In 1858 Col. Thos. A. Scott was appointed general superintendent of the road; he became vice president in March 1860. It was Col. Scott who, at the outbreak of the Civil War, was appointed to take charge of Government railroads and telegraphs. He was instructed by Simon Cameron, secretary of war, after the destruction of the Northern Central Railway, to open a line of communication from Washington to Philadelphia and the North and East. The Pennsylvania Railroad Company at once placed all its resources at the disposal of Col. Scott, and a route via Annapolis and Perryville was placed at the disposal of the Government in a few months.

In 1862 the Philadelphia and Erie Railroad passed to the control of the Pennsylvania Company under a lease for 999 years. Meanwhile the road had improved its main lines and branches, and in 1864 began the use of steel rails and the development of their manufacture.

*Western Lines.*—The next important undertaking was to aid the construction of lines west of Pittsburg. The Pittsburg, Fort Wayne & Chicago Railroad was the first of these to be built, extending 468 miles from Pittsburg to Chicago, and being the essential link in the chain which was to bind the Atlantic seaboard and the Mississippi Valley. On 7 June 1869 this road was leased by the Pennsylvania Railroad Company for 999 years; as was also Newcastle and Beaver Valley Railroad, the Massillon and Cleveland Railroad, the Akron Branch Railroad and the Lawrence Railroad, all in Ohio. On 6 Nov. 1867, the Pittsburg and Steubenville Railroad was sold at auction and was purchased by the Pennsylvania. In 1869, the leases were signed for the control of the Pittsburg, Cincinnati and St. Louis Railroad and its numerous branches. In 1869 the Cincinnati



## PENNSYLVANIA RAILROAD

and Muskingum Valley, and the St. Louis, Vandalia and Terre Haute, and the Terre Haute and Indianapolis roads were added, thus extending the line to the Mississippi River at St. Louis. In March 1870, the Erie and Pittsburg was leased and in October 1871, the Cleveland and Pittsburg was also leased for 999 years. In the same year the Pennsylvania purchased a controlling interest in the Jeffersonville, Madison & Indianapolis, extending from Indianapolis, Ind., to Louisville, Ky. Other roads, large and small, were added to the system from time to time, embracing important direct and connecting lines in Ohio, Indiana, Illinois, Michigan, Kentucky, West Virginia, Missouri and other States.

*Eastern Development.*—After the Civil War the Pennsylvania made rapid progress east of Pittsburg. Between 1868 and 1872 the company leased the Philadelphia and Trenton Railroad; Camden and Amboy Railroad; the Northern Central, extending from Canandaigua to Baltimore, Md., and in 1873 completed the Baltimore and Potomac Railroad, and built the Baltimore tunnel. Further acquisitions of connecting lines were made from time to time, including the Allegheny Valley Railroad, the Philadelphia, Wilmington and Baltimore Railroad, the West Jersey Railroad and the Camden and Atlantic Railroad. Numerous branch lines were built in the mining and lumber districts, the principal of which was the Schuylkill Valley Railroad, from Philadelphia to Pottsville, Pa., and Wilkesbarre, which brought the anthracite coal region in touch with the main line. The total mileage of the Pennsylvania Railroad System on 31 Dec. 1903 was, east of Pittsburg and Erie, 5,852.44 miles; west of Pittsburg and Erie, 5,061.45 miles; total, 10,913.89.

Upon the accession of Alexander J. Cassatt to the presidency in June 1900, the policy known as the "community of interest" was inaugurated, whereby large interests were acquired in connecting and competing lines. A controlling interest in the Norfolk and Western Railway, the Baltimore and Ohio Railroad and the Long Island Railway, and a joint interest in the Chesapeake and Ohio Railway and the Reading System was purchased, thereby securing to the Pennsylvania Railroad a share of the profits and the control of the policy of an additional 9,101.22 miles of railroad.

Through expenditures for improvements in the last five years the company has a four-tracked line from New York to Pittsburg, a double-tracked line from Pittsburg to Chicago by the Fort Wayne route and to Columbus by the Pan Handle route. The construction work on the tunnels under the Hudson and the East Rivers has begun, which when completed will move eastward the terminus of the line from Jersey City to Long Island City. The tunneling of the two rivers and Manhattan Island is the most notable piece of underground engineering ever undertaken.

The company has water lines on Chesapeake Bay, Long Island Sound and the Great Lakes, covering a distance of 3,000 miles of water transportation.

*Finances.*—The gross earnings of the Pennsylvania Railroad Company for 1902, from the lines east of Pittsburg, were \$112,663,330; operating expenses, \$75,051,071; net earnings from

operation, \$37,612,258. The income from investments, etc., for 1902 were \$9,039,876; and after all expenses were paid for operation, taxes, interest, etc., there remained a net income for 1902 of \$25,849,963. West of Pittsburg the gross earnings for 1902 were \$59,660,005; operating expenses, \$43,288,881; net income, \$8,805,968. A conception of the company's financial status can be formed from the report of the Interstate Commerce Commission, which shows as follows: The capitalization and funded debt of all railroads in the United States, \$11,688,147,091; tons carried, 1,089,226,449; passengers carried, 607,278,121; gross earnings, \$1,558,526,037. The proportion which represents the operations of the Pennsylvania Railroad Company's system of lines is: Capitalization and funded debt, 9 per cent; tons carried, 22.35 per cent; passengers carried, 17.20 per cent; gross earnings, 12.72 per cent.

*Traffic Statistics.*—The traffic statistics for all lines owned, operated or controlled by, or affiliated in interest with, the Pennsylvania Railroad system, both east and west of Pittsburg, for 1902, were as follows:

PASSENGER.		
	Number of Passengers	
	1902	Comparison with 1901
		Increase
Lines East of Pittsburg and Erie	90,439,163	7,200,644
Lines West of Pittsburg and Erie	25,409,678	3,220,876
Total .....	115,848,841	10,421,520

FREIGHT.		
	Number of Tons	
	1902	Comparison with 1901
		Increase
Lines East of Pittsburg and Erie	164,967,834	11,865,608
Lines West of Pittsburg and Erie	104,545,045	14,183,291
Total .....	269,512,879	26,048,899

The aggregate coal and coke shipments over the Pennsylvania Railroad Division during the year 1902 were 41,722,988 tons, as against 37,001,478 tons in 1901, an increase of 4,721,510 tons, or 12.76 per cent.

*Equipment.*—The following figures show the equipment of the Pennsylvania system east and west in 1903:

Locomotives of all kinds.....	5,163
Passenger, express and mail cars.....	5,093
Freight cars .....	215,864
Maintenance of way.....	8,713
Floating equipment, ferry boats, tugs, barges, etc.....	336
Total .....	235,169

The number of employees 31 Dec. 1902 in the service east of Pittsburg was nearly 108,000; west of Pittsburg about 43,000, making a total of 151,000. Applying the statistics of the last census that there is an average of five persons



## PENNSYLVANIA STATE COLLEGE—PENNSYLVANIA, UNIVERSITY OF

dependent upon the head of each family, it would seem that there are at least three quarters of a million of people who depend directly upon the operations of the road for their means of subsistence. In addition, there are the employees of many industries supplying rails, cars, locomotives, etc., besides merchants of all classes in the cities and towns located along the roadway, whose prosperity is largely dependent thereon. The company asks and insists upon faithful service from its employees. It administers a fund which takes care of them in cases of sickness or accident, and when their days of usefulness are over it provides them with a pension which cares for them in their declining years.

WILLIAM A. PATTON,  
*Secretary to the President.*

**Pennsylvania State College, The**, a State institution located at State College, Centre County, Pa. It was chartered in 1855 as the Farmers' High School, and in 1862 the name was changed to the Agricultural College of Pennsylvania. The legislature having appropriated the income from the national land grant of 1862, the scope of the college was broadened, and the name changed in 1874 to The Pennsylvania State College. In accordance with the provisions of the national grant, the main work of the college is in teaching "such branches of learning as are related to agriculture and the mechanic arts," with their applications; but general collegiate courses are also offered. The technical courses are agriculture, biology, chemistry, civil, electrical, mechanical and mining engineering, mathematics and physics; for the completion of these courses the degree of bachelor of science is conferred. The general course includes general scientific, classical, Latin-scientific, modern language and literature and philosophical; for the completion of the classical the degree of bachelor of arts is conferred; for the others, bachelor of science. There are also short winter courses in agriculture and creamery work, which were temporarily suspended in 1902-3, a two-year course in chemistry, mechanic arts, and mining, and an elementary course in mechanics; a summer school of two weeks follows the commencement; and correspondence courses in agriculture are provided; there are 25 such courses, giving instruction to over 1,800 students. Provision is made for graduate work, and the graduate degrees of master of arts, master of science, civil engineer, mechanical engineer, mining engineer, and electrical engineer. The agricultural experiment station is connected with the college, and receives a separate Federal appropriation of \$15,000 annually. Farmers' institutes are organized throughout the State; in 1904 185 such institutes were held, 35 of which members of the college faculty attended. The college is coeducational, but only very few women are enrolled; two were graduated in 1904. The farm and grounds contain 400 acres, of which 250 are under cultivation; the value of grounds and building in 1905 was about \$1,300,000. The college is excellently equipped with scientific laboratories and museums, and the library in 1905 contained 22,094 volumes. The income is derived mostly from the national land grant fund, from the annual Federal appropriation (\$25,000), and

from State appropriations. In 1903-4 the total income amounted to \$237,192.12. The students in 1904-5 numbered in all 749 and the faculty numbered 62.

JOHN H. LEETE,  
*Registrar.*

**Pennsylvania, University of**, located at Philadelphia. In 1749 Benjamin Franklin published a pamphlet entitled 'Proposals Relating to the Education of Youth in Pennsylvania,' and shortly afterward 24 citizens of Philadelphia associated themselves for the establishing of an "academy." They joined with the new institution a charitable school which had been in existence since 1741 and the building occupied by this school became the home of the two schools so combined. The academy classes were first opened in 1751 and the free charitable part of the institution was maintained until well into the 18th century, when the charitable feature was merged into free scholarships in the college. In 1753 the treasurer obtained a charter from the proprietors of the colony of Pennsylvania in which the institution was designated as a "college and academy." In 1761 the college was in need of funds, and Dr. Smith, the provost, was sent to England to raise money for an endowment. There he met the commissioner from King's College (now Columbia) who had come on a similar errand, and they agreed to aid each other; through the influence of the Archbishop of Canterbury, they obtained a circular letter from the king to all the churches, and succeeded in raising a considerable amount of money for each college. During the Revolution the college did not prosper; the attention of students was diverted by the stirring events of the time and the city was for a time occupied by British troops; hence the college was closed for over a year and a half and the buildings used for other purposes, being the meeting place of the Congress for several days in July 1778. In 1779 the legislature on a pretext that the original plan of the college was not being carried out, seized its rights and properties and transferred them to a new organization, called the "Trustees of the University of the State of Pennsylvania"; in 1789 the property was restored, and in 1791 the old college and the university united under the corporate name of the University of Pennsylvania. For several years (1802-29) the university occupied the house which was built for the residence of the President of the United States, when it was expected that Philadelphia would become the national capital; and later new buildings were erected on the same site. In 1872 the university was moved to its present site in West Philadelphia and the original group of four buildings erected. The most marked growth has taken place since that time; the work of the old departments extended and many new buildings added.

The first professional department established was that of medicine, founded in 1765, being the first medical school in the United States. Lectures in law were given in the university as early as 1790, but the law department did not receive its present organization till 1850. The university was among the earliest to undertake systematic instruction in science, technology and engineering. In 1852 it was resolved to estab-



## PENNSYLVANIA, WESTERN UNIVERSITY OF — PENNYPACKER

lish a department of mines, arts, and manufactures, and professorships in geology and mineralogy, civil engineering and mining; also two regular courses in science were offered. In 1874 John Henry Towne, a trustee, made the university the residuary legatee of his estate; whatever sum might accrue from this bequest to form a portion of the endowment fund of the university, and the income from it to be devoted exclusively to the payment of the salaries of professors and instructors in the department of science. In recognition of this gift the department was named the "Towne Scientific School of the University of Pennsylvania." The present organization of the university includes: (1) the college; (2) the Department of Philosophy or Graduate School; (3) the Department of Law; (4) the Department of Medicine; (5) the University Hospital; (6) the Wistar Institute of Anatomy and Biology; (7) the Laboratory of Hygiene; (8) the Department of Dentistry; (9) the Department of Veterinary Medicine; (10) the Veterinary Hospital; (11) the University Library; (12) the Department of Archæology; (13) the Flower Astronomical Observatory; (14) the Department of Physical Education. The college includes the School of Arts, which offers courses in arts and science, in biology, and in music; the Wharton School of Finance and Commerce, the Towne Scientific School, which offers courses in architecture, mechanical and electrical engineering, civil engineering, chemistry, and chemical engineering; the courses for teachers, and the summer school. In 1903 it was resolved to discontinue the former five-year course of the scientific school in science and technology. The School of Arts confers the degrees of A.B. and B.S. Electives were first introduced to a slight extent in 1867; and the number of elective studies for the junior and senior years were increased in 1887. In 1893 the group system was established, by which privilege of election in certain subjects was carried into the first two years.

The Wharton School of Finance and Commerce is intended to give special training to students who expect to enter banking, insurance, railway service, manufacturing, law and public service, social work or accounting. The work of the first two years is largely prescribed; and that of the junior and senior years is elective. Graduate courses are also offered to advanced students in the same general fields. The object of the Wistar Institute of Anatomy and Biology is to afford facilities to post-graduates and advanced students; it is a distinctive corporation with separate funds, but organically united with the university so as to constitute one of its departments. The library is one of the original departments of the university, and contains many interesting historical documents; it includes several special libraries, and contained (1905) 234,527 volumes. The Museum of Archæology (organized 1889) was made a department of the university in 1891; in 1897 Mrs. Lucy Wharton Drexel gave to this department a fund for a gold medal to be awarded annually to an English-speaking scholar whose archæological excavation or publication based on such excavation, should be deemed worthy of honor;

in 1902 E. W. and C. H. Clark founded, in this department, the Clark Research Chair of Assyriology, endowed with \$100,000. Women are admitted to the courses in biology and the course in music in the college; and there is a graduate school for women in the Department of Philosophy. The present site of the university is on rising ground, half a mile west of the Schuylkill River; the buildings (in 1905) number 33; among them are Houston hall, the centre of the student social life; College hall, the library, the Archæological Museum and the gymnasium. The value of grounds and buildings in 1904 was about \$5,700,000. Among the notable new buildings are the laboratories for engineering, and medicine, which together have cost \$1,500,000. Much attention is paid to systematic physical culture, and to general athletics. There are two athletic fields, the largest and newest being Franklin field, which is equipped with a gymnasium, and a stadium which accommodates nearly 25,000 persons. The final control of athletic sports is vested in the University Committee on Athletics, which consists of members of the faculty, and two representatives each from the trustees, the Athletic Association, and the students.

The students have a number of large debating societies, dramatic societies and musical clubs. The Greek letter fraternities are well established, 43 having chapters, many of which have attractive fraternity houses.

The total assets of the university, as reported by the treasurer 31 Aug. 1904, were \$11,647,085. The property of the university used for educational purposes, which includes the buildings, grounds, etc., is valued at \$5,239,473. The income from investments for the year ending 31 Aug. 1904 was \$207,244 and the income from tuition fees and all other sources for that year was \$480,199, making a total income of \$687,443. The students in all departments number 2,692 and the faculty 316.

EDWARD W. MUMFORD,  
*Bursar.*

**Pennsylvania, Western University of.** See WESTERN UNIVERSITY OF PENNSYLVANIA.

**Penny**, a British coin and money of account, the 12th part of a shilling. It was at first a silver coin weighing about  $22\frac{1}{2}$  grains troy, or the 240th part of a Saxon pound. Till the time of Edward I. the penny was so deeply indented by a cross mark that it could be broken into halves (thence called halfpennies) or quarters (four-things or farthings). Edward I. reduced the weight of the penny to a standard, ordering that it should weigh the 20th part of an ounce. It afterward steadily decreased in weight; it was 18 grains under Edward III., 8 grains under Edward VI., and at last, in the reign of Elizabeth, it was fixed at  $7\frac{2}{3}$  grains, or the 62d part of an ounce of silver. This proportion was observed up till the introduction of the bronze coinage in 1860. The intrinsic value of the bronze penny is about half of that of the old copper coin. Copper pennies were coined by the American colonies prior to 1780. See NUMISMATICS.

**Pennypacker, Samuel Whitaker**, American jurist: b. Phoenixville, Pa., 9 April 1843. He



## PENOBSCOT — PENOLOGY

was educated at the West Philadelphia Institute, and on graduating entered the Federal army. As a member of the 26th Pennsylvania "Emergency" regiment, he was present at the battle of Gettysburg. After the war he studied law at the University of Pennsylvania, and was admitted to the bar. In 1868 he was elected president of the Law Academy of Philadelphia, and while holding this position compiled four volumes of Pennsylvania Supreme Court reports. In 1889 he was appointed judge of the court of common pleas to fill a vacancy, and the next year was elected to that court without an opposing candidate; his term of service was 10 years, and for a part of the time he was president of the court. In 1902 he was Republican candidate for governor and was elected; as governor he approved a law intended to suppress political cartooning and to restrain the press from extreme criticism of public officials, which aroused considerable opposition both within and without the State. He has been particularly interested in the study of local history and biography, and has a valuable collection of early Pennsylvania reprints. He has written 'Annals of Phoenixville and Vicinity'; 'Historical and Biographical Sketches'; 'The Settlement of Germantown'; 'Congress Hall'; 'Capture of Stony Point'; and other historical books and papers.

**Penobscot**, pē-nōb'skōt, a bay on the southern coast of Maine. It is about 28 miles long and nearly 28 miles wide at its mouth. It is really a fiord, the river current being submerged. The tide waters extend beyond the head of the bay, up the river. There are a number of small inlets along the shores, and it contains a number of islands.

**Penobscot**, a river in Maine, its headwaters are on the northwest boundary of the State, in Somerset County. It flows east and passes through Lake Chesuncook, then southeast through Pamedumcook and other lakes, then east to the southwest corner of Aroostook County, where it turns and flows south by west to Penobscot Bay. It is about 310 miles long, the largest river in Maine, and navigable for 56 miles from its mouth. The river is a swift-flowing stream along its upper and middle course, and furnishes water-power for many mills. The headwaters are in the pine forests, and the rough timber is brought down to the mills by floating or rafting. The output of the winter's work in the lumber camps is thus brought to the lumber mills in the spring when the waters, ice-locked for several months, become free. It drains an area of 8,500 square miles. Bangor is the most important city on its banks. Other towns are Castine, Orrington, Bucksport, Belfast, Frankfort, and Prospect.

**Penobscot Expedition**, in American colonial history; in 1779, a force of 900 Americans were sent out from Boston against a British post on the Penobscot. A combined land and naval attack was planned. The land force debarked and gallantly assaulted the fort. Owing to disagreement between the commanders, the marines did not support them, and a British fleet appearing on the scene forced all assailants to retire. It was an unfortunate affair. The commander, Saltonstall, and the generals, Lowell and Wadsworth, were publicly censured.

**Penobscot Indians**, an American tribe of the Algonquin family, formerly residing along the Penobscot River, in Maine. On the site of the present city of Bangor a chief village was established where the French founded a mission in 1688. The Penobscots took an active part with the French in all the American colonial wars until 1749 when they made a peace treaty with the English. About 400 of these Indians remain, residing at Oldtown, a few miles above Bangor.

**Penology** is an acknowledged science which has grown so rapidly that it has not had time to create and arrange a universal terminology, and its works, a large proportion of which have been produced within the last quarter of a century, still lack a systematic nomenclature that can be understood by its students in all lands. Thus a "convict" means one of a very different class in Great Britain than it does in France; and in the common speech of the people of the United States a convict of any kind means a criminal; one who follows any kind of a criminal life, from the misdemeanant in the county penitentiary to the worst felon in the State prison: inasmuch as he has once been sentenced he is everywhere and always a convict; whereas he is simply a criminal who has been convicted of a certain kind of offense and committed to a certain kind of prison.

Yet from the point in human history where there has been a sufficient social organization to create an acknowledged authority, there has been crime and punishment; there has been law and possible disobedience to it. The earliest punishments were of the simplest nature, such as could be administered by the infliction of death or pain. As soon as property of any kind could be held, its deprivation could be made a means of punishment. As soon as structures of any kind could be built to hold human beings securely, they were locked up according to law or the will of the rulers—either isolated or in groups—and the rude dungeon of mediæval times was our foundation in all the prison systems of the world.

Through its development it has demanded the best thought of our greatest sociologists, and it hardly takes an expert to judge of a nation's welfare by the methods and motives shown in the care of its prisoners.

History owes much to penology as a conservator in architecture and archæology. The earliest prisons built were round, and of such construction as they who seek in sandy places to treasure up water or make cellars—build up "jug cisterns" or "jug cellars"—being exactly like the inside of a jug, with an opening where the cork hole would be, having neither door nor window. Such a prison is to be found in the old Borough Hall in Warwick, England, not shown as a rule, and not generally known even by the inhabitants to exist. The same construction exists in many a cistern for the conservation of water in parts of New England.

Penology in its early years groped its way along through one precedent after another handed down from one old warder to another, and no two systems were quite alike in their principles or in the application of them. There were no handbooks. There was nothing to help those into whose hands the newcomers in



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the prison might fall, and new circumstances might put new men in the old prisons to be their governors.

It is a singular fact that almost our whole body of knowledge touching penology and criminology has been gathered along the line of its faults and abuses of the old systems. We have come to the knowledge of all conditions by studying bad conditions. We know what we do know by studying the things, and taking note of the things that ought not to have been, oftentimes a legacy of shame and injustice, yet pointing the way to better methods.

The first great book on penology was a very positive book, and has been the foundation of more than one system—one might say of all existing systems—Beccaria's 'Crimes et Delits,' brought out in 1764.

A little later than Beccaria's book appeared John Howard's 'State of the Prisons in England,' which at once came to the notice of Parliament. Such an investigation of the British penal system was then made as had never been made before; perhaps has never been so studied since. Nothing in the way of social reform ever moved England as did this book, and yet the reform in the prisons was very slow. It was not until the matter got into a reforming family, and Frederic Hill, the brother of the man who gave us the postage stamp, became inspector of prisons in Scotland, that there was the full statement of the fact, with unanswerable argument, that there would be no permanent reduction of the criminal class except by taking the young criminal, as he fell into the hands of the government, and treating him wholly with a determination to create in him both the ability and inclination to lead an upright life, and earn an honest living.

In 1877, when, through the efforts of the Prison Association of New York, the reformatory at Elmira was created, it became at once an object lesson to the world. Long before this institution was founded, the prisons of America had introduced several innovations, which were studied with great interest by foreign penologists; as early as 1886 it was not a strange thing to hear in an International Penitentiary Congress, at Rome, the prevailing systems of the world given American names; in all the discussions the Elmira system, the Pennsylvania (solitary) and the Auburn system (congregate), not one of the delegates was at a loss to know what was meant by either allusion.

The penal system in Great Britain has been through many changes, and each change has been made with a thoroughness and good faith that characterizes all administration in the British Government, when a scheme is once determined upon. The ticket-of-leave system was tried fully, and under most humane conditions, but lacking other necessary concomitant features, was a failure; afterward it became a successful part of the Elmira system into which it was fitted and became like one of the wards of a lock. Every form of transportation was tried, but the British government had not in its control a territory isolated enough and so fully devoid of shame as to wish itself stigmatized as a convict settlement.

While transportation was still much in vogue the British Government was studying other plans, and made a trial of a graded system, dur-

ing which the great prisons of Millbank, Clerkenwell, Dartmoor, Portsmouth, and others, were built or rebuilt.

In the meanwhile, or since 1836, a series of penological experiments were going on in the United States with much greater success, though similar in outward appearance to those going forward in England. Quoting from Arthur Griffiths, one of the closest of British students in criminology, we find:

"The chief experiments in this direction (that is, the reformation of the criminal) had been made in the United States, where two remarkable systems of penal discipline had for some time been in operation. Each had its warm supporters and friends; one had been originated with the Quakers of Pennsylvania, who as far back as 1786 had abolished capital punishment and all other purely personal penalties, and had subjected offenders instead to solitary confinement, without occupation for mind or body. This as developed in the years following, became the purely solitary system, and was the first of the two methods mentioned above. The method was not altogether absolutely new, having been tried in the United Kingdom, both in Glasgow, Bridewell, and in the Gloucester penitentiary, and was hailed with enthusiasm as a solution of all the difficulty of prison treatment. . . ."

Many other States of the Union followed the lead of Pennsylvania. New York in 1816 built a great prison at Auburn and introduced at first a purely solitary system, but this was so unnatural that insanity was rapidly developed, until the prison became a culture cabinet for madness. The system was speedily modified in such a way that while the prisoners were alone in their cells and between work hours, they were together in the workshops and theoretically were not to speak to each other, and were to march in silence to and from their cells to their work. This silent congregate system was never, in practice, fully carried out; nor was the Pennsylvania system, in which men were never out of their cells, but worked and lived alone in them, rigidly observed.

About the middle of the 19th century a group of penologists in the United States, through the assistance of the Prison Association of New York, began to feel that a penological advance should include all the good points in various systems, already in vogue, or any that had been found unquestionably valuable through experiments in progress. Facts and figures were gathered from all quarters, and no feature was considered worthy of adoption that had not been tested beyond the experimental stage.

At the same period there was incorporated the National Prison Association of the United States, made up of publicists, of criminologists, of anthropologists and of prison officials of the highest order. A little later still there was inaugurated a series of international congresses in the interest of prison reform. The culmination of work of what is called the New Penology was the creation of the Elmira Reformatory, under the patronage of the Prison Association of New York, the president of which society, Prof. Theodore W. Dwight, wrote the charter of the new reformatory prison. It was based on the following principles and plan of organization:



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1. The indeterminate sentence, dependent in length on the conduct and character of the prisoner, and his ability and inclination to earn an honest living and to forsake all criminal associations. The sentence though called indeterminate cannot extend beyond the maximum term of the statute. The release is determined by the board of management and the superintendent. As imitated elsewhere in the country the conditions of release vary somewhat in the different States, but the principles are the same everywhere.

2. The conditional release now following—since it is not a discharge, but is simply freedom conditioned upon industry and good conduct, so that the prisoner is a ward of the State and subject to surveillance during the months of his freedom, until by good conduct he is found fitted to receive his full discharge and return to society. The average term in New York State is 22 months, while under the old system the average, by the last obtainable statistics, was 4 years and 2 months. The average length of term is varied in different States and different under age conditions—so that without long and close tables of statistics, the Elmira results named might be considered closely typical, but cannot yet be determined with absolute correctness.

Although the United States has absolutely led in the upbuilding of its prison system, it has also in some of the phases of its lower administration stood still, so that to-day in county jails in some of the most advanced States we are under a ban of shame for conditions tallying in the revolting neglect and corruption, with the worst things that made England shudder in Howard's early books.

Of the European countries France has easily led in the care of juvenile criminals. One of its institutions, at Mettray, has had a wide celebrity, has trained thousands of youth from 12 to 16 years of age, and has exercised paternal supervision over them, sending them largely into the army and navy and fitting them for agricultural pursuits. I have named Mettray because its success is beyond praise and because it is a distinct and valuable adjunct to the penal institutions for adult offenders. France has more than any other country dealt successfully with the subject of penal deportation, sending its convicts in grades according to intellectual and trades value to the nation, and removing them frequently into communities where the circumstances of their career may not be known, or be a hindrance through ill assorted fellowship or unfortunate association.

In Austria, Bavaria, and to a large extent in Germany, the old methods—partly solitary, and with congregate labor features—prevail. The prisons are admirably administered, as in most other parts of Europe, by retired army and navy officers. In Prussia one is struck with the great number of prisons, their consequent smallness, and the great number of people required to make the official and disciplinary staff. There is the greatest variety in trades taught, and every long-sentenced convict is expected to acquire a trade.

Italy has long been interested in prison reform, and some of the earliest efforts of penologists have been in this country. They have lacked unity because of the want of unity in the country itself, and it is only since Garibaldi

carried the "good news" to Rome, that a most scientific scheme of penal reform has been devised and developed there. It is made to harmonize with the new penal code, and was wrought under the guidance of Signor Beltrani Scalia, who will ever be remembered as one of the most eminent penologists of his own or any other country. In Italy a composite system prevails, but recently measures have been taken to inaugurate a more complete scheme. The Elmira methods are to be arranged with a background of the parole for both boys and adults, and also for a further extension of domiciliary imprisonment, which in its application has proved a success in Italy—both Beltrani Scalia and Zenardelli being impressed with its usefulness.

In the Netherlands the prison system, with the exception of the great prison colony for vagrants, is much like the prisons of the German confederation—eclectic in character, and most firmly administered. The great colony for vagrants already mentioned is at Veenhuizen, and its population varies from 2,500 to 3,000. Here, with the minimum of restraint, an indeterminate sentence is given of not less than one year, and on its severe side to the maximum of the statute, as in case of slowness in learning a trade, or efforts to escape, or the commission of misdemeanors within the prison. There may be, and often is, a transfer to the regular penal establishments, or to the drunkards' prison at Hoorn. The reformatory for boys at Alkmaar is an exceedingly useful institution, with much to remind one of Mettray plus the kindness and helpfulness that have always been the typical features of the Rauhes Haus, which has never varied in its success since its foundation by Dr. Wichern.

Among the American prisons other than those of the United States, the system of Canada is, in method, as would naturally be supposed, a combination of the prisons of the various United States and of Great Britain. Canada unites with the National Prison Association of the United States, sending delegates to its congresses and receiving its reports. The other American prisons, those of Central America and Mexico, are in the main far behind the European provinces of the most insignificant description. Mexico is beginning anew with some attempt at improvement, but the others are plague spots in the administration of successive governments, finding their population largely dependent on the success with which the last revolution has come to an end, and the number of leaders that have thereby become conspirators.

Norway, Sweden, and Denmark have no special features other than such as are required by conditions of climate and varying length of days. The prisons contiguous to Russia are quite like those of the overshadowing nation, though the severities of which we have read as existing in Siberia are not to be found there. Indeed the late book of the learned and competent observer, Dr. Benjamin Howard, who has died so recently, protests that the Siberian cruelties are not so great as have been represented in the descriptions written by George Kennan. Nor is Tolstoy credited with an unprejudiced description of present conditions. The frightful knout, still in use in Siberia as a



## PEÑÓN DE CORÓN — PENSACOLA

punishment, is savage beyond all description, but is used much less than sensational writers have led sentimental readers to suppose. Dr. Howard considers it, as usually administered, more dangerous and painful than floggings in the navy, and in some prisons.

As to the labor of prisoners, there is no question that they should be required to work and taught to work, if they do not know how already. Under an indeterminate sentence they are not released until they have a knowledge of some occupation by which they can earn a simple living. Even this moderate and reasonable requirement has been bitterly fought by some of the trades societies on a ground that it was an unjust interference in competition with outside honest labor. The prison competition, even in New York, where it is claimed to be greatest, was not in any case more than a fraction of 1 per cent of the number engaged in the same industry outside the prison shops.

W. M. F. ROUND,

*Late Director National Prison Association.*

**Peñón de Corón**, pā-nōn' dā kō-rōn', or **Crown Peak**, an island of the Calamaines group, Philippines, lying south of Busuanga Island and northeast of Palawan, area 42 square miles. It is rocky, and the southern end terminates in a sharp, steep point called Calis. The soil is sterile and unfitted for agriculture, and the chief employment of the inhabitants is the gathering of edible birds' nests. The birds' nests of Peñón de Corón are of the finest quality and are unrivaled in the market, the Chinese paying very high prices for them.

**Penrose**, pēn'rōz, **Boies**, American lawyer and politician: b. Philadelphia, Pa., 1 Nov. 1860. He was graduated from Harvard in 1881, studied law, was admitted to the bar in 1883, and established a law practice in Philadelphia. In 1884 he was elected to the lower house of the Pennsylvania legislature, and while there was active in securing a reformed charter for the city of Philadelphia; in 1886 he was elected to the State Senate and several times re-elected, serving till 1895, for two terms (1889-93) he was president *pro tem* of the Senate. In 1897 he became United States Senator, and in 1903 was re-elected for the full six years' term, being the unanimous choice of the party. During his last term he was chairman of the committee on post-offices and post roads, and a member of the committees on commerce, finance, and on immigration. He wrote with E. P. Allinson 'History of the City Government of Philadelphia' (1887).

**Pensacola**, pēn-sa-kō'la, Fla., city, port of entry, and county-seat of Escambia County, on Pensacola Bay; 6 miles north of the Gulf of Mexico; 48 miles east of Mobile and 204 miles west of Tallahassee. It is on the line of the Louisville & N. and the Pensacola, A. & T. R.R.'s. The city has an excellent land-locked harbor with from 31 to 33 feet of water on the bar. The climate here is mild and very healthful, the sanitary and quarantine regulations precluding any danger from yellow-fever. The city has gas, electric light, water and street railway plants.

**Public Buildings.**—There is a United States navy yard here and three forts, Pickens, Bar-

rancas, and McRee. The remains still exist of the old Spanish forts of San Bernardo and San Miguel. There is a State armory, Federal government building, opera house, court-house, and 11 public school buildings.

**Commerce and Industries.**—Pensacola is a considerable commercial centre, having a large domestic trade in lumber, fish, naval stores, cotton, phosphate, and coal. It has three national and several private banks. The commerce of the port for 1903 included imports to the value of \$247,000, with exports to the value of \$15,850,000. In 1903 the city had an assessed valuation of \$6,950,920 and a net debt of \$270,000.

**History.**—The city was first permanently settled in 1696, by a colony of Spaniards from Vera Cruz, Mexico. In 1719 it was captured by the French, but was restored to Spain in 1723. The British secured possession of the town in 1763, but in 1781 it was again captured by the Spanish. In the War of 1812 (q.v.) it was taken by Gen. Jackson. The United States took permanent possession of the city in 1821, in accordance with the treaty of 1819. A navy yard was soon afterward established. There was a destructive fire here in 1864.

**Population.**—Pensacola had a population in 1890 of 11,750 and in 1900 of 17,750. The population in 1904 is conservatively estimated at 22,000.

THOMAS C. WATSON,

*Sec. Chamber of Commerce, Pensacola.*

**Pensacola Bay**, an inlet of the Gulf of Mexico in the western part of Florida, extending 25 miles inland. It is only one mile wide at the entrance between Santa Rosa Island on the east and the mainland on the west; the bar has over 20 feet of water. The bay itself is from 4 to 10 miles wide; it is land-locked and affords an excellent harbor. About 15 miles from the entrance it divides into two branches, Escambia Bay on the west, and Santa Maria de Galvez or East Bay on the east. On the western shore near the entrance is the city of Pensacola, also a United States navy yard, and naval hospital. The entrance is defended by Fort Pickens on Santa Rosa Island and Fort McRee on the mainland.

**Pensacola in the Civil War.** After the secession ordinance of 10 Jan. 1861, the State authorities seized Fort McRee, Fort Barrancas, north of it, and the navy yard, and demanded the surrender of Fort Pickens, but it was resolutely held by Lieut. A. J. Slemmer and a small body of United States regulars, shortly aided by Wilson's Zouaves of New York and a small blockading squadron. The garrison and marines made night raids on the navy yard, on 2 September burning the dry dock, on the 13th burning a vessel fitting out as a privateer. The Confederates in turn attempted to surprise and capture Wilson's troops. For this purpose an expedition of 1,000 men under Gen. R. H. Anderson crossed over to Santa Rosa Island and landed several miles beyond Fort Pickens. It was the early morning of 9 October. Anderson divided his force into three battalions, one 260 strong under Col. John K. Jackson, the rest about evenly divided under Cols. James Chalmers and J. Patton Anderson respectively.

After a march of three or four miles, the shooting of a sentinel by some one of Chalmers'



## PENSIONS

command gave the alarm to the Federal camp. Jackson's battalion of Georgians then pushed through thickets to the middle of the island, driving the Federal outposts before them and, charging bayonets, entered the camp, which they found deserted. Here they burned the storehouses and sheds. As daylight came before arrangements could be made for further concerted action, Gen. Anderson ordered all back to the boats. During the withdrawal a sharp skirmish occurred with two companies of Federals that attempted to intercept the retreat. While the troops were embarking, an unavoidable delay enabled the Federals to come up and open fire, by which several Confederates were killed or wounded.

The total Confederate loss in this affair was officially stated as 18 killed, 39 wounded, and 30 captured. The total Union loss reported was 64.

JOSEPH T. DERRY,  
*Author of 'History of Georgia.'*

**Pensions.** A pension is a gratuity. The Supreme Court of the United States has decided that "no pensioner has a vested legal right to his pension. Pensions are the bounties of the Government, which Congress has the right to give, distribute, or recall at its discretion."

An act of Congress, approved 21 Dec. 1893, provides, however, that a pension shall be deemed and held by all officers of the United States to be a vested right in the grantee to that extent that payment thereof shall not be withheld or suspended until after due notice to the grantee of not less than 30 days, the Commissioner of Pensions shall decide to annul, vacate, modify, and set aside the decision upon which such pension was granted.

Laws have been enacted from time to time for the purpose of protecting pensioners from any diversion of their pensions either by their own acts or by the acts of others. Any pledge, mortgage, sale, assignment or transfer of any right, claim or interest in any pension shall be void and of no effect. The holding of a pension certificate as collateral security for any debt or promise, or the retention of a certificate and refusal to surrender it upon proper demand are misdemeanors, and punishable by heavy fine, upon conviction thereof.

Pension legislation in this country was first enacted by the different States, for the relief of those who were wounded or disabled in service during the War of the Revolution, but in 1789 by an act of Congress the general government assumed the payment of such pensions as had been granted by the States, and this provision was continued by subsequent legislation. Later on, pensions were granted to the widows of Revolutionary soldiers, and in 1861 the pension rolls contained the names of 63 survivors of that war and 2,728 widows of Revolutionary soldiers. The last survivor was Daniel F. Bakeman, of Freedom, Cattaraugus County, New York, who died 5 April 1869, aged 109 years 6 months and 8 days. On 30 June 1906 the rolls still contained the names of one widow and three daughters of Revolutionary soldiers, the daughters having been pensioned by special acts of Congress. The amount disbursed to Revolutionary pensioners up to 30 June 1905 was \$70,000,000.

*War of 1812.*—On 14 Feb. 1871 an act was passed by Congress granting a pension of eight

dollars per month to the survivors of the War of 1812 who rendered a service of 60 days, and to their widows provided they were married to such soldiers or sailors prior to the treaty of peace 17 Feb. 1815. The act of 9 March 1878 reduced the period of service to 14 days, and made no limitation as to date of marriage in case of widows. By subsequent legislation the pension to widows was increased to \$12 per month. On 30 June 1906 the pensioners of the War of 1812 were 660 widows. The amount disbursed under said acts up to 30 June 1906 was \$45,542,069.24.

*Indian Wars.*—On 27 July 1892 Congress enacted a law granting pensions to those who served 30 days in the Black Hawk, Creek, Cherokee, and Florida War with Seminole Indians from 1832 to 1842 and to their widows. On 27 June 1902 the benefits of said act were extended to the survivors of the Florida and Georgia Seminole Indian War of 1817-18; the Fevre River Indian War of Illinois of 1827; the Sac and Fox Indian War of 1831; the Sabine Indian disturbances of 1836 and 1837; the Cayuse Indian War of 1847-8 on the Pacific Coast; the Florida wars with the Seminole Indians from 1842 to 1858; the Texas and New Mexico Indian War of 1849-56; the California Indian disturbances of 1851-2; the Utah Indian disturbances of 1850-3, and the Oregon and Washington Territory Indian wars from 1851 to 1856, and to their surviving widows. The pension is fixed at \$8 per month. The number of pensioners on the rolls under said acts on 30 June 1906 was 5,540, consisting of 2,173 survivors and 3,367 widows; the amount disbursed thereunder up to said date was \$8,260,143.38.

*Mexican War.*—By act of 29 Jan. 1887 Congress granted a pension of \$8 per month to the surviving soldiers and sailors of the war with Mexico, provided that they actually served 60 days with the army or navy of the United States in Mexico, or on the coasts or frontier thereof, or en route thereto, in the war with that nation, or were actually engaged in a battle in said war, and were honorably discharged; and to such officers and soldiers and sailors as may have been personally named in any resolution of Congress for any specific service in said war; and to the surviving widow of such officers and enlisted men. The conditions under which title is granted under said act are that the soldier or sailor must be 62 years of age, or if under said age he must be disabled from causes not incurred while in any manner voluntarily engaged in or aiding or abetting the late rebellion against the authority of the United States. The provisions of said act were subsequently extended to Powell's Battalion of Missouri Mounted Volunteers and to Gray's Battalion of Arkansas Volunteers, and by the act of 3 March 1903 the pension to survivors was fixed at \$12 per month. Widows of officers and enlisted men who served as above stated are entitled to pension on the same conditions as to age, disability, or dependence, as apply to such officer or soldier, but their pension is not subject to increase, nor are the descendants of survivors entitled to pension under said acts. The number of Mexican War pensioners on 30 June 1906 was 11,472, consisting of 3,984 survivors and 7,488 widows, and the total payments to them on that date had amounted to \$38,059,245.23.



## PENTACLE — PENTATEUCH

*Civil War.*—There are two distinct systems of pensioning on account of service in the Civil War. Under the acts of 14 July 1862, and 3 March 1873 any officer, soldier, sailor, or marine, disabled by reason of wound or injury received or disease contracted in the service of the United States, and in the line of duty, may be pensioned for such disability during its continuance. In case of his death from causes originating as above set forth, his widow or his child or children under 16 years of age become entitled to pension. If he left no widow, or child under 16, his dependent mother, father, or orphan sisters and brothers are entitled in the order named.

Under the acts of 27 June 1890 and 9 May 1900 any officer, soldier, sailor or marine who served 90 days or more in the military or naval service of the United States during the late war of the Rebellion, who has been honorably discharged therefrom, and who is suffering from disability of a permanent character, not the result of his own vicious habits, which incapacitates him from the performance of manual labor in such a degree as to render him unable to earn a support, is entitled to pension under said acts of not less than \$6 per month nor more than \$12 per month.

In case of the death of any person named above, his widow becomes entitled to pension, provided she married him prior to 27 June 1890, and that she is without other means of support than her daily labor. If she remarries or dies, the child or children of such soldier or sailor under the age of 16 years become entitled. The act of 9 May 1900, which is an amendment of the act of 27 June 1890, provides that in determining inability to earn a support each and every infirmity shall be duly considered, and the aggregate of the disabilities shown be rated. It is also provided that a widow may have title to pension if she is left without means of support other than her daily labor and an actual net income not exceeding \$250 per year. On 30 June 1906 there were 666,453 invalid pensioners of the Civil War and 264,450 widows, minor children, and dependent relatives. The amount of money paid to pensioners of the Civil War up to 30 June 1906 was \$3,259,195,306.60. The rates of pensions to invalids under the general law range from \$6 per month to \$100 per month, there being various intermediate rates for different degrees of disability. The rates of pensions to widows and dependents range from \$8 per month to \$30 per month and are governed by the rank held by the husband on the date his fatal disease was incurred in the service.

*War with Spain and Insurrection in the Philippine Islands.*—The provisions of the acts of 14 July 1862 and 3 March 1873 apply to those who served in the war with Spain and the insurrection in the Philippine Islands, and up to 30 June 1906 17,646 invalids and 4,975 widows and dependents had been pensioned on account of such service. The amount disbursed to them was \$15,438,355.16.

*Regular Establishment.*—The acts of 14 July 1862 and 3 March 1873 also apply to those who have served in the army and navy in time of peace since 4 March 1861, and to those who are now in the military or naval service. The number of pensioners of this class is 10,648 invalids and 3,544 widows and dependents.

*Army Nurses.*—Under the act of 5 Aug. 1892 all women employed by the surgeon-general of the army as nurses, under contract or otherwise, during the late War of the Rebellion for a period of six months or more, and who were honorably relieved from such service, are granted a pension of \$12 per month, provided they are unable to earn a support. On 30 June 1906 the pension rolls bore the names of 579 pensioners under this act.

*Total Disbursements for Pensions.*—From 1 July 1790 to 30 June 1865, a period of 75 years, the disbursement for pensions amounted to \$96,445,444.23. From 1 July 1865 to 30 June 1906 the disbursements for the payment of pensions were \$3,363,414,867, making the actual total disbursements in pensions since the beginning of the government \$3,459,860,311.23. Adding to this amount the cost of maintenance, namely, \$106,546,165.51, it will be seen that the pension system since the foundation of the Government has cost \$3,596,406,476.74, which sum is exclusive of the establishment of soldiers' homes.

*Number of Soldiers and Sailors of the Various Wars.*—Revolutionary War, 184,038; War of 1812, 286,730; Mexican War, 78,718; Indian wars, 83,993; Civil War, 2,213,363; Spanish War, 312,000; Philippines and China, 146,151; total, 3,304,993. The average pension paid to each enlistment has been \$919.

*Pension Agencies.*—Pensions are paid quarterly through the 18 pension agencies located in different parts of the country. The President is authorized by law to establish agencies for the payment of pensions, wherever, in his judgment, the public interests and the convenience of the pensioners require. Pension agents are appointed by the President by and with the advice and consent of the Senate, and they are required to give bond, with good and sufficient sureties, for such amount and in such form as the Secretary of the Interior may approve.

E. F. WARE,

*Formerly Commissioner of Pensions.*

**Pen'tacle.** See PENTAGERON.

**Pentac'rinus.** See CRINOID.

**Pentateuch.** The term Pentateuch is in common use as the designation of the first five books of the Old Testament, Genesis, Exodus, Leviticus, Numbers, and Deuteronomy. It is the English form of the Greek name which is probably as old as the Septuagint, and means "five books." The common Jewish term for this division is *Torah*, meaning "law." The period of time covered by the Pentateuch extends from the creation of the world to the beginning of the conquest of Palestine. In place of this ancient division of the Old Testament books, many at the present time prefer the term Hexateuch, including the Pentateuch and Joshua. This is partly because the same documents are thought to be used in all six books, but chiefly because Joshua is considered to show greater similarity in subject matter with the Pentateuch than with the following books. Either division may be employed without inappropriateness, for Joshua is closely connected both with that which precedes and with that which follows. In the present treatment of the Pentateuch, the question of critical analysis and date will be considered, which is often discussed in connection with the Hexateuch.



## PENTATEUCH

*Authorship.*—The first general question must be concerning the authorship and the time and manner of composition of the Pentateuch, or Hexateuch. The older view was that Moses was the author of the whole, or practically the whole, of the Pentateuch. This view is still maintained by many, including some scholars of ability. But most careful students of the subject believe that the Pentateuch is the result of the combination of separate documents, having different authors and dates, with the addition of some supplementary matter. The problem involves two principal questions, however, which need separate consideration, and are very often confused with each other. The first question is a literary one: Is the Pentateuch, or Hexateuch, a unit, in which case the author of the Pentateuch is Moses, or is it composed of separate works with more than one author? The evidence is largely internal. In support of the Mosaic authorship of the whole, or practically the whole, of the Pentateuch, it is said that this is claimed in several passages in these books themselves, is assumed in other parts of the Old Testament, is the general Jewish tradition, and is asserted in the New Testament. But the Pentateuch itself only makes this claim for certain, comparatively small, portions. The other parts of the Old Testament and the New Testament only show that the name of Moses was associated with parts, or with the whole, of the Pentateuch, but without any claim of authorship of the whole. The Jewish tradition is not uniform, and is of a date sufficiently late to give it no independent value. It is further urged, and with much force, that some regulations are more appropriate to the Mosaic age than to any other. All that these arguments really indicate, then, is a strong presumption that there are Mosaic elements in the Pentateuch of sufficient extent and importance to justify the association of his name with it.

The chief reasons given for the composite character of the Pentateuch are as follows. The existence of many repetitions strongly suggests this. While some of these repetitions might merely be peculiarities of style, there are many cases where the two, or more, accounts are sufficiently distinct to present every appearance of parallel narratives. A familiar example is the story of the creation, where one account is given in Gen. i.-ii. 4a, and another in Gen. ii. 4b-25. A lack of order is a natural accompaniment of repetition. It is a feature which occurs so frequently as to suggest compilation, even where repetition is not conspicuous. There are also variations in two or more accounts of the same event. These variations ordinarily affect only the details of the narrative, and are such as would be natural in accounts by different authors, but would not be expected if there were unity of authorship. Further, differences of style and language as well as conception are found in the different parts. Historically this reason has great interest and importance. In the early stages of discussion concerning Pentateuchal analysis, after Astruc's division of Genesis in 1753, the varying use of the divine names was the chief reason for the belief in the existence of documents. It is not now, however, given an importance so exclusive as that. It is based upon the other reasons: where a division has been suggested by them, the thought

and phraseology are found to be confirmatory of the result. Yet it has an independent value. When the characteristics of the different documents have been determined, these serve as a basis for the division in many passages where the other reasons would be inconclusive.

Much can be said in specific passages in answer to these reasons, and it can not be denied that their conclusiveness has often been overstated. But it must be recognized that they are arguments of much force, and give good reason for thinking that the Pentateuch is not a unit. Most scholars of the present day are in general agreement concerning the literary division of the Pentateuch, or Hexateuch. They recognize four main documents, for convenience ordinarily designated by the letters J, E, D, and P. J is the Jehovistic or Yahwistic code, so called because of its preference for the divine name Yahweh. E is a code similar in many respects, but distinguished by its preference for the divine name Elohim, and so called the Elohist code. D is the Deuteronomic code, and P the Priests' code. J, E, and D are prophetic, P is priestly. J is usually supposed to have been composed in Judah, and E in Ephraim. D comprises nearly the whole of Deuteronomy. P includes Ex. xxv.-xl., Leviticus entire, and Num. i.-x., xxvi.-xxxi., and xxxiii.-xxxvi. Of the remainder of the Pentateuch, P furnishes the general framework, while the most is provided by J and E. The last two often occur side by side, but E is not found before Gen. xv. Some verses from J, E, and P are found in Deuteronomy. In Joshua the analysis is less definitely agreed upon than in the Pentateuch. J and E can not be separated with any certainty. In i.-xii., J E is the predominant source, and in xiii.-xxiv., P. Small portions are also similar to D. Of smaller codes, special mention should be made of the Book of the Covenant, Ex. xx. 23-xxiii. 33, which is a part of J, but is generally acknowledged to be older, and the Law of Holiness, Lev. xvii.-xxvi., which is a part of P, but is also recognized as being older than the remainder of P. It may be noted, among the chief characteristics of the style and contents of these documents, that both J and E are largely narrative, and are full of life and vigor. J is the more anthropomorphic of the two. The style of D is graceful; in substance the document is hortatory and spiritual. P emphasizes the ceremonial law, embodies many statistical details, and is stiff and formal in style.

While there is general agreement in what has been stated thus far, there are many further details upon which there is much divergence of opinion. The precise limits of the different documents are open to doubt, in particular the division between J and E is often very difficult to trace. How many smaller works, in addition to those already mentioned, are included in each document, either earlier or later than the main portion, is a question upon which there is no general agreement. How great was the activity of the redactor, or redactors, is also uncertain. In fact, many who agree with the general division think that it is easily possible to go to unwarranted lengths in such details.

*Dates.*—The second question is historical as well as literary, and is quite distinct from the first, although often they are confounded. This



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question is, What are the dates of the different documents? The question has a general and a more specific form. The general question is in what relative chronological order these documents stand to each other. To this the answer given by a great majority of students at the present day is that the chronological order is J, E, D, P. A few, of whom Dillmann was the most prominent, reverse the order of the last two. Dillmann and others also reverse the order of J and E, which is, however, a question of much less importance. For the general order the great argument is the development of thought, although the relation to the history is also important. Concerning D and P the question is, Which presupposes the other and marks a development of thought in comparison with it?

The specific form of the question is this, What are the dates to be assigned to the different documents? Those commonly given are: for J, about 850 B.C.; for E, about 750; for D, somewhat before 621; and for P, about 444. Dillmann gave 900-850 for E, 800 for P, 750 for J, and the same date as above for D. It is generally held that J and E were first united, and D was joined to them some time after 621 B.C. There is difference of opinion on the question when P was joined with the others. The chief reason given for the specific dating is the relation to the history. Thus D is claimed, and is generally believed, to be the book found in the reign of Josiah in 621 and made the basis of his reformation. It is said that centralization of worship is the great teaching of D, and the great thought of Josiah's reformation. It is stated, further, that there are no traces of D in the history and prophecy before this time. It is also argued that there is no trace of the ritual system of P until the reading of the book of the law in the time of Ezra and Nehemiah. For the dating of J and E the chief dependence is upon their style as compared with that of the early prophets. Phrases in all which seem plainly to imply a date later than the time of Moses also constitute a general argument.

As a matter of fact, there is much difference of opinion in details concerning the matter of dating, by those who agree in the general analysis. The arguments for the dates usually assigned are largely from silence, and, as such, doubtful. The relation to the history is by no means as close as it is often claimed. Style and language favor an earlier date for P than the usual one. The possibility must also be kept in mind that a large part of a document may have been written a considerable period of time before it was given its final form. There is also much difference of opinion on the question how far a document represents earlier thought and usage. Many hold that this is the case only to a very slight extent, that in general the documents are the real composition of the time when they were written. On the other hand, many think that the substance is very much older than the form. The latter view appears necessary to reconcile data which seem almost inconsistent. All the documents bear not only marks of lateness, but of earliness as well, some passages point to an early date as clearly as others to a late one. This seems to indicate that much of the substance, in oral if

not in written form, is in each case older than the final composition of the document.

*Extent of Mosaic Authorship.*—The question how much of the Pentateuch is Mosaic is also one on which there is much difference of opinion. This matter is of course closely connected with those which have preceded, so that varying views on this point are the necessary result of diverse decisions hitherto. Here it must be noted that a distinction between what Moses actually wrote, and what he uttered that was preserved orally, or in writing, by others is not only possible but probable. Many maintain that Moses wrote nothing, and that very little, if anything, is preserved that he uttered. Many others hold, however, that an appreciable quantity was written by Moses, and that much was uttered by him, if not written. The latter view seems necessary to account for the facts. For it must be remembered that the testimony of the whole Old Testament is that Moses was prominently connected with the law. It is difficult to account for the origin of this representation unless it was the fact. Then, too, at whatever periods in the history the different documents were presented to the public, there was evidently no hesitation in accepting them. It would be difficult to account for this unless they were in each case in substantial accord with the previously known Mosaic teaching. It is generally agreed that the decalogue, Ex. xx. 1-19, and the Book of the Covenant, Ex. xx. 23-xxiii. 33, are among the oldest parts of the Pentateuch, being older than J or E. The primitive character of the regulations of the Book of the Covenant testify to their antiquity. It seems probable that at any rate the most of these portions were written by Moses. There is also a strong presumption that other regulations either spoken or written by him form the kernel of all the other documents.

*Historicity.*—The historicity of the Pentateuch should be touched upon. Those who hold that both form and substance of each document were late usually think that the most of the Pentateuch is unhistorical. But those who consider much of the substance to be old do not share this view. They generally believe that the historical character of the Pentateuch is not materially affected by their conclusions. Of course, even on this view, the record is often much later than the event, so that the presence of some unhistorical details may be regarded as not only possible, but probable. The documents need to be carefully studied with this possibility in mind. But it would be only the details that are affected, not the substance of the different accounts. From the standpoint of the conception of historical writing prevalent in their own times, the historians were accurate and reliable. In many cases, indeed, the historicity would be enhanced by the recognition of documents. For some variations are such as to involve contradiction if proceeding from the same pen, which can yet be easily understood without that necessity if they come from different authors. It should be added, however, that not all which is ordinarily regarded as history in the Old Testament is justly entitled to that term. Especially in the early part of Genesis it is probable that some legendary and mythical material is employed. This is used for its value in re-



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religious teaching, not as history. But that is a matter which is largely independent of the date of the documents.

*Book of Genesis.*—It should be recognized, however, that the Pentateuch consists not simply of documents but of books, that the books of the Pentateuch as we now have them possess a real history and character of their own. It will be desirable, therefore, to make a brief statement of the contents of each book. Genesis treats of the early history of men. Chapters i.-xi. deal with the earliest history, which is often called primeval, xii.-l. with patriarchal history. It is a book of beginnings. Here are the beginnings of the world, of man, of many different nations, and in particular of the Hebrew nation. The earliest accounts were handed down by tradition, and it is not probable that they are, or were intended to be, entirely historical. The closest parallel to any of these accounts in the literature of other nations is in the story of the deluge among the Babylonians. Here many of the principal incidents are the same, while some of the details are different. The comparison confirms what seems probable on other grounds, that the Genesis account is historical, at least in its principal features. The Babylonian account of the creation, several different versions of which are known, resembles the Hebrew story much less closely than in the case of the deluge. Here, as well as in the story of the deluge, the contrast between the ethical monotheism of the Hebrew accounts and the anthropomorphic polytheism of the Babylonian furnishes one of the most notable differences. It is doubtful whether any other early tradition in Genesis has a Babylonian parallel. While the connection between the Hebrew and Babylonian traditions is evident, the differences by the side of the resemblances do not favor much if any direct borrowing, but rather indicate a common possession by both nations from early times.

*Exodus.*—The book of Exodus treats of the exodus of the Hebrews from Egypt and the events which followed that movement. It includes a full account of the exodus itself. It also comprises the march to Sinai, the adoption of the covenant there, the detailed directions for the building of the tabernacle, and its construction and erection. The covenant adopted at Sinai is given in the book of the covenant, previously mentioned. The book is thus chiefly historical.

*Leviticus.*—The book of Leviticus consists largely of ceremonial and ritual legislation, except in the law of holiness, xvii.-xxvi. The chief subjects treated are the following: sacrifices, i.-vii.; consecration of the priests, viii.-x.; clean and unclean animals, xi.; purification, xii.-xv.; the day of atonement, xvi.; the law of holiness, xvii.-xxvi.; and vows and tithes, xxvii. The fundamental thought of the law of holiness, xvii.-xxvi., is the holiness of God and the resulting necessity for holiness on the part of his people, with all that it involves. While much of the legislation of these chapters is ceremonial, yet the larger part is of a different character, dealing with the religious and moral behavior of the people in their ordinary social life.

*Numbers.*—The book of Numbers is very largely historical. It contains the history of the

Hebrews from the second to the fortieth year after the exodus. The early part of the book gives the occurrences in the camp at Sinai. This is followed by a condensed and elliptical account of the wanderings. Then come the events on the plains of Moab, narrated at considerable length. The small amount of legislation in the book is mingled with the history.

*Deuteronomy.*—The most of the book of Deuteronomy, namely, v.-xxvi., consists of legislation. The remainder is largely separate discourses by Moses, with some narrative portions; v.-xi. are really introductory to xii.-xxvi., giving a general account of the principles governing the relation between God and his people. The legislation is of a popular character, dealing very largely with the ordinary life and duties of the people. The contrast with the legislation of the most of Leviticus is marked. In a general way it may be said that religious matters are treated in xii.-xvi., while xvii.-xx. contain civil regulations, and xxi.-xxvi. regulations for social and domestic life.

*Relation of Pentateuchal Legislation to Code of Hammurabi.*—Of special importance in relation to the legislation of the Pentateuch is the code of Hammurabi, discovered at Susa early in 1902 by French excavators under the direction of J. de Morgan. (See CUNEIFORM WRITING.) This is a code of laws drawn up by authority of Hammurabi, king of Babylon, who reigned about 2250 B.C. It is probable that portions of this code were older than the time of Hammurabi. The code seems to have continued in use without material change until the latest periods of the history of Babylonia and Assyria. A comparison of this code with the Pentateuchal regulations shows very many resemblances, and also a large number of differences. The code of Hammurabi is exclusively civil, while the Pentateuchal legislation is religious as well. Many detailed resemblances are very close, extending even to the phraseology. In most cases of resemblance, the substance of the two laws is similar, but the details differ, the Pentateuch being especially distinguished by a greater mildness of penalty. Sometimes the Pentateuchal regulations give a teaching directly opposite to that of Hammurabi, apparently with the latter in mind. It is important to note that a large majority of the resemblances are with the book of the covenant in Exodus, which is generally regarded as being, with the ten commandments, the oldest legislation in the Pentateuch. A few laws resemble D, and a few also P, both in Leviticus and Numbers. The facts show plainly that there is a connection between the Pentateuchal legislation and the code of Hammurabi. They also show with equal plainness that this relation is not that of direct borrowing by the Old Testament from Babylonia. They rather suggest that there was acquaintance at any rate with certain parts of this code as early as the beginnings of Pentateuchal legislation. This knowledge, however, became a part of the life of the Hebrew people, so that when the legislators used any of the material from the code it was with many changes, and much different teaching. Excellent as the code of Hammurabi is in many respects, the Pentateuchal legislation is distinctly superior in its whole tone.

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**Pentecost**, pěn'te-köst, **George Frederick**, American Presbyterian clergyman: b. Albion, Ill., 23 Sept. 1842. He was private secretary to the governor of Kansas Territory in 1857 and later entered Georgetown University which he left to join the Union army, where he was chaplain of the 8th Kentucky cavalry volunteers in 1862-4. After the war he held several Baptist pastorates, was pastor of a Congregational church in Brooklyn 1880-7; engaged in evangelical work in Scotland in 1887-8; and in 1889-91 was employed in a mission to the English-speaking Brahmans in India. He was pastor of a church in Marylebone, London, 1891-7, and of the 1st Presbyterian Church, Yonkers, N. Y., 1897-1902; since when he has been engaged in evangelical work in China, Japan, and the Philippines. He has written: 'The Angel in the Marble' (1876); 'Bible Studies' (10 vols. 1880-9); 'Precious Truths' (1898); etc.

**Pentecost** (from the Greek *pentekoste*, the fiftieth), a Jewish festival, held on the fiftieth day after Passover, in celebration of the ingathering and in thanksgiving for the harvest. It was also called the Feast of Weeks, because it occurred at the end of a week of weeks, or seven weeks; the Feast of the Harvest; the Day of First-Fruits, etc. It is also a festival of the Christian Church, occurring 50 days after Easter, and is celebrated in commemoration of the descent of the Holy Ghost. It is called Pentecost in the Roman Catholic Church; but Whitsunday by Anglicans.

**Pentland Firth**, pěnt'land fěrth, a channel separating the mainland of Scotland from the Orkney Islands. It is about 17 miles long, east to west, six to eight miles broad, and is regularly traversed by a steam-ferry. A current, setting from east to west, flows through it with a velocity of three to nine miles, causing many eddies and whirlpools, and rendering its navigation dangerous for sailing vessels. At its eastern extremity are the Pentland Skerries, the scene of numerous shipwrecks. On the Muckle Skerry, about four and a half miles north by east of Duncansbay Head, are two lighthouses, with two fixed lights—the one 170 feet and the other 140 feet high.

**Pentland Hills**, a range of Scotland, in the counties of Edinburgh, Peebles, and Lanark, commencing four and a half miles south by west of Edinburgh, and extending southwest for

about 16 miles. The highest summit, Scald Law, rises to the height of 1,898 feet above sea-level.

**Pen'tonville**, London, England, a populous district in the parish of Saint James, Clerkenwell, first settled in 1773. It gives its name to the Pentonville Model Prison, built in 1840-2 in Caledonian Road, in the adjacent parish of Islington. The prison is constructed on the radiating principle, so as to admit of thorough inspection, and contains accommodation for 520 prisoners. The treatment is to "enforce strict separation, with industrial employment and moral training."

**Penuchle**, pē'nūk-l, or **Pinocle**, a game of cards very popular among German-Americans. The object of the game, which may be joined in by either two, three, or four persons, is to secure 1,000 points. The game is played with two full packs of cards, mixed, from which the twos, threes, fours, fives, sixes, sevens, and eights have been taken. This is the schedule of "points":

Eight aces count.....	1,000
Eight kings count.....	800
Eight queens count.....	600
Eight jacks count.....	400
Two queens of spades and two jacks of diamonds (double penuchle) count.....	300
Ace, ten, king, queen, and jack of trumps count..	150
Four aces of different suits count.....	100
Four kings of different suits count.....	80
Four queens of different suits count.....	60
Four jacks of different suits count.....	40
Queen of spades and jack of diamonds (penuchle) count .....	40
King and queen of trumps (royal marriage) count	40
King and queen of a suit not trumps (marriage) count .....	20
Nine-spot of trumps counts.....	10

The relative value of the cards is: Ace counts for 11 points, 10-spot counts for 10 points, king for four, queen for three, jack for two, and the nine counts nothing. The last trick counts 10 points for the player who takes it. The total points, therefore, of the cards and last trick combined amount to 250. Four-handed penuchle is usually played two against two as partners, sitting opposite one another. The cards are all dealt out, four at a time, each player receiving 12, and the last card is turned up for trump. If a nine is turned up the dealer is credited at once with 10 points; if any other card is turned up either of the other players who holds a nine of trumps may exchange it for the trump card and claim 10 points, the player sitting on the left-hand side of the dealer having the preference. Each player then melds whatever he has in his hand and the partners score together. The eldest hand then leads a card for the first trick. In every trick each player must follow suit; if he cannot he must trump; if neither is possible, he may play any card he pleases; he must take the trick if he can; the player who takes the trick leads for the next. When either side reaches 1,000 points the scorer calls "game," and the balance of the hands are void.

**Penum'bra**. See ECLIPSE.

**Penza**, pěn'zä, Russia, (1) the capital of a government of the same name, beautifully situated on an eminence at the junction of the Penza and Soua, 440 miles by rail southeast of Moscow. It was founded in 1666, as a defense against Tartar incursions, and consists of an old town with wooden houses, and a new town with many fine mansions and houses, and handsome churches standing in the centre of



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large open squares. In the town are several beautiful gardens, a large park, and numerous good educational institutions, including a horticultural school. It possesses cloth-factories, iron-works, tanneries, soap-boiling and candle-making establishments, etc. Pop. (1897) 61,851. (2) The government, bounded north by Nijni-Novgorod, west by Tambov, south by Saratov, and east by Simbirsk, has an area of 14,997 square miles. Its surface is undulating, and intersected by low hills separating the basins of the Don and Volga, the latter of which receives the far larger share of the drainage indirectly. The climate is rather severe; the soil is a fertile black loam. The forests are extensive, especially in the north. Mill-stones are quarried. The chief exports are corn, flour, spirits, leather, soap, wax, honey, potash, wool, and timber. Manufactures are steadily progressing in the government. Pop. (1897) 1,491,215.

**Penzance**, pěn-zăns', England, a seaport town of Cornwall, picturesquely situated on the northwest of Mount's Bay, on a finely curved shore, bordered by rocky heights, 26 miles southwest of Truro. Besides three fine parish churches, it has various Dissenting chapels, a handsome town-hall, market-house, and custom-house; a grammar-school, and science and art schools; a geological society with a valuable collection, a public library, and other scientific or literary institutions. The harbor is formed by two piers, with a lighthouse at the extremity of the southern one. There is a large export of tin and copper, china-clay, and pilchards. The town was burned by a band of Spanish marauders in 1595, and was sacked by Fairfax in 1646. Pop. (1901) 13,123.

**Pe'ons and Peonage.** Peon is a Spanish word signifying a day laborer, and in South America is applied especially to Indians. By the civil law under the Spanish colonial system, and by special statute in some countries, as for instance by the law regulating contracts between masters and servants in Mexico, peons are compelled to work for their employers, provided they are in debt to the latter, until the debt is paid. They receive wages, amounting in Mexico to \$5 a month. It is alleged that many proprietors, by enticing the peons in their employment into needless expenditures, and by selling them goods and advancing them money, contrive to keep them hopelessly in debt and in a consequent state of bondage. The creditor, however, has no power over the wife and children of the peon, nor can the latter be sold like a slave. Peonage was abolished in the Argentine Republic in 1886.

In the United States peonage has always existed to a greater or lesser extent, especially in the Southern States. When Arizona and New Mexico came under the jurisdiction of Congress it was found that the local laws and customs recognized the peonage system, and it continued until 1867, when Congress abolished peonage in the United States and the Territories thereof. This condition of qualified servitude is still more or less secretly prevalent in the South, and in some places the horrible atrocities perpetrated have led to the indictment and prosecution of a few offenders for violations of these statutes. Since 1890, the prosperity of the Southern States has rivaled that of the North, and the demand for labor has been phenomenal, and employers,

especially in the naval stores industry and on the plantations, have had great difficulty in securing workmen. As a result of these conditions there has been a great demand for convict labor (q.v.). In many instances persons, white as well as black, apparently without money or friends, have been arrested by the local constable and arraigned before the police or justice of the peace court. At this point it has been customary for an employer or agent of a large employer of labor to appear on the scene and induce the prisoner to plead guilty to a trivial offense, with the understanding that the employer (who is quite often in conspiracy with the court officials) would pay the fine and prevent an imprisonment. A written acknowledgment of debt is generally secured from the victim, in which he agrees to work for the person paying the fine, either on his plantation or in his labor camp. The victim is then taken to the place of labor, and finds that he is guarded there like a convict. If he turns to and works diligently so as to pay off the debt due his employer, he is charged with all kinds of goods at high prices, and the debt is held over him for an indefinite period. If, on the other hand, he revolts and escapes, he is run down, arrested without process, returned to the private prison, and probably beaten brutally, because many of the contracts provide for all of this.

Another way of securing victims is for the employer or his agent to proceed to some town or city and to hire a lot of laborers, agreeing to pay them certain wages and their railroad fare to the place of labor, and to advance them provisions from the company store, or, as it is commonly called, the commissary. The laborers arrive, and at the outset are indebted to the employer, who sees that they trade out their wages at the commissary, and in many instances, by a system of deductions and false entries, manages to keep the laborer perpetually in debt. If the laborer has a family, so much the better for the employer; they must live out of the commissary, and if the laborer runs away his family is detained at the camp. The writer has known of an employer withholding young children from both father and mother for the purpose of forcing the payment of a debt. If the laborer escapes, the machinery of the local criminal law is put in motion to arrest and return him under the charge of false pretenses, cheating and swindling; or, in the State of Florida, under the law relating to false promises. If the runaway is arrested he is seldom tried before the courts. The arresting officer, often in the pay of the employer, induces the victim to return to work rather than go to jail, and so he returns to bondage with a heavier load of debt to carry, for the cost of pursuit and arrest is charged to him. Often no process is issued for arrest, but the employer arrests without process, returns the prisoner to his labor camp, and inflicts severe chastisement. Many of the labor contracts contain provisions to the effect that the laborer consents to allow himself to be locked in a stockade at night and at any other time when the employer sees fit to do this. As recently as 23 June 1903, in the United States court at Macon, Ga., Judge Emery Speer imposed a fine of \$1,000 each on three young men for holding a negro in involuntary servitude. He suspended the fine under conditions.



## PEONY — PEOPLE'S PARTY

In New York and San Francisco thousands of Chinese coolies, mostly employed in laundries, exist under a system of peonage not unlike that in vogue in the South; while the Italian padrone system, which has always held sway in the Italian quarter of New York city, has held hundreds of immigrants in slavery. These two evils of metropolitan life have received scant if any attention from the Federal, State, or municipal authorities.

**Pe'ony**, a genus (*Pæonia*) of the order *Ranunculaceæ*. With one exception (*P. brownii*) the species are natives of Europe and Asia. They are practically all in cultivation in gardens, being valued for their hardiness, easy cultivation, and large, attractive flowers. They are mostly herbaceous perennials with tuberous rootstocks, large pinnate leaves, and flowers ranging through all shades of red to white and yellow. Many garden varieties and hybrids have been produced, including numerous double forms. The plants will grow in almost any soil, but thrive best in rich, rather moist deep loam. The crowns should be buried two inches below the surface and the ground, especially close to the plant, kept free from weeds. When once established annual dressings of stable manure should be given and the plants left undisturbed. Properly treated peonies will often prove satisfactory for 25 years without removal or renewal. The most popular species is *P. officinalis*, a native of southern Europe, which produces large flowers abundantly during late spring. The next most popular is probably *P. albiflora*, a native of Siberia, blossoming about a month later than the preceding species and having fragrant flowers. A large number of the cultivated forms are derived from these two species. The roots of the latter are used by the Tartars for food. Several species are known as Chinese peonies but this term is more widely applied to hybrids and varieties of a more extended list than the native Chinese kinds. They are often fragrant and double-flowered. The tree-peony (*P. moutan*) often grows five feet tall, is much branched, and prolific of bloom. It is somewhat less hardy than the common peony and in the North is often grown as a greenhouse plant. It is a native of China, where it has long been cultivated and where there are hundreds of varieties. In America it is less known than the first two species. When grown out of doors the tree-peonies should be mulched with litter or leaves if in exposed places, especially north of Philadelphia.

**People's Palace**, a building in the East End of London, situated in Mile-end Road, opened by the Queen, May 1887. It provides for the population of the East End a hall for concerts and other entertainments, a library and reading-rooms, gymnasia, swimming-baths, social-meeting rooms, rooms for games, refreshment-rooms, a winter-garden, technical schools, etc. The nucleus of the palace was the Beaumont Philosophical Institute, founded by J. T. B. Beaumont (died 1840), who left \$60,000 to establish an institution for the moral and intellectual improvement of the working-classes in the East End of London. A movement set on foot by a novel by Sir Walter Besant — 'All Sorts and Conditions of Men' — resulted in raising the fund to \$375,000, and with this largely increased fund the People's Palace was

constructed. There is a similar institution in Brussels called the Maison du Peuple. In Jersey City, N. J., there is a People's Palace, in connection with the People's Tabernacle, which has a day nursery, baths, gymnasium, industrial training school, etc. The social settlement plan adopted in New York and Chicago is a development of the People's Palace movement. Consult: Besant, 'All Sorts and Conditions of Men' (1882).

**People's Party, The, or Populist Party**, an American political party with National and State organizations, originally formed at a national convention held at Cincinnati, Ohio, in May 1891. The People's Party was the outgrowth of various smaller organizations like the Greenback Party, the National Farmers' Alliance, the Grangers, and other bodies composed of workingmen and the agricultural classes. It became the third political party in size and strength, next to the Republican and Democratic parties, and since 1891 has been no small factor in American politics. The original convention platform demanded:

The free and unlimited coinage of silver; the abolition of the national banking system; the issue of fiat money in sufficient quantity to transact the business of the country on a cash basis, and the loan of such currency to the people at not more than two per cent per annum on non-perishable agricultural products, national ownership of all means of public communication and transportation; a graduated income tax; popular election of United States Senators; the adoption of the initiative and referendum in legislation; and the prohibition of alien ownership of land.

In 1892 the second National Convention of the People's Party met at Omaha, Neb., on 2 July, to nominate candidates for president and vice-president, and adopted substantially the same platform as that promulgated at Cincinnati. The nominees were James B. Weaver of Iowa, for president, and James B. Field of Virginia, for vice-president. At the subsequent election in November the ticket received 22 electoral votes and a popular vote of 1,055,424. In the next presidential campaign, that of 1896, the party nominated William Jennings Bryan, for president, and Thomas E. Watson of Georgia, for vice-president. The platform adopted at the National Convention was as follows:

1. We demand a National money, safe and sound, issued by the General Government only, without the intervention of banks of issue, to be a full legal tender for all debts, public and private; a just, equitable, and efficient means of distribution, direct to the people, and through the lawful disbursements of the Government.

2. We demand the free and unrestricted coinage of silver and gold at the present legal ratio of 16 to 1, without waiting for the consent of foreign nations.

3. We demand that the volume of circulating medium be speedily increased to an amount sufficient to meet the demands of the business and population, and to restore the just level of prices of labor and production.

4. We denounce the sale of bonds and the increase of the public interest-bearing debt made by the present Administration as unnecessary and without authority of law, and demand that no more bonds be issued, except by specific act of Congress.

5. We demand such legislation as will prevent the demonetization of the lawful money of the United States by private contract.

6. We demand that the Government, in payment of its obligations, shall use its option as to the kind of lawful money in which they are to be paid, and we denounce the present and preceding Administrations for surrendering this option to the holders of Government obligations.

7. We demand a graduated income tax, to the end that aggregated wealth shall bear its just proportion of taxation, and we regard the recent decision of the Supreme Court relative to the income tax law as a misinterpretation of the Constitution and an invasion



## PEORIA

of the rightful powers of Congress over the subject of taxation.

In this campaign of 1896 Bryan also received the nomination of the Democratic Party, and a majority of the People's Party also voted for the Democratic vice-presidential candidate, W. J. Sewall of Maine. Those who remained steadfast to the Bryan and Watson ticket were popularly known as "Middle-of-the-Road Populists." Bryan received 176 electoral votes, Sewall 149, and Watson 17. Various State conventions of the People's Party in 1898 adopted substantially the same declarations of principles, the salient points of which were: The free and unrestricted coinage of silver and gold at the ratio of 16 to 1, without waiting for the consent of other nations; the speedy increase of the circulating medium to an amount sufficient to meet the demands of a growing business, and no further issue of United States interest-bearing bonds. Other demands of these conventions were for postal savings banks, the government ownership of railroads, telegraph, telephones, and lighting plants; the construction and ownership of the Nicaragua Canal by the United States; the election of United States Senators by the direct vote of the people, and the adoption of the initiative and referendum. "Government by injunction" was denounced; also all funding bills calculated to extend the time for the payment of the Pacific Railroad debt. All conventions commended the action of the United States in making war upon Spain and promised the support of their party to the Government in its efforts to carry it to a successful issue. The North Carolina convention opposed "the domination of gold and monopoly" and favored the "overthrow of national banks and railroad influence in controlling legislation." The Nebraska convention demanded "more money and less misery for the people" and protested against the retirement of the greenback.

At the close of the campaign of 1896 much opposition arose among Southern Populists against a further alliance with the Democratic Party and spread northward. On 14 Feb. 1897 the first open rupture occurred at Grand Rapids, Mich., in a State convention, and resulted in two State organizations. On 22 Feb. 1897, at a meeting of the Populist Reform Press Association at Memphis, Tenn., a committee was appointed to endeavor to heal the differences, and call a conference, if deemed necessary. The Nashville Conference, held 3, 4 and 5 July 1897, was the outcome, but turned out to be a mid-road convention. A National Organization Committee, similar to the National Committee, was appointed with power to call a National Convention if deemed necessary. This committee called a convention, which was lightly attended, at Cincinnati, Ohio, on 5 Sept. 1898. In February 1900 a meeting of the regular National Convention was held at Omaha, Neb., resulting in a complete separation of the factions and a call for a national convention from each—the fusion at Sioux Falls, Ia., and the anti-fusion at Cincinnati, Ohio, both for 9 May. The Sioux Falls convention, in addition to the platform of previous conventions, vigorously denounced the imperialistic policy of the government, expressed sympathy with the Boers in their struggle with Great Britain, advocated public ownership of public utilities, and condemned the practice of the courts in issuing in-

junctions in labor disputes between employees and employers. William J. Bryan was nominated for President and later by the Democratic convention. Charles A. Towne of Duluth, Minn., was nominated for Vice-President after a lively contest to leave the second place vacant until action by the Democratic National Convention, and to accept the nominee. After the Kansas City Convention Mr. Towne declined the Populist nomination and the Populist National Executive Committee substituted Mr. Stevenson, the Democratic nominee. The Cincinnati Convention nominated Wharton Barker of Philadelphia, Pa., for President, and Ignatius Donnelly of St. Paul, Minn., for Vice-President, and adopted as its platform:

(1) Initiative and referendum; (2) public ownership and operation of those means of communication, transportation and production which the people may elect; (3) land for actual occupation only and alien ownership prohibited; (4) a scientific, or absolute paper money, based upon the entire wealth and population of the nation, not redeemable in any specific commodity, but a full legal tender for debts, taxes and public dues, issued by the government only in sufficient quantity to meet the demands of commerce, and free coinage of silver and gold at 16 to 1 until such currency system could be established; (5) graduated tax on incomes and inheritances; (6) election of president, vice-president, senators and Federal judges by direct vote of the people; (7) direct nominations.

Both wings of the People's Party maintained national committees in 1903-4 with a representative from every State in the Union, and in the summer of 1903, through the initiative of the fusion wing, a joint meeting of the two National Conventions was held at Denver, Colo., resulting in harmony, and in a united call for a meeting of both committees at Saint Louis, Mo., on 22 Feb. 1904 when plans for the approaching National campaign were discussed and it was positively decided to nominate independent candidates for the offices of President and Vice-President. At the National Convention, held later in the year, therefore, Thomas E. Watson of Georgia and Thomas H. Tibbles were selected to represent the party in the forthcoming election, at which they received a popular vote of 120,903. On 27 Dec. 1906 the Populist party in Kansas was officially disbanded.

Consult: McKee, 'National Conventions and Platforms' (1900); Reynolds, 'National Platforms and Political History' (1898).

JAMES E. McBRIDE,  
*Secretary National Committee of the People's Party.*

**Peoria**, pe-ō'rī-a, Ill., the second largest city in the State and county-seat of Peoria County; situated on an expansion of the Illinois River called Peoria Lake, 155 miles southwest of Chicago. It is the centre of an extensive railroad system, consisting of the Iowa Central, the Toledo, P. & W., the Lake Erie & W., the Chicago, B. & Q., the Chicago, P. & St. L., the Chicago & A., the Chicago, R. I. & P., the Chicago & Northwestern, the Santa Fe and various other roads with interurban lines in course of construction. Many of these lines connect with the belt system of the Peoria & Pekin Union and with the Peoria & Pekin Terminal. The city is also connected with Chicago by the Illinois and Michigan Canal and the Illinois River is navigable to the Mississippi, giving an extensive trade by water. Peoria is built on a plateau 40 feet above the river extending back to the bluffs for a mile and a half



## PEORIA INDIANS — PEPE

and completely surrounded with rolling prairies. It covers an area of about 9 square miles. The streets are paved; it has a sewage system with all the modern improvements and is noted for its beautiful parks, which are connected by boulevards. Bradley and Glen Oak parks are the largest and finest.

*History.*—The site on which Peoria stands was originally a small Indian village and was visited by missionaries who were trying to convert the savages. La Salle stopped here in 1680 for the winter and built a fort called Fort Creve Cœur which was abandoned the next year. The place afterward became a seat for considerable traffic in furs. In the last half of the 18th century French traders made a settlement here, but they were regarded with suspicion by the Americans, who looked upon the French as allies of the Indians. In 1783 Col. George Rogers Clarke conquered the settlement and shortly afterward erected a fort, which was in existence at the middle of the 19th century. In 1812 Gen. Craig with a small force of United States soldiers drove the French away altogether from the Illinois River. Congress afterward settled the claims of the French for damages caused by these depredations, by granting tracts of land to the original occupants of the soil, and these claims known as "The French Claims" were clouds on much of the property where the present city stands and have only been settled in recent years. In 1819 a new colony took possession of the land, at first cultivating the land and giving attention only to farming, but gradually a village community was formed and in 1835, Peoria was incorporated. It was chartered as a city in 1845.

*Industries.*—Situated as it is, in the heart of an unrivaled agricultural region, a large portion of which is devoted to corn, the city possesses a great wholesale and retail trade in groceries, dry goods, boots and shoes and accessories. Nearby are large bituminous coal fields. The city is also the centre for a tremendous trade in carp, of which hundreds of thousands of pounds are caught in the Illinois River and shipped to eastern cities. Peoria is undermined by a vast basin of water, percolating through gravel and affording to the manufacturing an endless supply. This water maintains a temperature of 53° at all seasons of the year and this fact enables the manufacturer of corn products to secure the largest amount of starch from every bushel of corn and has made the city a favorite place for the manufacture of glucose and whiskey. It has been proven that Peoria possesses an advantage of 6 per cent in the manufacture of these products over any other point in the world. The city ranks first in the products of distilleries among the cities of the Union. These distilleries, of which there are ten, consuming over 60,000 bushels of corn daily, pay into the United States treasury in internal revenue tax, on the manufacture of alcohol and high wines, \$35,000,000 per year, a larger sum than any other revenue district in the United States. Peoria has long been the centre of an enormous grain trade and in 1904 shipped more grain by rail than either Saint Louis, Chicago, Kansas City or Omaha. It is also the seat of several meat packing houses, a large strawboard factory, wire fence works, agricultural implement factory, automobile works, foundries and

other industries. It has eight banks and three savings institutions, all in a flourishing condition, one of which is the largest bank in the State outside of Chicago.

*Public Buildings, Charitable Institutions, etc.*—There are the city-hall, court-house, United States post-office, numerous churches and public schools. The charitable institutions include the Proctor, Guyer and Bradley homes for the aged; the Cottage, the Deaconess' and Saint Francis' hospitals; Saint Joseph's Home, House of the Good Shepherd and the Home for the Friendless.

*Educational Institutions.*—Beside an excellent public school and high school system there are: Bradley Polytechnic Institute, allied with the Chicago University (q.v.), endowed with \$2,000,000 through the liberality of Mrs. Lydia Bradley; Spalding Institute, the work of Bishop J. L. Spalding (q.v.); the Academy of Our Lady of the Sacred Heart, the German School, under the patronage of the German Turners; several parish elementary schools, and a conservatory of music. There are also the Peoria Law Library and a fine public library containing 80,000 volumes.

*Government.*—The city is governed by a mayor and city council, elected every two years. The mayor appoints, subject to the approval of the council, all administrative city officials, except the city attorney, treasurer, police magistrate, and city clerk, who are chosen by popular vote. The annual expenditures for municipal maintenance and operation amount to \$611,000, divided as follows: Schools, \$235,000; police department, including truancy, etc., \$80,500; fire department, \$78,000; and lighting, \$36,000.

*Population.*—In 1900 there were in the city as residents 8,900 people of foreign birth and 1,400 colored persons. Since the Federal census of 1900 was taken, North Peoria has been annexed, increasing the population nearly 3,000. Pop. (1900) 56,100; (1904) 68,200.

E. F. BALDWIN,  
*Editor 'Peoria Star.'*

**Peoria Indians**, an American tribe of the Illinois Confederacy, who formerly resided on the shores of Peoria Lake in central Illinois. In 1832, the tribe, very much reduced in numbers, removed with the Kaskaskias (q.v.) to Kansas, and in 1854 took up their residence on a reservation in Indian Territory. In 1900 they numbered less than 200, the majority being of mixed blood.

**Pepe, Guglielmo**, Italian general and revolutionist: b. at Squillace, 15 Feb. 1783; d. at Turin, 9 Aug. 1855. He served for some time in the Parthenopean army, then fought with the French against Spain, and later served under Murat, gradually working up in the service until he attained the rank of lieutenant-general in 1815. In 1820 he joined the Liberal party of Naples, known as the Carbonari and in that year commanded the military revolt against the king. He entered Naples in triumph, and forced the king to accept his new constitution, but on 7 March 1821 was defeated at Rieti, and fled to London. The Austrian government with the sanction of the Holy Alliance then replaced the Bourbons on the throne. He returned in 1848, however, and was given command of the Neapolitan forces in the war with Austria and re-



gained his lost favor by his defense of Venice in 1849. Among his works are: 'Relation des Evénements Politiques et Militaires qui ont eu lieu à Naples en 1820 et 1821' (1822); 'Histoire des Révolutions et Guerres d'Italie en 1847-49' (1850).

**Pepi**, Egyptian monarch of the 6th dynasty, called also MERIRA. His reign was prosperous and of some length. He is the first warlike Egyptian king of whom any record exists. He made an expedition against the Mentu, who had regained possession of the Sinai peninsula, and, with large levies, against the Herusha and the Amu, people inhabiting the desert region east of Lower Egypt. The latter enemies again assembled, farther northward, and again were defeated. The negro races of the south appear in Pepi's time as subject to Egypt, and furnish a contingent for the wars. He executed several public works, and was ably seconded by his ministers.

**Pepin**, pēp'īn (Fr. pā-pān), or **Pippin II.**, known as Pepin of Heristal, Duke of the Franks: d. Jupille 16 Dec. 714. He became mayor of the palace in Austrasia, under Dagobert II., fought successfully against the Germans, and by the victory of Testry (687) gained control of Neustria and Burgundy, and was recognized as mayor of the palace in the three kingdoms. His power was royal and generally despotic, though he permitted the defeated king of Neustria, Thierry III., to retain the title, the latter being the first of the so-called "do-nothing" kings (*rois fainéants*).

**Pepin the Younger** (called also "The Short"), king of the Franks: b. about 715; d. 24 Sept. 768. Charles Martel, who succeeded Pepin of Heristal, was not only able to maintain, but so to extend his power that his two sons, Karloman and Pepin the Younger, were able to share the kingdom between them. Pepin, after his brother entered a monastery in 747, became sole ruler, and after the deposition of Childeric III. in 751, by agreement with the pope, was proclaimed King of the Franks. Shortly after, Pope Stephen III., pressed by the Longobards under Astulf, applied to France for aid, and by a visit paid to Pepin induced him to march to Italy, where he signally defeated the Longobards, and made the pope a present of the lands which he had conquered from them. These lands thus formed the first nucleus of the Papal States. After a second expedition to Italy, to which he was compelled by the treachery of the Longobards, he defeated the Bavarians, and warred successfully with the Saxons (753-757). He was succeeded at his death in 768 by his son, Charles the Great, usually called Charlemagne (q.v.).

**Pepin, Lake**, an expansion of the Mississippi River between Goodhue and Wabasha counties, Minn., and Pierce and Pepin counties, Wis.; 60 miles below St. Anthony's Falls. It is 25 miles long and from one to three miles wide, and is surrounded by picturesque rocky cliffs. On its shores are the city of Wabasha and Point au Sable, once the site of a French fortress.

**Pepoli**, pā'pō-lē, **Gioacchino Napoleone**, Marquis, Italian statesman: b. Bologna 6 Nov.

1825; d. Rome 26 March 1881. He was a grandson of Murat, and in 1848 in the war with Austria, being in command of the National guards, defended his native city for some time against the Austrian troops, but upon the capitulation of the garrison was forced to flee into Tuscany. He returned, however, and seven years later, in 1859, became chief of the provincial government in Bologna. Upon the annexation of Romagna he became a member of the left centre of the Italian Parliament, and in 1862 was appointed minister of agriculture. From 1863-4 he was ambassador to Saint Petersburg; from 1868-70 was ambassador at Vienna; and from 1868 until his death in the year 1881 he was a senator in the Italian Parliament.

**Pepper, George Dana Boardman**, American educator and theologian: b. Ware, Mass., 5 Feb. 1833. He graduated from Williston Seminary, Easthampton, Mass., in 1853; from Amherst in 1857, receiving the degree of D.D. in 1882; from Newton Theological Institution in 1860, which conferred upon him the degrees of D.D. in 1866 and LL.D. in 1890. Colby University and Lewisberg University in 1882 also conferred these degrees. After completing his studies, he became pastor of the First Baptist Church of Waterville, Me., where he remained for five years, from there going to Newton Theological Institution as professor of ecclesiastical history, occupying that position until 1867. In 1868 he became professor of systematic theology in Crozer Theological Seminary, and served in that capacity until 1882, in which year he received a call to the presidency of Colby University. Ill health caused him to resign from his duties as president in 1889, and for three years he traveled. Upon his return in 1892 he was appointed to the chair of Biblical Literature in Colby University, a position he held until 1900. He has published 'Outlines of Theology' and written numerous articles for theological reviews.

**Pepper, George Wharton**, American lawyer and author: b. Philadelphia, Pa., 16 March 1867. After graduating from the University of Pennsylvania in 1887, he took a two years' course in law there, and was admitted to the bar in 1889. He practised law until 1893, when he was appointed Algernon Sydney Biddle professor of law in the University of Pennsylvania, a position he still occupies. He has written: 'The Borderland of Federal and State Decisions' (1889); 'Pleading at Common Law and Under the Codes' (1891); 'Digest of the Laws of Pennsylvania, 1700-1901,' and 'Digest of Decisions and Encyclopædia of Pennsylvania Law, 1754-1898' (with W. D. Lewis, 1902).

**Pep'per, John Henry**, English chemist and mechanical inventor: b. Westminster, England, 17 June 1821; d. Leytonstone, Essex, England, 29 March 1900. He was appointed analytical chemist at the Royal Polytechnic in 1848, but is best known as the improver and exhibitor of "Pepper's Ghost," in its earliest form, the invention of Henry Dircks, a device for presenting on the same stage living persons and phantoms as acting simultaneously. Pepper traveled with this invention in the United States and Australia, and became public analyst in



## PEPPER — PEPPERELL

Brisbane, Queensland. He published: 'Scientific Amusements for Young People' (1861); 'Cyclopædic Science Simplified' (1869); 'The True History of Pepper's Ghost' (1890); etc.

**Pepper, William**, American physician: b. Philadelphia, Pa., 21 Aug. 1843; d. Pleasanton, Cal., 28 July 1898. He was graduated from the University of Pennsylvania in 1862, and from its medical department in 1864. In 1868-70 he was lecturer there on morbid anatomy, on clinical medicine in 1870-6; and was professor of clinical medicine in 1876-87, when he was appointed professor of the theory and practice of medicine. From 1881-94, when he resigned, he was provost of the university, and under his administration the institution made phenomenal progress, the number of instructors increased from 88 to 268, the material equipment and endowment rose from \$1,600,000 to more than \$5,000,000, many new departments were added, and through his efforts the university hospital was established. He founded the Philadelphia 'Medical Times' and edited it in 1870-1; was one of the founders of the Pennsylvania Museum and School of Industrial Art; through his efforts the course of study in medicine was extended to four years; and an endowment fund for the medical department was established and received a gift of \$50,000 from him on his resignation. He was medical director of the Centennial Exhibition of 1876 and was prominently connected with the leading medical organizations of the country. He published: 'Trephining in Cerebral Disease' (1871); 'Higher Medical Education' (1877); 'Phthisis in Pennsylvania' (1886); 'A Text-book on the Theory and Practice of Medicine' (1893); etc. Consult the biography by F. N. Thorpe (1904).

**Pepper**, a popular name for several plants and their products. The best known is common or black pepper (*Piper nigrum*) of the order *Piperaceæ*, a native of the East Indies, whence it has been introduced into many tropical countries (especially the West Indies and northern South America, where it is an important commercial crop). The plant is a climbing shrub often more than 15 feet tall, with smooth soft stems which bear pointed heart-shaped, leathery leaves, opposite which are spikes of mostly perfect flowers, followed by little red fruits. The plants are propagated by cuttings, which when well rooted are set near small trees over which they can spread, or in fields where poles are provided as supports. In about four years the plants commence to bear and continue to yield two crops annually for 10 years or more. As soon as the earliest berries commence to color, the whole crop is harvested to prevent loss by dropping and to retain the pungency. After drying the product is ready for market. White pepper is derived from dried black pepper by soaking in water and rubbing off the dried fleshy covering. The pungent qualities of black pepper are dependent mainly upon an acrid volatile oil and an acrid resin. A closely related species, *P. triviale*, is also cultivated to some extent in India for its highly pungent fruits. Meleguetta or Guinea pepper is derived from species of the order *Anonaceæ* and *Scitamineæ*; and Jamaica pepper or pimento from the order *Myrtaceæ*.

The red peppers of temperate gardens are various species of *Capsicum*, particularly *C. an-*

*nnum* and *C. frutescens*, the former an annual herb, the latter a shrubby perennial. The former is the parent of the peppers of northern gardens; the latter, being slower in its growth, is found only in the South. The species are all natives of tropical America, where they were cultivated for condimental uses prior to the landing of Columbus, who took specimens back with him to Europe. It seems, however, to have been introduced into European gardens by way of Africa. In the South the fruits, green or ripe, are very popularly used as a condiment and for mixing with pickles. Some varieties are used for special purposes; for example, the little-fruited sorts, which are ground to make Cayenne or red pepper and the Tabasco variety, which forms the basis of Tabasco sauce. The green peppers of northern markets are merely immature red peppers. They are used for salads, and for making "mangoes," the contents being removed and chowchow pickles put in their place. Olives are often stuffed with minced pepper which has been steeped in olive oil. The plants are grown from seed started under glass and transplanted to the field after all danger of frost has passed. They require a fairly light, rich soil, plenty of sun, and a warm season. Their insect enemies are the same that attack the egg-plant.

**Pepper-grass.** See CRESS.

**Pepper-pot**, in the West Indies, a prepared food of which cassareep is the principal ingredient, together with fresh or dried fish and vegetables.

**Pepper-root.** See DENTARIA.

**Pepper-tree, Peruvian Mastic-tree, or Pea-tree**, several species of the genus *Schinus* of the order *Anacardiaceæ*. Only two of the 17 species are cultivated. In California they are popular as far north as San Francisco. *Schinus molle* is the commoner species. It is an evergreen tree 20 or more feet high with rounded top, pendulous branches, and yellowish-white flowers in conical panicles followed by fruits about the size of peppercorns. The narrow leaves are rich in a resinous fluid which they discharge into the air especially after a rain when the tissues become turgid. Next to the blue gum tree (*Eucalyptus globulus*) this has been the most popular ornamental tree, but owing to its acting as a harbor for scale insects, etc., it has suffered in orange-growing districts, thousands of trees having been cut down because of this.

**Pepper-wood.** See PRICKLY ASH.

**Pepperell**, pĕp'ĕr-ĕl, SIR William, American general: b. Kittery Point, Maine, 27 June 1696; d. there 6 July 1759. He became a merchant but in 1727 was elected one of his majesty's council for the province of Massachusetts, and was regularly re-elected for 32 years in succession. Living on an exposed frontier, where the inhabitants were constantly engaged in warfare with the savages, a large portion of his life was spent in the camp. When the expedition against Louisburg was undertaken, the governors of New England gave him the command of the troops. Beginning the siege in May 1745, he soon compelled the city to surrender, and in reward for his services was made a baronet. In 1759 he was appointed lieutenant-



## PEPPERIDGE — PEPPERMINT

general. His grandson was created a baronet in 1774, and embraced the royal cause during the Revolutionary War, in consequence of which his estates were confiscated. Consult: Usher Parsons, 'Life of Sir William Pepperell' (1855); Parkman, 'A Half Century of Conflict' (1892); Brooks, 'Sir William Pepperell' (1903).

**Pepperidge, or Black Gum.** See TUPELO.

**Peppermint.** "Mint" was among the plants first recognized as of value by the ancients, and many interesting references to it are found in the earliest known literature. Its extreme antiquity is evidenced by the fact that it was known in Greek mythology, where it was given a birth both romantic and divine in connection with the loves of the gods. "Mintha" (*Μινθη*), a beautiful girl, had won the affections of Hades, and in a fit of jealousy was transformed by Ceres into the plant which was then given her name, from which followed the Latin "*Mintha*," "*Mentha*," and "*Menta*." There still exists under this name in Pylos, Greece, *Mount Mintha*, upon which the transformation occurred. At the base of the mountain was in ancient times a grove dedicated to Ceres and a temple to Hades. This romantic tradition is recorded by Strabo (*Geographia*, liber VIII.), Julius Pollux, and others.

Hippocrates, the most celebrated physician of antiquity, b. about 460 B.C., mentions the virtues of mint, and also says "It excites to love." Aristotle, b. 384 B.C., describes its well-known beneficial effects upon the human system, and Theophrastus, his successor, in his 'History of Plants,' also mentions its various virtues in a most interesting way under the newer name which had been given it of *ἡδύσμων* (fragrant, or sweet-scented). This name is also used in both the Greek gospels, which record the well-known utterance of Jesus, from which we learn that taxes were annually paid in this plant, indicating that it had already become an article of regular commerce.

A very interesting account of mint is given by Pliny (23-79 A.D.) in his 'Historia Plantarum' (liber XIX., cap. 8), where he mentions the methods of propagation, its use in banquets, etc., and its various medical virtues. Ovid also speaks of its having "magical power." Much prominence is given to its virtues in the writings of the great physicians of antiquity, including Galenus, Avicenna, Celsus, etc.

**Commercial History.**—There are 17 varieties of the *mentha* genus noted by various writers, but by far the most important and the only one cultivated or distilled in a large commercial way in Europe or America is the true peppermint plant, *Mentha Piperita*. The regular cultivation of this plant in a commercial way began in Surrey, England, about 1750, where at that time only a few acres were devoted to medicinal plants. Fifty years later about 100 acres were under cultivation. The growers, having no distilleries of their own, sold their plants to London chemists who were engaged in distilling other products as well; but afterward distilleries were built at the sources of production to save transportation expenses. The industry in England reached its maximum about 1850, the area

under cultivation being about 500 acres, after which it began rapidly to decline owing to the growth of the American industry.

The inception of the industry in America occurred in 1816, in Wayne County, N. Y., which for a number of years was the chief producing centre of the world, but in the year 1835 it was inaugurated in Michigan, where, with soil of extreme fertility, under climatic conditions especially favorable, it soon became the chief producing centre of the world, which position it has since maintained. It is accordingly of interest to note that over three fourths of all the true peppermint of the world is produced within a radius of 75 miles of the city of Kalamazoo. Besides the climatic advantages and fertile soil of Michigan, radical improvements were effected here in the apparatus for distillation, implements of cultivation, etc., enabling the process to be conducted with far greater rapidity, and materially enhancing the quality. The business, which had hitherto been in a crude state, now began to assume a more systematic form.

Peppermint, as is well known, is cultivated chiefly for its "essential oil," in which are secreted the aroma and virtues of the entire plant. This exists in minute microscopic cells in the leaves and blossoms. Distillation is effected by placing the plants which have been harvested and dried, in large vats, thoroughly packed and closed with air-tight covers, steam being admitted to the bottom of these vats by means of pipes and valves. The oil cells are ruptured by the heat, the oil escaping upward with the current of steam. The steam thus impregnated with oil flows through condensers where it is converted into oil and water, from thence flowing into the "receiver," where the oil, which is lighter, floats upon the top, while the water settles below and is again forced into the boiler to be reconverted into steam for successive charges.

The product thus obtained is the crude or "natural" oil; but this although "pure" contains some resin extracted from the stems, and some approximate hydrocarbons. The quality is consequently greatly improved by an intelligent "fractional distillation" by which the objectionable properties may be separated, the refined product being the "quintessence" of the plant, with a rich and mellow aroma.

The soil now mostly used for mint culture is formed by the deposit during many centuries of the decay from aquatic plants, forests and other vegetation grown in the beds of ancient lakes. Being soft and porous, it is necessary to provide the horses with "mud shoes," which are fastened to their hoofs to prevent sinking.

The essential parts of a distillery are a boiler for generating steam, a series of vats for containing the plants, and a condensing apparatus; these all being connected to each other by a system of pipes, valves, etc. Auxiliary to these in the larger "stills" are engines, steam cranes, etc., for economizing labor. While the first distilleries had a capacity of only five pounds per day of oil, four distilleries recently erected at some of the farms of the writer have a daily capacity each of four hundred thousand pounds of plants, yielding about fifteen hundred pounds of oil. Much of the labor formerly done by



## PEPSIN — PERAK

hand now being accomplished by steam and other forms of power.

The production in America of peppermint during the past 10 years has averaged annually about 60,000,000 pounds of plants, yielding between 150,000 and 400,000 pounds essential oil. About half of the entire production is used in America, the other half being exported to foreign countries. An oil sold as "Peppermint" is distilled largely in Japan, which, however, is not produced from the true peppermint plant, but from *Mentha Arvensis*, and is inferior in flavor, etc.

Peppermint in the pure state is highly agreeable and beneficial and its consumption is rapidly increasing, owing to new uses which have been found and an increased demand for those purposes to which it has long been applied; its chief uses being in medicine, confectionery, chewing gums, toilet articles, and fine pharmaceuticals.

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**Pepsin**, a ferment secreted by the mucous lining of the stomach. It has never been prepared in the pure state, but it is believed to be of a proteid nature. When present in a feebly acid solution, at a temperature approximately the same as that of the human body, pepsin possesses the power of transforming coagulated albuminous substances into soluble peptones, and thus rendering them capable of absorption in the alimentary canal. Owing to this remarkable power, pepsin is a highly important agent in the chemistry of digestion, and it is very commonly administered, in medicine, when the quantity secreted by the stomach is deficient. The commercial supply of pepsin is obtained from the stomachs of hogs, sheep, or calves, and its digestive power varies considerably. A solution containing two grains of pepsin in one ounce of water, and acidified by the addition of five minims of hydrochloric acid of specific gravity 1.16, should dissolve at least 100 grains of the white of a hard-boiled egg in 30 minutes, if the egg is finely divided, and the mixture is kept at 125° F., and constantly stirred. The total solvent power of pepsin is much greater than this, however, and in normal digestion one grain of pepsin probably dissolves as much as 3,000 grains of coagulated albumin. Specimens of pepsin have been prepared, which have dissolved as much as 25,000 times their own weight of coagulated proteid, and some authorities are of the opinion that pepsin is theoretically capable of exerting its peculiar powers indefinitely, without being itself destroyed in the process. There is evidence that pepsin is re-absorbed by the alimentary canal to a considerable extent, and returned to the secreting glands of the stomach for repeated use; and it has also been detected in the muscles, and in the urine. The pepsin of commerce is an amorphous powder, of a yellowish-white color; but the substance is also administered in the form of elixirs, and in many other ways. It is used, not only as a digestive corrective, but also for effecting the solution of various superficial necrotic tissues, such as diphtheritic membranes. Its existence was first recognized by Schwann (1836) and Wasmann (1840).

**Pepys**, pēp'is, pēps, or pīps, **Samuel**, English diarist: b. 23 Feb. 1633; d. London 26 May

1703. He was educated at Cambridge, and early acquired the patronage of Sir Edward Montagu, afterward Earl of Sandwich, who employed him as secretary in the expedition for bringing Charles II. from Holland. On his return he was appointed one of the principal officers of the navy. In 1673, when the king took the admiralty into his own hands, he appointed Pepys secretary to that office. He was employed under Lord Dartmouth in the expedition against Tangier, and often accompanied the Duke of York in his naval visits to Scotland, and coasting cruises. During the excitement of the Popish plot he was, at the instigation of the Earl of Shaftesbury, committed to the Tower on an unfounded charge of aiding in the design to dethrone the king and extirpate the Protestant religion, but was presently discharged without a trial, and reinstated in his office at the admiralty, which he held until the abdication of James II. On the accession of William and Mary he published his 'Memoirs' (1690), relating to the navy for 10 years preceding, and led a retired life from this time till his death. He was president of the Royal Society in 1684-6. He left a large collection of manuscripts to Magdalen College, Oxford, known as the Pepysian library, and consisting of naval memoirs, prints, and five large folio volumes of ancient English poetry, begun by Selden, and carried down to 1700, from which Bishop Percy made numerous selections for his 'Reliques of Ancient English Poetry.' His unique 'Diary' (begun 1 Jan. 1660, and ending 31 May 1669, on account of defective eyesight) affords a curious picture of past manners and particularly of the Stuart court. It was written from day to day in a sort of shorthand which was deciphered by the Rev. J. Smith, and first published under the editorship of Lord Braybrooke in 1825. Fuller editions have since been published, the fullest being that of H. B. Wheatley (1893). Consult: Wheatley, 'Samuel Pepys and the World he Lived In' (1880); Stevenson in 'Familiar Studies' (1892).

**Pequot**, pē'kwōt, Conn., the name of a former Indian fort on Pequot Hill, eight miles northeast of New London, Conn. (q.v.).

**Pequot Indians**, an American tribe of the Mohican family who, in the early part of the 17th century, were warlike and powerful in the country round the Thames River when Connecticut was first settled, and made treaties with the Dutch and English. Hostilities broke out in 1637, and the tribe was cut to pieces and scattered. A few descendants may be found at Green Bay, Wis.

**Pequot War**. See COLONIAL WARS IN AMERICA.

**Perak**, pā-rāk', one of the federated Malay states, under British protection, lying between 3° 37' and 6° 5' N., and between 100° 3' and 101° 51' E. on the west coast of the Malay Peninsula, north of Selangor, south of Wellesley and Kedah, and west of Pahang, Kelantan, and Petani. Extreme length, 172 miles; extreme breadth, 100 miles; coast line, 90 miles; area, between 9,000 and 10,000 square miles. The region is crossed by two parallel ranges. Between them lies the Perak River, the only navigable stream in the country: steamers go up it 40 miles, and trading boats



## PERCEPTION

200 miles. The climate is very damp, hot on the coast and the river plains, and much cooler in the mountains; the mean temperature along the coast is  $87^{\circ}$  F. by day and  $78^{\circ}$  by night. Sugar, tobacco, and rice grow in the plains; tea, coffee, and vanilla in the uplands. Deer, snakes, leopards, and elephants are found in the hills, and there are crocodiles in the rivers. The mineral resources are great; in 1900 the exports of tin were valued at \$26,032,000. Exports of sugar, coffee, etc., brought the total for the year up to \$29,190,663. Gold, silver, lead, iron, copper, zinc, arsenic, tungsten, titanium, etc., are also found. A railroad connects the centre of the mining district, Kinta, with Kuala Kangsar, and this road is being extended to Wellesley. Pop. (1901) 329,665. There is continual immigration from China and India, so that the Chinese outnumber the Malays.

Perak was long ago settled by the Malays. The Dutch made a settlement by treaty in 1650, but were repeatedly driven out by the natives and in 1795 by the English, who in 1824 made a treaty with Siam by which Perak's independence was recognized in spite of Siamese conquest in 1818. In 1874 British intervention was asked by one of the native sultans; a year later the British resident was murdered; the resulting punitive expedition brought the country under British protective control, though Perak was still nominally independent. Perak joined the Federation of the Malay States in 1895-6.

**Perception.** In its psychological meaning, perception is the direct conscious apprehension of physical objects and events through the medium of the senses. Thus one perceives trees, animate objects, one's own body, rhythms, harmonies, movements, etc. Perception is frequently contrasted with ideation in which the object is "thought" or "imagined," but not seen or heard or handled.

Inasmuch as perceptual knowledge comes by way of the senses, the most obvious mode of classification is by reference to the various sense-departments. This plan of classification would yield one large group of visual perceptions, another of auditory, a third of tactual, and so on through the senses. It would include, also, perceptions in which more than one sense-department is involved. Sight mediates the largest number of perceptions. The primary function of vision is the apprehension of *objects*; the primary function of audition, the apprehension of *events*. Vision, in conjunction with tactual and kinæsthetic sensations, gives us our spatial world—objects which are of various sizes, colors and shapes, which occupy various positions and offer, to each other and to the experiencing individual, varying degrees of resistance. The ear is less well equipped than the eye for spatial perception. It is only by aid of the eye and of the skin, tendons and muscles that sounds acquire definite spatial characteristics. But—as if to offset this deficiency—hearing is rich in qualities, the normal ear distinguishing several thousand tones and noises; and it is also quick to detect rapid and complicated changes in the environment. The three chief functions of the ear are the perceptions of human speech, of music and of the sounds of nature. Tactual perceptions, that is, perceptions mediated by nervous organs lying within the skin, inform us—though not so accurately or so minutely as visual perceptions do

—of the spatial characteristics of objects; their size, position, form, etc. They also acquaint us with the texture (roughness, smoothness, bluntness) and the temperature of objects, and with the condition of the skin itself (whether wet or dry, irritated or bruised). When reinforced by sensation-elements from muscles (muscular pressure), tendons (tendinous strain), and joints (articular pressure), tactual sensation-complexes furnish knowledge of the weight, resistance, extent and movement of objects and of the position and movement of the observer's own body. The perception of bodily orientation is aided by a specific quality of sensation set up within the semicircular canals of the ear. Finally, tactual factors, pressure, temperature and pain, in co-operation with sensations of taste and smell, bear information regarding the nature of food and other substances placed in the mouth. Olfactory sensations serve, by themselves, to acquaint the individual with the nature of odorous substances. The perception of the state of the large organs within the body is mediated, for the most part, by sensations set up in these organs themselves; for example, the stomach, heart and lungs.

Although the objects of perception are innumerable and the sensory materials involved of great variety, the forms of perception, that is, the ways in which sensations are interwoven and compounded, are reducible to three primary types; one form or pattern underlying spatial perception, a second underlying the perception of temporal sequence and order, and a third furnishing a basis for the apprehension of the qualitative nature of things. The perceptual consciousness is constantly undergoing, both in the individual and in the race, elaboration and refinement. For, in the individual, experience is continually investing the apprehension of objects with new shades of meaning and, in the animal series at large, evolutionary processes have modified and are still modifying both the structures and functions of the nervous system and the external organs of sense.

Perceptual knowledge is by no means infallible. Its ambiguities and inaccuracies are termed illusions. They may arise when an object is perceived under varying conditions (for example, a stick looks longer in a vertical than in a horizontal position) or when a perception falls into conflict with the results of objective measurement or of some other standard of knowledge (for instance, a filled right angle seems to contain more than  $90^{\circ}$ ). Certain illusions are ineradicable factors of normal experience; others—as illusions of insanity—rest upon derangement of mental function. Hallucination is generally considered to be a more serious derangement of perception than illusion. The hallucinatory object either does not exist at all—as in certain deliriums—or it exists in quite a different form from the actual object; for example, the mistaken apprehension of subjective noises as human speech. The perceptions of the dream-consciousness may be considered as hallucinations of a normal type. Consult: Calkins, 'An Introduction to Psychology' (1901); James, 'The Principles of Psychology' (1890); Titchener, 'A Primer of Psychology' (1899).

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## PERCEVAL — PERCHLORIC ACID

**Perceval**, pĕr'sĭ-val, **Spencer**, English politician: b. London, England, 1 Nov. 1762; d. there 11 May 1812. He was graduated from Trinity College, Cambridge, in 1781, studied law, was admitted to the bar and rose rapidly in his profession, attaining a high reputation as a constitutional lawyer. In 1796 he was returned to Parliament for Northumberland, and there proved himself an eloquent speaker and a quick and keen debater. In 1801 he was solicitor-general, in 1802 attorney-general; appointed chancellor of the exchequer in 1807 he continued in the office until 1809 when he became premier, which office he held until his assassination at the door of the House of Commons by a person named Bellinger. Consult: Williams, 'Life and Administration of the Right Honorable Spencer Perceval' (1856); Walpole, 'Life of Spencer Perceval' (1874).

**Perch**, a popular name, used with some specific qualifying word for a variety of spiny-rayed fishes; but generally and properly applied to species of the genus *Perca*, and in this country to *Morone interrupta* also. These fishes belong to the families *Percidæ* and *Serranidæ* respectively. The yellow perch (*Perca flavescens*), known in many localities as "yellow Ned," ringed perch, etc., is very closely related to the *Perca fluviatilis* of Europe, with which many zoologists consider it to be identical. It may be recognized by the possession of two spines before the anal fins, the well developed pseudo-branchiæ, the absence of canine teeth on the vomer and jaws, and the distinctive colors, which are olivaceous above, golden yellow with six or eight dark vertical bands on the sides, and the pectoral and ventral fins orange or red. It reaches a length of one foot and a weight of two pounds, but generally does not exceed one pound. This well-known and deservedly popular fish abounds in the fresh waters of the eastern United States, descending coastwise streams to the brackish waters of bays and inlets, in which it attains a large size and excellent quality. It is especially abundant in the Great Lakes, and is common in the lakes and streams of the upper Mississippi Valley; but is not found in the lower Mississippi and its tributaries, nor on the Atlantic coast south of North Carolina. Recently it has been introduced, through the United States Fish Commission, in western lakes and streams from which it was formerly absent. The yellow perch prefers slow-running streams, ponds, or lakes with sandy or gravelly bottoms; and is to be sought in the deeper holes under shaded banks, about mill-dams, bridge-piers, sunken timbers, and in eddies. It is gregarious and a noteworthy circumstance is that each school is composed of fish all of one size—be they large or small. Like several other fresh-water fishes they become inactive in very cold weather and conceal themselves in holes. In the spring they assume brighter hues, the reddish parts becoming warmer as the spawning season approaches. The eggs are about  $\frac{1}{12}$  inch in diameter, and are remarkable for their adhesive quality, and the manner of deposition in strings or bands which sometimes reach a length of seven feet, and a width of three or four inches. They are laid from February to May, according to locality. The favorite food of this fish consists of minnows and other small fishes, which they pursue with relentless vigor; but they also

eat many kinds of worms, insects and their larvæ, etc. The yellow perch is highly esteemed as a panfish and is shipped to the principal markets to an annual value of several hundred thousand dollars. The principal fisheries are on several of the eastern rivers, and especially the Great Lakes, where they are taken in large numbers in various kinds of traps and set-nets.

The white perch (*Morone americana*) belongs to the family of the sea-basses and rock-fish (*Serranidæ*). It has three spines before the anal fin, and the two dorsal fins are united, with very strong spines in the anterior. The color is olivaceous above, silvery white on the sides and belly, marked with faint longitudinal streaks. This species is exceedingly abundant along the coast from Nova Scotia to South Carolina, in the brackish and fresh waters of estuaries and rivers, and is found landlocked or introduced in many fresh-water ponds. It appears to be somewhat migratory, the schools remaining in brackish water during the winter, and ascending the rivers in the spring. They usually spawn about May,—about 40,000 small, clear, semi-buoyant, and separate eggs being deposited by each female on regular spawning grounds. Their food resembles that of the yellow perch, but they show a preference for shrimps and other crustaceans. Both of these perches are favorites with anglers and may be caught with live bait and the simplest of tackle; but the finest sport is afforded by the use of a trout rig with either bait or artificial fly.

Consult: Goode, 'American Fishes' (New York 1888); Henshall, 'Bass, Pike, Perch, and Others' (New York 1903).

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**Perch, Pole, or Rod**, a measure of length used in surveying land, equal to  $5\frac{1}{2}$  yards or  $16\frac{1}{2}$  feet. Surveyor's chains are usually four perches in length. In square measure 160 square perches make an acre, and in masonry a perch is equal to 25 cubic feet.

**Percheron** (pĕr-shĕ-rôn) **Horse**, a breed of heavy horses perfected in the province of Perche, in northwestern France, a long time ago. It has Arabian characteristics imparted to a large, bony frame, giving a very strong and durable draft-horse, rarely less than 15, and often 16, hands high. Many stallions of this breed have been imported extensively into the United States, and have influenced favorably the work-horses of the country. A 'Stud-book' of Percherons has long existed.

**Perchlo'ric Acid and Perchlorates.** Perchloric acid,  $\text{HClO}_4$ , is prepared by the careful distillation of a mixture of powdered potassium perchlorate and an excess of concentrated sulphuric acid; the product being purified by repeated distillation in a vacuum. The water-free acid is a heavy, colorless, syrupy liquid, specific gravity 1.8, soluble in water with evolution of heat, can be distilled without decomposition at  $39^\circ \text{C}$ . ( $102^\circ \text{F}$ .) under diminished pressure. It unites with a small amount of water forming a white crystalline compound  $\text{HClO}_4 \cdot \text{H}_2\text{O}$ . It is a strong monobasic acid resembling sulphuric acid in many of its physical and chemical properties, except that it is very apt to decompose with explosive violence particularly when brought in contact with anything of an organic



## PERCIER — PERCY

nature as paper, wood, flesh, etc. It forms a number of salts, the most important being potassium perchlorate and sodium perchlorate. Potassium perchlorate is made by the careful application of heat to potassium chlorate which decomposes, giving oxygen and a mixture of potassium perchlorate and potassium chloride. The two salts are separated by fractional crystallization. It is a colorless crystalline body, rather difficultly soluble in water, and differs markedly from the free acid in being very stable, decomposing only at a high temperature to oxygen and potassium chloride.

**Percier, Charles**, shärl pâr-sê-â, French architect: b. Paris 22 Aug. 1764; d. there 5 Sept. 1838. He was a pupil of A. F. Peyre, in 1786 won the *premier grand prix de Rome*, during the Revolution designed furniture and decorations, and by the antique motifs which he introduced from Pompeii and Rome, may be said to have begun the "Empire style" so widespread in Europe in the early 19th century. From 1794 to 1814 he worked in collaboration with Pierre Fontaine (q.v.), with whom he continued the decoration of the Paris Opera, restored the Louvre colonnade, and completed the upper story of the buildings about the court, built the theatre and chapel of the Tuileries, and designed the Arc de Triomphe du Carrousel. Among his writings are: 'Restauration de la Colonne Trajane' (1788); and 'Choix des Plus Célèbres Maisons de Plaisance de Rome et de ses Environs' (1809-13).

**Percival, James Gates**, American poet: b. Kensington, Conn., 15 Sept. 1795; d. Hazel Green, Wis., 2 May 1856. He was the second of three sons of Dr. James Percival. At the age of 16 he entered Yale College; when 20 he stood at the head of his class, which included the poet John G. Brainard, statesmen John M. Clayton and Thomas A. Marshall, and author Rev. Wm. Buel Sprague, and was graduated as bachelor of arts June 1815. At the age of 25 he published his first volume of poems. Then, having received the degree M.D., and being in feeble health, he went to Charleston, S. C., where he began to publish a periodical entitled 'Clio,' which failed after two issues. In the year 1824 he was appointed professor of chemistry and a United States physician at West Point, which positions he resigned after a few months. He never attempted to follow the practice of medicine. During the year 1825 he published a second volume of poems, which was republished in London. After leaving West Point he drifted about and soon became assistant of Noah Webster in publishing 'Webster's Dictionary.' Having been appointed assistant State geologist of Connecticut, in 1836, he continued in that capacity until the year 1842. The next ten years of his life were passed in poverty and ill health. In 1853 he was employed by the American Mining Company to examine into and report upon its mines in Wisconsin. After he had finished that work in 1854, he was appointed by Gov. Barstow as State geologist for Wisconsin, which place he filled until his death, having made one report, and died during the time that he was preparing his second.

Percival was a great linguist and scholar and wrote poems in Danish, German, Italian, Latin and Greek. Also, he was noted as a geologist

and in his day ranked with Hitchcock and Comstock. He translated from the French, Malta Brun's Geography.

In religion he was a Universalist; in politics, an Abolitionist. All his poems show an artistic finish, and several of them are entitled to a high place among the classic literature of the English language. His 'The Deserted Wife' has run through school-readers and has been recited upon many a rostrum. 'Prometheus' was his greatest effort, and, no doubt, one of the best of all his works.

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**Percussion**, in medicine, that method of investigation which consists in striking gently on the surface of the body, and then endeavoring to ascertain from the sound produced the condition of the parts lying beneath. It forms a principal branch of modern medical diagnosis. Anatomy teaches how the organs enclosed in the cavities of the body are regularly formed, whether they are firm or loose in their texture, whether they are full or empty of air, whether they are tense or lax, etc.; and, according to these distinctions, a slight stroke will produce variations of sound, as may be ascertained by physical experiments made, not on the body, but on any kind of subject. Thence by a comparison of the sounds emitted on percussion with the information furnished by physiology as to the position and structure of any particular organ, and by pathology as to the morbid changes to which it is liable, an idea more or less distinct is obtained of the actual condition of the organ, and of the nature and extent of any disease which may be acting upon it. In a technical point of view percussion is either immediate or mediate. In the former a stroke is given with the ends of the fingers on the part of the body, either bare or slightly covered, which is to be examined; in the latter an intermediate substance, as a firm elastic plate or body of ivory, wood, gutta-percha, etc., called a pleximeter, is placed on the part in question, and the stroke is given on it either with the fingers or with a percussion-hammer. Much depends on the way in which the stroke is given, as its force and elasticity, as well as its direction, have much influence on the sound. It was introduced in modern times by Auenbrugger (q.v.), and was afterward adopted by Corvisart and Laënnec. The practice of it has extended throughout the medical world. Mediate percussion was invented by Piorry, and it has been carried to the highest perfection by Skoda and his pupils. See AUSCULTATION.

**Percy**, an ancient and noble English family, of Norman or Danish extraction, tracing their descent from Mainfred, who settled, before Rollo came to France, at Percy, near Villedieu. Its founder in England was William de Percy, called "Alsgernons" or "Algernon," "the mustachioed," who came over with William I. in 1066 (or 1067) and received lands in Lincolnshire, Essex, and Hampshire. His son Richard (about 1170-1244) signed the Magna Charta. The male line died out early in the 12th century, but Joscelin of Louvain, upon his marriage with Agnes de Percy, took the family name. Their direct descendant in the 6th generation was Henry Percy, 1st Earl of Northumberland



## PERCY — PERDIDO

who rebelled against Richard II., and then, with Henry IV., was defeated at Shrewsbury (1403), where his son Henry Percy, called "Hotspur," was killed, and at Barnham Moor, where he died (1408). Hotspur's son Henry (3 Feb. 1394–23 May 1455), 2d Earl of Northumberland, became Lord High Constable and fell on the Lancastrian side at St. Albans. Eight years later the 3d earl, again named Henry Percy (25 July 1421–29 March 1461), died at Towton, where he was defeated by the Yorkists. The 4th Earl Henry (1446–28 April 1489) was killed in a popular uprising directed against him. His son Henry Algernon (13 Jan. 1478–19 May 1527) served under Henry VII. and Henry VIII., holding important offices and escaping the jealousy of Wolsey. His son of the same name, the 6th Earl (1502–29 June 1537), had no children, and the title went to his nephew Thomas, 7th Earl of Northumberland (1528–72), a Catholic, whose religion made him distasteful to Elizabeth. He joined Westmoreland in behalf of Mary Queen of Scots, rebelled openly in 1570, and was beheaded at York 22 Aug. 1572. He was succeeded in the title by his brother Henry (1532–21 June 1585), was devoted to Elizabeth, assisted in suppressing the Catholic rising led by his brother, but after his execution followed his example, declared for Mary, was seized, tried for treason, fined and released, only to be arrested a second and a third time, being sent to the Tower in 1584. There he was mysteriously shot through the heart, probably by his own hand. His son Henry (1564–5 Nov. 1632) was accused of complicity in the Gunpowder Plot and was imprisoned for 16 years (1605–21) in the Tower, where he devoted himself to the sciences. His kinsman Thomas Percy, the actual organizer of the Gunpowder Plot, b. 1560; d. Holbeach 10 Nov. 1605; was educated a Protestant, but became an ardent Catholic, and with Guy Fawkes and others, having hired a house adjoining the Parliament house, stored gunpowder in the cellar, intending to destroy the members at the next session. His plot was discovered and he escaped from London, but was pursued and killed. The 10th Earl of Northumberland, Algernon Percy (October 1602–13 Oct. 1668), was the third great earl. He attempted in vain to reform the navy under Charles I.; sided with the opposition in the Long Parliament, but was in favor of peace throughout the civil war and took no part in public affairs during the Commonwealth; and advanced the cause of the Restoration. His son Josceline (4 July 1644–21 May 1670) was survived by a daughter, later the Duchess of Somerset, whose son became Duke of Northumberland. Consult De Fonblanque, 'Annals of the House of Percy.'

**Percy, Florence**, the pen name of Elizabeth Akers Allen (q.v.).

**Percy, George**, English colonial governor: b. Northumberland, England, 4 Sept. 1580; d. England March 1632. He entered the army, served in the Netherland wars and in 1600 came to America where in 1609 he succeeded Captain John Smith as governor of Virginia, retaining the office until Sir Thomas Gates arrived from England in 1610, when he became a member of the governor's council. From March 1611 to May 1612 he acted as deputy governor and in 1612 returned to England where he again served in the wars in the Low Countries. He was

a man of much courage as a soldier and showed ability in administering the affairs of the colony when in his charge. He wrote: 'Discourse of the Plantations of the Southerne Colonie in Virginia' (1606); and 'A Trewe Relaycion of the Proceedings and Occurentes of momente . . . in Virginia . . . 1609–1612' (1625).

**Percy, Thomas**, English prelate and antiquary: b. Bridgenorth, Shropshire, 13 April 1729; d. Dromore, Ireland, 30 Sept. 1811. He was graduated at Oxford in 1753, and after taking orders in the English Church was vicar of Easton Maudit, Northamptonshire, 1753–78. In 1778 he was raised to the deanery of Carlisle, which he resigned in 1782 for the Irish bishopric of Dromore. He is best remembered by his 'Reliques of Ancient English Poetry'; and a poem, the 'Hermit of Warkworth.' Many of the pieces in the 'Reliques' were retouched, recast, and, when fragmentary, completed, almost always with great taste. The work was published in 1765, and materially helped to give a more natural and vigorous tone to English literature. Percy was well skilled in the Icelandic and several of the Oriental languages, especially in Chinese, from which he made some translations. He also published a curious domestic record, long extant in the Percy family, and known as the 'Northumberland Household Book'—a document valuable for the light it throws on the manners of a bygone age.

**Percy Anecdotes**, a collection of popular anecdotes published in monthly parts (1820–3). They were assumed to be from the pens of "Sholto and Reuben Percy, Brothers of the Benedictine Monastery of Mount Bengier." The real names of the authors were Thomas Byerley (d. 1826), first editor of the 'Mirror of Literature,' and Joseph Clinton Robertson (d. 1852), editor of the 'Mechanics' Magazine.' The Percy coffee house in Rathbone Place, London, was the customary place of meeting of Byerley and Timbs, and the series derived its name from this circumstance. A new edition of the 'Percy Anecdotes' in 4 volumes appeared in 1887.

**Perdiccas**, pēr-dīk'as, Macedonian general: d. near Memphis, Egypt, 321 B.C. He was descended from the royal house of Orestis, a Macedonian province, attached himself to the court of Philip and was a member of that ruler's bodyguard at the time of his assassination. He fought in all the important campaigns of Alexander, and for his services at Susa received a crown of gold and the daughter of a satrap of Media for his wife. At Alexander's death Perdiccas received from him his signet ring, the symbol of royal power, and was placed in command of the military forces by the new sovereign Arrhidæus over whom he soon gained a paramount influence, practically controlling the government. War was at length declared against him by Antipater, Craterus, and Ptolemy. Perdiccas thereupon marched into Egypt to meet Ptolemy and was slain by his own soldiers.

**Perdido**, pēr-dī'dō (Sp. pēr-ťhē-ťhō), a river and bay which form the western boundary of Florida, separating it from Alabama. The river rises in southwestern Alabama and flows south into the bay. The bay is entirely land-locked and its outlet into the Gulf of Mexico is so small, and enters at so acute an angle with the line of coast, as to be almost undistinguishable



from sea, from which circumstance the river and bay probably derived their Spanish name *Perdido*, or "lost." There are generally but four or five feet of water on the bar at its mouth. The river and bay were from an early period the boundary between the French colony of Louisiana and the Spanish colony of Florida, and were claimed as the eastern boundary of the territory acquired by the United States by the Louisiana purchase in 1803. The question was not settled till the cession of West Florida to the United States in 1819.

**Père Goriot, Le**, lê pâr gō-rê-ō, a novel by Honoré de Balzac, published in 1835. It is one of the most painful of modern fictions and is in substance the history of a modern Lear. Crowded with incidents, and made profoundly interesting by its merciless fidelity of characterization, 'Père Goriot' compels attention; while in style it is one of the most brilliant of Balzac's long succession of novels.

**Peregrinus, Petrus**, otherwise Pierre de Maricourt, writer of the earliest treatise on the magnet, A.D. 1269. He owes his surname to the village of Maricourt in Picardy and the appellation Peregrinus, or Pilgrim, to his having visited the Holy Land. Little is known of his life save that he was a man of academic culture and a leader in experimental philosophy, that he was greatly admired by his contemporary, Friar Bacon, and that he served in the engineering corps of the French army which laid siege to Lucera in southern Italy in 1269. It was in the midst of his warlike duties at Lucera that Peregrinus sought to construct a motor which would keep the orrery of Archimedes in continuous rotation for a definite time; and in the course of this work, he was led to the consideration of perpetual motion itself with the result that he showed diagrammatically and to his own satisfaction how a wheel might be kept in movement forever by magnetic attraction.

To explain this magnetic motor, the first of its kind the world had ever heard of, Peregrinus wrote a letter of 3,500 words — the 'Epistola ad Sigerum' — from the trenches at Lucera to one Sigerus, a friend of his at home, in which he expounds clearly and methodically the properties of the magnet, many of which he himself had discovered. The letter is one of great interest in physics, geodesy and navigation. In it Peregrinus assigns a definite position to the poles (he uses the term) of a lodestone, and shows how to determine which is north and which south; proves that unlike poles attract and similar ones repel each other; breaks a magnet into pieces and finds that each fragment, however small, is a complete magnet; recognizes that a pole of a magnet may neutralize a weaker one of the same kind and even reverse its polarity; and crowns his work by supporting his magnets on a pivoted axis instead of floating them on corks or in glass vessels, as previously done, and by surrounding them with graduated circles; all this 50 years before Flavio Gioia of Amalfi invented his form of the mariner's compass which brought him fame.

Of manuscript copies of the 'Epistola,' the Bodleian library has six; the Vatican two; Trinity College, Dublin, one; the Bibliothèque Nationale, Paris, one; Leyden, Geneva, and Turin, one each.

The first printed edition came from the presses of Augsburg in 1558, having been prepared by Achilles Gasser, a physician of Lindau who was well versed in mathematics, astronomy, history and philosophy. Libri published another in his 'Histoire des Sciences Mathématiques en Italie,' (1838), as did Bertelli in the 'Bulletino di Bibliografia e di Storia delle Scienze Matematiche et Fisiche' (1868), and Hellmann in his 'Rara Magnetica' (1898).

Bertelli not only gives the Latin text, but collates and compares the readings of the Vatican codices with other manuscripts, adding copious references, critical remarks, etc.

Of translations, we have one by Prof. Silvanus P. Thompson (London 1902), and another by Brother Arnold of Manhattan College (New York 1904). **BROTHER POTAMIAN, Manhattan College, New York.**

**Pereira da Silva**, dā sēl'vā, **Joao Manuel**, zhō-own ma'noo-ēl, Brazilian historian: b. Rio de Janeiro, Brazil, 30 Aug. 1817. He was educated in Brazil and in Paris, admitted to the bar of Rio Janeiro in 1814 and practised law successfully. In 1844 he was elected to Congress, where his course has been conservative. As a historian he has gained a wide reputation; among his works are: 'Historia da fundação do imperio Brasileiro' (1864-8); 'Plutarcho Brasileiro' (1866); 'Obras politicas e literarias' (1868); 'Republica dos Estados do Brasil Floriano Peixoto' (1894); etc.

**Péreire**, pā-rār, **Jacques Emile** (b. Bordeaux 3 Dec. 1800; d. Paris 6 Jan. 1875); **Isaac** (b. Bordeaux 25 Nov. 1806; d. 12 July 1880), French bankers. They gained an immense fortune through the organization of the Paris and Saint Germain Railroad and afterward engaged in vast speculations. They founded the Société du Crédit mobilier in 1852 (see CREDIT MOBILIER), and upon its becoming bankrupt contributed \$16,000,000 to aid its reorganization. They greatly built up trade between France and America and through their efforts lines were established to South America, Mexico, and the West Indies. They were the founders of a maritime company in 1855 which subsequently became the Compagnie générale transatlantique.

**Perez**, pā-rās, **Pedro Ildefonso**, Mexican poet: b. Merida, Yucatan, 23 Jan. 1826; d. there 21 Feb. 1869. He was self-educated, entered the employ of the government when very young, meanwhile continuing his study of literature, particularly the works of the Spanish poet Zorrilla. In 1849 he was one of the founders of the Academy of Science, and at his death was a member of the government council and controller of the treasury of his native state. His work was long in gaining recognition and the best of it was published in the literary journals 'Mosáico' and 'Pensamiento.' A collection of his poems was published in 1885. Among his works are: 'La Ida del Sol'; 'A Tunkas'; 'El Prisma de la Vida'; etc.

**Perez-Galdos**, pā-rāth gāl'dōs, **Benito**. See GALDOS, BENITO PEREZ.

**Perez de Zambrana**, pā-rās dā sām-brā'nā, **Luisa**, Cuban poet and novelist: b. El Cobre, Cuba, 1837. She married a prominent Cuban physician, Dr. Zambrana, in 1858, two years



## PERFECT NUMBER — PERFUMES AND PERFUMERY

after the publication of her first volume of poems. Her second collection of poetry appeared in 1860 and received much favorable criticism, portions being translated into French and Italian. Her novels have also attracted attention and among them are: 'Angélica y Estrella'; 'La hija del Verdugo'; etc.

**Perfect Number.** See ARITHMETIC.

**Perfectab'ilists.** See RELIGIOUS SECTS.

**Perfec'tionists.** See NOYES, JOHN HUMPHREY; ONEIDA COMMUNITY; RELIGIOUS SECTS.

**Perfumes** (pèr'fūnz or pèr-fūnz') and **Perfum'ery.** Perfumes are fragrant substances obtained from vegetable and animal life, which are prepared for use by combining them with inodorous materials, as grease, spirits, starch, soaps, snuffs. These substances are also used in the preparation of cosmetics, dentifrices, pastes, tinctures, incense, pastils, pomades, oils, hair washes and dyes, depilatories, and other toilet appendages.

**History.**—Perfumes of various sorts have been held in high estimation from the most ancient times. The Egyptians prepared them for various purposes; for embalming the dead, as offerings to the gods, and for domestic uses. They anointed their bodies with sweet-scented oils, which they also poured upon the heads of newly arrived guests. In the Bible frequent reference is made to the use of perfumes by the Hebrews. The Phœnicians, Assyrians, and Persians are known to have made great use of them; Tyre was a famous mart where they were exported by sea, as Babylon was for the supply of the interior. The art was practised to an extraordinary extent by the Greeks and Romans. The odor of perfumes was an offering to the gods; after bathing and in their athletic exercises the Greeks applied them liberally to their persons. Their wines were perfumed by infusing in them roses, violets, and hyacinths. Pliny gives a full account of the great variety of perfumes used by the Romans under the emperors. The use of perfumes was introduced by the Arabs into Spain. In the Middle Ages, France and Italy were most conspicuous for the use and manufacture of perfumes. Incense and fragrant tapers were consumed in the Church even as far back as the baptism of Clovis, 496. Charlemagne used perfumes, and Philip Augustus granted a charter to the master perfumers in 1190. Alcoholic perfumes are supposed to have been first made in the 14th century; the first of these of which we have an account is Hungary water, distilled from rosemary in 1370, by Queen Elizabeth of Hungary, who received the receipt from a hermit, and by the use of it is said to have preserved her beauty to old age. When Catherine de' Medici went to France she was accompanied by a famous Florentine perfumer named René, and ever since that time the French have made great progress in the art. In Europe at the present time the manufacture of perfumes is carried on in Paris and London, and in various towns near the Mediterranean, especially in the south of France. Certain districts are famous for their peculiar productions; as Cannes for its perfumes of the rose, tuberose, cassia, jasmine, and the neroli extracted from the leaves of the bitter orange; Nîmes for thyme, rosemary, aspic, and lavender; Nice for the violet and mignonette; and Sicily

for the lemon, bergamot, and orange. England claims the superiority for her lavender and peppermint; these herbs being cultivated upon a large scale at Mitcham in Surrey, and at Hitchin in Hertford. The celebrated perfumer Eugene Rimmel groups the scents mostly used in perfumery under 18 kinds, represented by the following types: rose, jasmine, orange-flower, tuberose, violet, balsam, spice, clove, camphor, sandal, citrine, lavender, mint, aniseed, almond, musk, amber, and fruit flavor.

**Vegetable Perfumes.**—The most ancient of the odoriferous bodies are the gum-resins which exude naturally from the trees which yield them, or from wounds accidental or purposely inflicted to increase the yield. The most important are benzoin, myrrh, opoponax, tolu, Peru, and storax. A second group which are procured by distillation, and are mostly fluid bodies, are termed volatile oils, essential oils, or ottos—formerly quintessences. Odor-bearing plants contain the fragrant principle in minute glands or sacs; these are found sometimes in the rind of the fruit, as the lemon and orange; in others it is in the leaves, as sage, mint, and thyme; in wood, as rosewood and sandalwood; in the bark, as cassia and cinnamon; in seeds, as caraway and nutmeg; in yet others in the petals, as in rose, lavender, or ylang-ylang. The odor principle of orris is a solid resembling cocoa-butter, and is contained in what is really the rhizome of *Iris florentina*, though technically called orris-root. These glands or bags of fragrance may be plainly seen in a thin-cut stratum of orange-peel; so also in a bay leaf, if it be held up to the sunlight, all the oil-cells may be seen like specks. All the fragrance-bearing substances yield by distillation an essential oil peculiar to each; thus is procured oil of patchouli from the leaves of the patchouli plant (*Pogostemon patchouli*), a native of Burma; oil of caraway, from the caraway-seed; oil of geranium, from the leaves of the *Pelargonium roseum*; oil of lemon, from lemon-peel, *Citrus limonis*; and a hundred of others of infinite variety.

**Animal Perfumes.**—There are four odors of animal origin used in perfumery—namely, musk (q.v.), ambergris (q.v.), civet (q.v.), and castor (q.v.). The aroma of musk freely imparts odor to every body with which it is in contact. Its power is such that polished steel will become fragrant of it if the metal be shut in a box where there is musk, contact not being necessary. In perfumery manufacture tincture of musk is mixed with other odorous bodies to give permanence to the more evanescent perfumes or bouquets, the musk acting to them almost as a mordant does to a dyestuff. The usual statement as to the length of time that musk continues to give out odor is exaggerated. If fine musk be spread in thin layers upon any surface, and fully exposed to a changing current of air, all fragrance, it is said, will be gone in from 6 to 12 months. The finest musk, that which indeed is only really useful in perfumery, is distinguished as Tonquin musk, the average price of which is about \$25 per ounce. Civet is exceedingly potent as an odor, and when pure, and smelled at in the bulk of an ounce or so, is utterly insupportable from its nauseousness; in this respect it exceeds musk. When, however, civet is diluted so as to afford but minute quantities to the olfactories, then its sweet perfume is generally admitted; the fragrant



## PERFUMES AND PERFUMERY

principle is the same as that breathed by the beautiful narcissus. Civet is extensively used duly attenuated in perfumery. Its powerful and lasting odor enables it to be used in some soaps, and especially in sachets. It is one of the perfumes of "Spanish leather," or *Peau d'Espagne*; the first gloves used in England were scented with it. Several thousand ounces are annually imported, the average price of which is about \$3 per ounce. Castor, although it cannot be largely used in any given perfume on account of the almost blackness of its tincture, when properly diluted is extensively employed. Its perfume, when old especially, is exceedingly pleasant, and its fixing power is at least equal to that of musk. Its market price is about \$12 a pound.

*Manufacture of Natural Perfumes.*—By the improvements introduced during the first half of the 19th century, by Darcet, Leblanc, Robiquet, and Chevreul, the perfume industry has developed rapidly and extensively. The reduction of the chemistry of essential oils to an exact science, and the simplification of the machinery employed, have done much for the industry, particularly in France. The preparation of all natural perfumes requires the exercise of the most delicate care. If, for example, the essence is contained in the flower, the perfume finally obtained will vary considerably with the age of the flower, with the atmospheric conditions at the time it was plucked, and with the process of extraction employed. It may happen, therefore, that instead of the exquisite aroma which is exhaled by the plant, an odor is obtained totally lacking in delicacy. No little skill, experience, and knowledge are required in the art of making perfumes. Nevertheless, certain general methods are employed which may here be roughly outlined. The process of infusion is employed for iris, musk, civet, benzoin, and the like. The odorous substances are macerated with alcohol, thus forming tinctures. The process of expression is employed to a certain extent in the making of citron, orange, and bergamot perfumes. If the flowers can be gathered in abundance, the essential oil is obtained simply by squeezing the fruit with the hand. In Calabria, Italy, the expressed residue is afterward distilled with steam; but the essential oil thus extracted is of an inferior quality. The process most widely employed is that of distillation, which is resorted to for the extraction of essences that neither a high temperature nor aqueous vapor can appreciably decompose. Rosemary, thyme, ylang-ylang, roses, patchouli, lavender, cedarwood, and sandalwood are thus treated. Long experience has shown that there are certain theoretical conditions which should obtain in practice. Among these conditions may be mentioned the picking apart of the flower to facilitate the diffusion of the essential oil; the treatment of proper quantities to obtain stronger products; distillation, gradually increased in violence by increasing the heat at the end of the process; the evacuation of the vapors with the utmost rapidity; and quick condensation. The apparatus used for the purpose of attaining these objects vary in form almost infinitely. The use of fixed solvents depends upon the property which fatty substances have of absorbing perfumes by contact with fragrant bodies. If the cold process is employed, absorption, or *enfleurage*, as it is called by the French, is chiefly made use of for procuring the

odoriferous principle of very delicate flowers. If the hot process be employed, in which case water or steam baths are used, maceration is resorted to. Either glycerine or, as is usually the case, vaseline can be employed. In the manufacture of extracts the flowers are treated with alcohol until the essence is entirely removed. Although most of the fragrant flowers which form the basis of natural perfumes are grown in the vicinity of Grasse, Cannes, and Nice, nevertheless almost every quarter of the globe pays its floral tribute to the perfume makers of France. The distilleries of essential oils in the department of Alpes-Maritimes use annually 5,500,000 pounds of orange blossoms; 4,400,000 pounds of roses; 440,000 pounds of jasmine; 330,000 pounds of violets; and an equal quantity of cassia and tuberose. In Basse-Alpes, Gard, Drôme, Hérault, and Var 220,000 pounds of lavender essence; 88,000 pounds of thyme essence; 55,000 pounds of rosemary essence, and the same quantity of aspic essence are annually manufactured. Furthermore, the environs of Algiers, Staouëli, the plain of Mitidja and Boufarik (Algeria), annually send to France a contingent of 13,300,000 pounds of geraniums.

*Manufacture of Artificial Perfumes.*—The first synthetic perfumes were discovered by Cahours, Grimaux, and Lauth; but the industry of artificial aromatic products hardly developed until the last part of the 19th century. The industry took its sudden rise after the remarkable synthesis of vanillin by Tiemann and Haarman. By artificial perfumes French and German chemists usually mean compounds formed entirely from artificial substances, and aromatic products obtained by the manipulation of natural essences. The methods of preparing artificial perfumes are of great theoretical simplicity; but in practice they are exceedingly difficult of application. Indeed, the principles underlying the preparation of artificial perfumes are by no means well understood. For alcohols, Haller has shown that succinct anhydrides are to be preferred. In the case of ether, the resultant alcohol is saponified and then re-etherized by means of an acid combined with the essential oil. The alkaline bisulphites are used in the treatment of aldehydes and ketones, which are separated from the compound formed by means of an acid or alkali. For the phenols, potassium is used, and the salt obtained is decomposed by means of an acid.

Among the more important nitrated derivatives, the first place should be given to the artificial musk invented by Albert Baur. This ingenious German chemist prepares his substitute for the costly natural musk by heating a mixture of isobutyl chloride and toluene with aluminum chloride. Water is added to the product of this reaction; the compound is subjected to distillation; and the distillates which pass over at a temperature between 170° and 200° C. are collected. These distillates are then treated with nitric and sulphuric acid; the product is washed with water, and when treated with alcohol yields crystals having a marked odor of musk. This same characteristic odor has been encountered in many of the benzenes. The compound most widely used in commerce is the compound invented by Baur, and the ketone musk which Malleman obtained by nitrating ketones with butyltoluene. More recently trinitro-butylxylene has been used as a substitute



## PERGAMUS — PERIANDER

for natural musk. In the series of alcohols and ethers, terpine should be mentioned. This compound is prepared by hydrating terpenes. Terpine is much used by perfumers, by reason of its strong odor of syringa. It is often mixed with heliotropine, the two blending well. Among the phenols, thymol, discovered by Doveri in the essence of thyme, but also extracted from other essential oils, is of extreme importance. In obtaining this aromatic compound, the essential oil of *Ajowan ptychocis* is agitated with soda lye. The mixture is allowed to settle, and the liquor is then decanted. Employed as an antiseptic, thymol finds its chief value as an ingredient of medicinal soaps. Vanillin is both an aldehyde and a phenol. Many ways have been devised for its preparation; but they are all more or less modifications of two methods—synthesis of benzene derivatives which are of slight scientific interest, and the oxidation of natural compounds, which is of more importance from an industrial point of view. Vanillin is employed not only by perfumers, but also by bakers and cooks, as a substitute for the vanilla of nature. Up to the present time it must be confessed that artificial perfumes have not curtailed the production of natural oils and pomades. At first it seemed that synthetic perfumes would result in cutting down the price of the natural product. But experience has shown that artificial essences, by reason of their coarseness, have not been able to dethrone natural perfumes in popular favor. Scientists, ingenious though they may be, have not as yet completely succeeded in reproducing the delicacy of nature.

**Formulas.**—Among popular perfumes the formulas for their preparation by other than the professional perfumer, are as follows: "Jockey Club Bouquet": 2 gallons extract of orris;  $\frac{1}{2}$  gallon each of cassia, rose, and tuberose pomades;  $\frac{1}{2}$  gallon civet;  $\frac{1}{4}$  gallon musk;  $1\frac{1}{2}$  gallons spirits of wine; 8 ounces bergamot otto;  $1\frac{1}{2}$  ounces rose. "White Rose": 2 pints extract rose pomade; 1 pint each cassia and jasmine;  $1\frac{1}{2}$  pints spirits of wine;  $\frac{1}{2}$  ounce rose otto; 1 dram patchouli otto. Formulas for lavender water and eau de cologne are as numerous as the leaves of Vallambrosa, and as varied as the fragments of a rainbow; but the following recipe yields a lavender water of fine fragrance, and is one of the best that can possibly be made:

English lavender otto.....	2	fl. drachms
Bergamot otto .....	1	fl. drachm
Rhodium otto .....	5	minims
Rose otto .....	10	minims
Ambergris .....	5	grains
Tonquin grain musk.....	$1\frac{1}{2}$	grains
Alcohol (90 per cent).....	10	fl. ounces

Mix, macerate for one month, and keep for two or three months before using.

Consult Piesse, 'Art of Perfumery' (1891).

**Pergamus**, pēr'gā-mŭs, or **Pergamum**, Asia Minor, an ancient city of Mysia, the modern Bergama, on the north bank of the Caicus, about 15 miles from the sea. Behind the town, on a conical hill, rose the acropolis, which was the original nucleus of the place. It was founded by emigrants from Greece, and first rose to importance about the commencement of the 3d century B.C., when it became the capital of an independent state, founded by Philetærus, who had revolted against his master Lysimachus, one of

the successors of Alexander the Great. A succession of monarchs reigned over the city and territory till 133 B.C., when Attalus III. bequeathed on his death-bed his kingdom to the Romans, and it subsequently became a Roman province. Under the Byzantine emperors the prosperity of the city rapidly declined. Pergamus was one of the most magnificent cities of antiquity, and was principally indebted for its architectural splendors to Eumenes II., who likewise founded the celebrated library of Pergamus, which was inferior in extent and value only to that of Alexandria. It was also famous for its manufacture of parchment, which derives its name (*Pergamena charta*) from this place. In ecclesiastical history it is memorable as one of the seven churches of Asia referred to by Saint John. Excavations carried out on the site in 1878-86 resulted in the discovery of splendid architectural and sculptural treasures.

The modern city of Bergama on the plain at the foot of the acropolis has a population of about 20,000 inhabitants. Consult Dörpfeld, 'Die Ruinen von Pergamon' (1902); Hachtmann, 'Pergamon' (1900); Pontremoli and Collignon, 'Pergame' (1900).

**Pergolesi**, Giovanni Battista, jō-vān'nē bāt-tēs'tā pēr-gō-lā'sē, Italian musical composer: b. Jesi near Ancona, 3 Jan. 1710; d. Naples 16 March 1736. In the Conservatory of the Poveri di Gesu Cristo at Naples he was initiated by Gaetano Greco in the mysteries of his art, and while a pupil there composed his sacred drama 'San Guglielmo d'Aquitania,' produced in 1731. About this time he wrote in addition to several operas, a famous intermezzo, or operetta, 'La Serva Padrona,' whose original indifferent reception was Pergolesi's greatest popular success, but which later became the basis of all Italian comic opera up to Rossini's time. In 1734 he was appointed chapel-master of the Church of Loreto. In 1735 he was invited to Rome to compose the opera 'd'Olimpiade' for the theatre Tordinone. It met with no applause, while Duni's opera of 'Nerone,' performed at the same time, and far inferior to it, was lauded to the skies. Ill health compelled him afterward to take up his residence at Pozzuoli, where he finished his celebrated 'Stabat Mater.' In addition to the above works he composed masses, a 'Kyrie cum Gloria,' and other church music; 30 trios for two violins and violoncello; and 'Orfeo,' a cantata. His posthumous recognition was somewhat exaggerated; but his achievement, despite his general lack of science, was considerable. Consult the study by Schletterer (1880).

**Pe'ri**, in Persian mythology, the descendants of fallen spirits excluded from paradise until their penance is accomplished. They belong to the family of the genii or jinn, and are constantly at war with the Devs (the evil jinn). They are immortal, and spend their time in all imaginable delights. They are male and female, the latter being of surpassing beauty.

**Periagua**, pēr-ī-ā'gwā. See PIROGUE.

**Periander**, pēr-ī-ān'dēr, Corinthian tyrant: d. about 585 B.C. He was a son of Cypselus, whom he succeeded about 625. His reign was at first mild but he soon developed into a tyrannous and oppressive ruler, though he was a patron of the arts and was reputed to be one of



## PERIANTH — PERICARDIUM

the Seven Wise Men of Greece. He put to death his wife Melissa, daughter of Procles, the tyrant of Epidarus, which circumstance when afterward related to her younger son Lycophron thoroughly alienated him from his father. Periander knowing Procles to have told his son of the mother's fate, thereupon made war upon Epidarus, reduced it, and took Procles prisoner. He then endeavored to make peace with his son, who resided at Corcyra, and proposed to visit him, whereupon the Corcyreans put Lycophron to death in order to avert the visit. His rule extended over Corcyra, Ambiacia, Leucas, and Anactorium, beside his kingdom of Corinth. He was said to have died of a broken heart over his son's death.

**Per'ianth**, in botany, the floral envelopes, the calyx and corolla, or either, especially when the calyx and corolla are combined so that they cannot be satisfactorily distinguished from each other, as in the tulip, orchis, etc. See FLOWER.

**Peribon'ka River**, Canada, an affluent of Lake Saint John, in the province of Quebec, over 400 miles long. It flows from about lat. 52° N., southward through a forest and lake region, Manonan being the chief lake along its course.

**Pericardi'tis**, inflammation of the pericardium, the membrane enveloping the heart, essentially the same as inflammation of other serous membranes. It is either acute or chronic. In acute pericarditis the membrane is usually bright red with sometimes spots of ecchymoses, and is covered with layers of soft or firm fibrinous exudation (false membrane) of varying thickness. Generally there is an effusion of flaky serum varying from a few ounces to a pint or more, which sometimes is sanguinolent. Rarely is pus present. If the serum is small in amount, or is absorbed, the sides of the pericardial sac adhere to each other in portions or entirely. Serum may distend the sac pulling apart adhesions into thread-like bands (hairy heart). Both serum and the exudate impede the action of the heart, especially if they are present in considerable amount. The principal causes of acute pericarditis are acute rheumatism and Bright's disease. It may also accompany pleurisy, pneumonia, erysipelas, and the continued and eruptive fevers. Sometimes it results from penetrating wounds or contusions. An instance is recorded where a set of false teeth swallowed by an intoxicated man, causing ulceration of the œsophagus, was forced into the pericardial sac, pericarditis resulting. It occurs most often before the 25th year, rarely after the 45th, and in about one sixth of the cases of acute rheumatism, is not, as popularly supposed, a transference (metastasis) of that affection, but a manifestation of it, due to the same condition of blood. When it appears in acute articular rheumatism, it occurs about the 6th day. The symptoms of acute pericarditis vary, depending on the amount of exudation and effused serum, and may be considered in connection with the three stages of the disease: (1) From the attack to the effusion, rarely beyond two days; (2) the stage of effusion; (3) stage of absorption. In the first stage there is more or less pain over the heart, increased by respiration; a shortened inspiration; generally a dry irritable cough, and some tenderness; sometimes there is distress rather than pain. The

action of the heart is increased; there is fever, anorexia, and debility. When effusion occurs, pain and soreness are less. If there is much serum, symptoms of pressure upon the heart and irregular action of that organ appear, with a feeling of weight, faintness on exertion, a feeble and irregular pulse, dyspnoea, a feeble voice, sometimes vomiting, dysphagia, and mental disturbances. The detection of acute pericarditis is sometimes difficult, especially if associated with pleurisy or pneumonia. To the physician it is revealed by the precordial or cardiac friction-murmur, by an increased area of normal dulness, and by the exclusion of the symptoms of other affections. The prognosis varies with the extent and character of the inflammation and its products, and also with the resisting powers of the patient. Sometimes the disease is mild and recovery occurs; often it is dangerous, death occurring in a day or two from paralysis of the heart, or within a week or two from impaired and, it may be, poisoned blood. Even if recovery takes place from a moderately severe attack, the action of the heart is usually impeded more or less for a variable time by the contracting fibrinous exudation. It must be borne in mind that very frequently endocarditis is associated with pericarditis. The treatment demands rest, soothing applications, freedom from excitement, and the relief of pain by remedies that do not disturb the heart's action or lower the strength of the body. Extensive serous effusion may have to be removed surgically.

Chronic pericarditis is usually one of the results of an acute inflammation following it after two or three weeks, but it may exist independently as a subacute affection from the outset. Generally there is little or no effused serum, but there are several layers of fibrinous exudation. Sometimes liquid distends the sac. Pus is rare. Usually there is little pain; but the heart is feeble; circulation is poor; dyspnoea is common, especially on exertion. If the lung is compressed, blood-tinged mucus may be expectorated. The prognosis is unfavorable. The treatment of chronic pericarditis requires tonics, saline laxatives, and attention to hygienic measures.

**Pericar'dium**, the investing fibro-serous sac or bag of the heart in man and other animals. In man it contains the heart and the origin of the great vessels. It lies behind the breast-bone, between the pleuræ and from the third to the seventh ribs. Its apex or smaller extremity is directed upward, and at this point it encloses the great blood-vessels about two inches above their origin from the heart. The base of the pericardium is fixed to the central tendon of the diaphragm or midriff. It rests upon the bronchi, the gullet, and the descending aorta, behind; while the margins of the lungs overlap it in front. The sac consists of two layers, an outer or fibrous and an inner or serous layer. The fibrous layer is continued upward on the great blood-vessels, and gradually merges into their outer coats. Its inner or serous layer, which directly invests the heart, is reflected over the inner surface of the fibrous layer; and it therefore consists in reality of two layers or portions—a visceral portion, surrounding the heart, and a parietal portion, reflected on the fibrous layer. A single fold of the serous layer



## PERICLES — PERIDOT

of the pericardium encloses the aorta and pulmonary artery. The inner surface of the membrane secretes a serous fluid, which in health is present only in sufficient quantity to lubricate the heart, and so to facilitate its movements within the sac. The pericardium is liable to various serious forms of diseased action. Of these pericarditis (q.v.) is the most common. See HEART.

**Pericles**, pĕr'ī-klēz (Greek, Περικλῆς) Greek statesman, whose age was the most flourishing period of Grecian art and science: b. Athens about 493 B.C.; d. there 429 B.C. Damon, Anaxagoras and Zeno of Elea were his instructors. It was thought that from Anaxagoras Pericles derived the elevation and independence of mind and the remarkable eloquence which characterized him in his public life. In 469 he entered upon his career as a statesman. Up to this time only the nobler and more influential citizens had held control of the important offices. Pericles accomplished the absolute democratization of the state. At once he proclaimed himself champion of the popular party, in opposition to Cimon, the aristocratic leader, and won favor by the legislation which he effected. Thus, he brought about the enactments that citizens serving as soldiers or as judges in the courts of the *Heliaea* should be paid; and that the public treasury should provide the two oboli charged for admission to the theatre at the Dionysia for such citizens as could not afford them. In 462-1, through Ephialtes, he introduced the measure by which the Areopagus was deprived of all those valuable political powers which made it antagonistic to his own success. Cimon was disposed of by being ostracized, and conservative resistance was slight. Subsequently Pericles himself obtained the return of his opponent, who died in 449. For 30 years Pericles was undisputedly the foremost personage of Athens. Popular allegiance was strengthened by further changes. A salary was attached to the archonship, and in course of time the office was made accessible to all citizens. All officials were eventually salaried. Poorer citizens were established in holdings in the Athenian colonies. The foreign policy of Pericles was based on the purpose of making Athens supreme in Greece. In 445 he won back the revolted island of Eubœa; in 441-440 he subdued Samos, Sophocles being among the generals of the expedition. During the ten years' interim preceding the Peloponnesian war, Pericles devoted his attention to increasing the maritime strength of Athens and to developing those plans of art which made Athens the wonder not alone of Greece but of the world. The funds obtained through the tribute of allies were applied to these designs. Among the temples and public buildings erected under his administration were the Odeum, the Propylæa, and that unapproached marvel of architectural skill, the Parthenon. The impetus thus afforded to the fine arts was notable. Phidias directed the general work upon the edifices. But while his personal achievement was very great, it is evident that that age must have been well supplied with architects, plastic workers, and decorators of admirable powers. The Parthenon sculpture, 50 colossal statues and 4,000 square feet of frieze and metope, could not all have been done by

Phidias, yet all is of about equal merit. These works diffused at Athens every sort of activity, and the consequent prosperity confirmed the influence of Pericles. The Peloponnesian war (q.v.) has been incorrectly ascribed to his ambition. Incorrectly, because, while he did urge resistance to Lacedæmonian demands, he did so because he saw that war was inevitable, and was convinced that as long as Athens retained the influence then possessed Sparta would never be content. At the commencement of the war (431 B.C.) Pericles recommended to the Athenians to turn all their attention to the defense of the city and to naval armaments rather than to the protection of their territories. Accordingly, as commander-in-chief, he allowed the superior forces of the Spartans and their allies to advance to Acharnæ, in Attica, without resistance, and at the same time sent a fleet to the shores of Peloponnesus, to Locris and Ægina, which took twofold vengeance for the ravages in Attica. After the Peloponnesians retired he invaded the territory of Megaris, which had been the cause of the war. At the end of this campaign he delivered a eulogy over those who had fallen in their country's service. The next year a plague broke out at Athens, which made such dreadful havoc that Pericles was obliged to summon all his fortitude to sustain his countrymen and himself. To occupy their attention he fitted out a large fleet and sailed to Epidaurus; but the mortality among his troops prevented him from effecting anything important. He returned with a small force; but the Athenians no longer put confidence in him. He was deprived of the command and obliged to pay a heavy fine, though no particular crime was charged against him. The people, however, soon recalled him and gave him more power than before. Pericles maintained a reserve quite unwonted among Athenian statesmen. Such was his dignity, according to Plutarch, that "the epithet Olympian—attached to his name by a rash and thoughtless crowd—" was "a worthy and becoming title." His oratory was very highly esteemed, and as a military commander he was able, though he did particularly seek distinction in that field. There is little doubt that his policy of personal government had for Athens injurious results. He had been the greatest man in the state, but had not encouraged a second; and at his death democracy was helpless and a prey to demagogues. His lofty ideals, however, and their influence, became a permanent part of civilization. There are accounts of him by Plutarch and Thucydides. Consult also Evelyn Abbott, 'Pericles, and the Golden Age of Athens' (1891); Frey, 'Leben des Perikles' (1889); Lloyd, 'The Age of Pericles' (1875).

**Pericles, Prince of Tyre**, a play written in part by Shakespeare, and published in 1609, but not included in the First Folio of 1623. It is presumed that Shakespeare remodeled to some extent an earlier play by Wilkins and Rowley and to him is assigned the authorship of Acts III. and V. and a part of Act IV. The play was very popular with the masses for a hundred years.

**Peridin'ium; Peridinidæ.** See REDWATER.

**Per'idot**, a pale, yellowish-green or pistachio-colored variety of chrysolite (q.v.). It is used as a gem, but is soft and difficult to polish. In New Mexico and Arizona it is found



## PERIDOTITE — PERIOD

abundantly in small grains or pebbles in the sands. From their form they are commonly known as "Job's tears." It is obtained also in Brazil and Egypt.

**Per'idotite**, a ferro-magnesian rock of which the essential constituent is olivine. It is of ultra-basic composition, is free from quartz and feldspar, and is generally considered to be of igneous origin, having been definitely proved to be so in some cases. With the olivine are associated more or less of the minerals augite, enstatite, magnetite, diallage, hornblende, chromite, and sometimes biotite. According to the kind of accessory mineral and its amount relative to the amount of olivine, the following varieties have been distinguished: dunite, saxonite, lherzolite, buchnerite, eulysite and picrite. Of these the first four appear in meteorites, as well as in terrestrial rocks, while the others have been discovered only in the latter. From the abundance of magnesia in the peridotites they are sometimes known as magnesian rocks, and because of being the richest in magnesia and poorest in silica of the terrestrial rocks they are considered as intermediate between these and rocks of meteoric origin. Their component minerals readily change by taking up water as the result of weathering into serpentine.

**Perier**, pā-rē-ā, **Casimir**, French politician: b. Grenoble 11 Oct. 1777; d. Paris 16 May 1832. He studied at the Oratorian college in Lyons, and then in Paris; fought in Italy in 1795; became a partner in his brother's bank; and was very successful in his varied business ventures, soon becoming a director of the Banque de France. He was elected to the House of Deputies in 1817, and made his mark there as a financier, but especially as a conservative. He sharply opposed the domestic policy of Polignac in 1829 and signed the 'Address of the 221.' He did not approve of the revolution of 1830 but acquiesced in it; served as minister in Lafitte's cabinet, but soon retired; in 1831 became prime minister, taking the portfolio of the interior; and in this office carried out what he called the "policy of the right mean" in domestic affairs, showing himself severe toward the republican opposition but insisting on his independence of the king—for instance in the matter of the meeting place of the cabinet, which he arranged should be at his home and not at the Tuileries. His foreign policy was "non-intervention"; but in 1832, in spite of the united opposition of the majority of his colleagues and the king, he sent an armed force to Ancona as a check on Austria's influence on the papacy. The awful cholera plague in Paris was met by strict sanitary measures devised by Perier and carried out under his personal supervision. In this work he was attacked by the plague, to which he fell a speedy victim, worn out as he was with overwork and anxiety. Consult: Castille, 'Casimir Perier' (1859); and Nicoullaud, 'Casimir Perier, Député de l'Opposition' (1894).

**Perigee**, pēr'i-jē, that point in the orbit of the moon which is at the shortest distance from the earth. See MOON.

**Périgord**, pā-rē-gōr, France, an ancient province forming part of the military government of Guienne and Gascony, now represented by Dordogne and part of Lot-et-Garonne. See FRANCE.

**Périgueux**, pā-rē-gé, France, capital of the department of Dordogne, on the right bank of the Isle, .68 miles east-northeast of Bordeaux. The chief buildings are a Byzantine cathedral with a lofty tower and five small cupolas, a handsome modern prefecture, a court-house, hospital, museum, library, barracks, and theatre. The manufactures are bombazine, serge, hosiery, cutlery, nails, pottery, liqueurs, spirits, leather; many hands are employed in cutting and polishing marble. One article of trade is the famous partridge and truffles (*pâtes de Périgueux*). Périgueux is the Vesunna of Cæsar, and near the town are the remains of a vast amphitheatre, of ancient aqueducts, baths, and temples. The Tour de Vésonne is a remarkable Roman structure, 67 feet high and 200 feet in circumference, with neither door nor window. Périgueux was one of the eight towns ceded to the Protestants in 1576. Pop. (1901) 28,875.

**Perihe'ion**, in astronomy, that part of the orbit of the earth or any other planet in which it is at the point nearest to the sun. The "perihelion distance" of a heavenly body is its distance from the sun at its nearest approach. The "perihelion longitude" and the "perihelion passage" of a heavenly body are other astronomical terms.

**Perim**, pā-rēm', British island in the Strait of Bab-el-Mandeb, 12° 40' N. and 43° 23' E., two miles from the Arabian coast and 12 miles from Africa. It has neither water nor vegetation and the entire island (about six square miles) is merely the remains of a great volcano. It was seized for the second time by the British in 1857, in spite of the protest of nearly all the Powers; has a fortress and lighthouse, built 1861, and a small garrison; and is a key to the Suez Canal. The harbor is excellent.

**Perinæ'um**, the outlet or floor of the pelvis, comprising muscles, blood-vessels, nerves, the lymphatic glands, the anus, and a portion of the vagina in females and the genital apparatus in males. It is somewhat triangular in shape and is bounded by the rami of the pubes and ischia, the tuberosities of the ischia, the sacro-ischiatic ligaments, and the apex of the coccyx. The portion between the pudendum and the anus is sometimes called the anterior perinæum, or triangle, and that between the anus and coccyx the posterior perinæum or triangle. The perinæum is sometimes ruptured or torn during the birth of a child, especially in primiparæ, and is sometimes the seat of operation for the removal of a stone from the bladder (perinæal lithotomy).

**Period**, in geologic chronology, a time interval the value of which has been variously interpreted. The special committee of the International Congress of Geologists at the Bologna meeting in 1881 recommended the use of the term period for the time division of second magnitude, that for the first being *era*. The rocks formed during this time period were to be grouped as a system. According to this usage we should have Cambrian, Ordovician, Silurian, Devonian, etc., periods. In this sense the term is used by the United States Geological Survey. Dana on the other hand uses *era* for this time division, giving *period* a subordinate rank—as Niagara period, Onondaga period, Lower Helderberg period. The New York State survey



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uses the term in nearly this sense but emphasizes more especially the threefold division of each era, that is, early, middle, and later Devonian periods, or early, middle, and later Cambrian periods. The dual nomenclature of geologic classification, that is, the separate grouping of the time divisions and of the corresponding rock divisions was first strongly urged in this country by Prof. Henry S. Williams of Cornell (late of Yale). He also proposed the use of the prefixes *eo*, *meso*, and *neo* for the periods. Thus he uses *Eosiluric*, *Mesosiluric* and *Neosiluric* periods. The New York State Survey has adopted these terms with the substitution of *palæo* for *eo*. Consult Williams, 'The Making of the Geological Time S. Cal.' (Journ. of Geol. I., 180-197); 'Dual Nomenclature in Geological Classification' (*ibid.*, II., 145-160); 'Geologic Biology' (1895); Clarke and Schuchert, 'The Nomenclature of the New York Series of Geologic Formations' (Science, 8 Dec. 1899), and 'American Geologist' (February 1900). See AGE; CENOZOIC; ERA; FORMATION; MESOZOIC; PALÆOZOIC; QUATERNARY; SECONDARY; SERIES; SYSTEM; TERTIARY.

**Periodic Law**, in chemistry, the law which teaches that the properties of the elements are periodic functions of the atomic weights; so that when the elements are arranged in the order of increasing atomic weights, similar properties recur periodically, as we proceed from one end of the array to the other. It had long been known that certain approximate numerical relations exist among the atomic weights of elements that have strikingly similar properties. For example, if we consider the three closely related elements lithium, sodium and potassium, we find that the atomic weight of sodium is almost exactly the arithmetic mean between the other two. Thus  $\text{Li} = 7.03$  and  $\text{K} = 39.15$ , the mean of which is 23.09; and the atomic weight of sodium is 23.05. Again, in the triad calcium, strontium and barium, we have  $\text{Ca} = 40$  and  $\text{Ba} = 137.4$ , the mean of which is 88.7; and the atomic weight of strontium is 87.6. The triad chlorine, bromine and iodine affords still another familiar example, for we have  $\text{Cl} = 35.45$  and  $\text{I} = 126.85$ , giving a mean of 81.15; and the atomic weight of bromine is 79.96. These relations, of whose precise significance we are still ignorant, forcibly suggest a relationship among the elements, similar (for example) to that prevailing among the paraffins in organic chemistry; for the paraffins all have analogous properties, and their molecular weights form an arithmetic series. In 1862 De Chancourtois conceived the idea of arranging all of the known elements along a helix, each element being represented by a point, whose distance from some fixed point, as measured along the helix, was numerically equal to the atomic weight of the element. He chose the unit of measurement, to be used in laying off the positions of the various points, so that a difference of 16 in the atomic weights of two elements corresponded to a complete turn of the helix. He then endeavored to show that similarity in properties in any group of elements corresponds to some simple geometric relation among the representative points. Chlorine, bromine and iodine, for example, are represented by points that lie sensibly upon a straight line parallel to the axis of the helix. De Chancourtois was primarily a mathematician and geologist,

and his contribution to chemical science did not receive the attention that it merited, until many years had elapsed. In 1864 and 1865, Newlands published two papers in which he exhibited the elements in a tabular array, following the order of increasing atomic weights approximately, but not without some slight transpositions. He pointed out that the elements in his scheme fall into groups, and he likened the members of each group to the notes composing one octave in music, calling the regularities which he pointed out the "law of octaves." In March 1869, Mendeléeff read a paper before the Russian Chemical Society, in which he examined the whole subject with great thoroughness, investigating the way in which various properties of the elements change with the atomic weights. His general conclusion was, that the measureable properties of the elements do not, as a rule, increase or decrease continuously as the atomic weights increase, but that they exhibit a species of periodicity, increasing and decreasing alternately, though apparently not with sufficient regularity to admit of representation by a definite mathematical expression. In 1870 Lothar Meyer, independently of Mendeléeff, published an important paper on the same subject, in which he showed that the periodicity of the "atomic volumes" of the elements is especially marked; "atomic volume" being defined as the quotient obtained by dividing the atomic weight of an element by the specific gravity of the element in the solid state. Meyer's diagram, with some changes and additions to bring it down to date, is presented in the accompanying engraving. The atomic weights of the elements are here laid off along a horizontal line, or "axis," and the corresponding atomic volumes are laid off vertically, according to the scale given at the left. In this way a series of points is obtained, corresponding to the respective elements; and through these points a broken line has been drawn, so that as we proceed along the line from left to right, we pass the different elements in the order of ascending atomic weights. The specific gravities of some of the elements, in a solid state, are not known, and those of others (such as nitrogen) are more or less uncertain, owing to the great experimental difficulties involved in their determination. Without doubt, therefore, Meyer's diagram will be still further modified, as our knowledge of the physical properties of the elements increases. There are five regions in the diagram, for which we possess no acceptable data concerning the specific gravities in the solid state, and for which, therefore, we do not know the atomic volumes. These regions are indicated by the dotted lines. In two places, also, the line passing through the representative points does not strictly follow the order of increasing atomic weights. Argon (A), for example, appears to have an atomic weight slightly greater than that of potassium (K), and yet there seems to be no doubt but that argon should precede potassium as we pass along the broken line to the right. Argon forms no compounds, and its atomic weight is known only by inference from its density; so that this trifling irregularity can hardly be considered serious. Again, tellurium (Te) precedes iodine (I) on the diagram, although the diagram shows the atomic weight of tellurium to be the greater by a trifling amount. The atomic weight of tel-

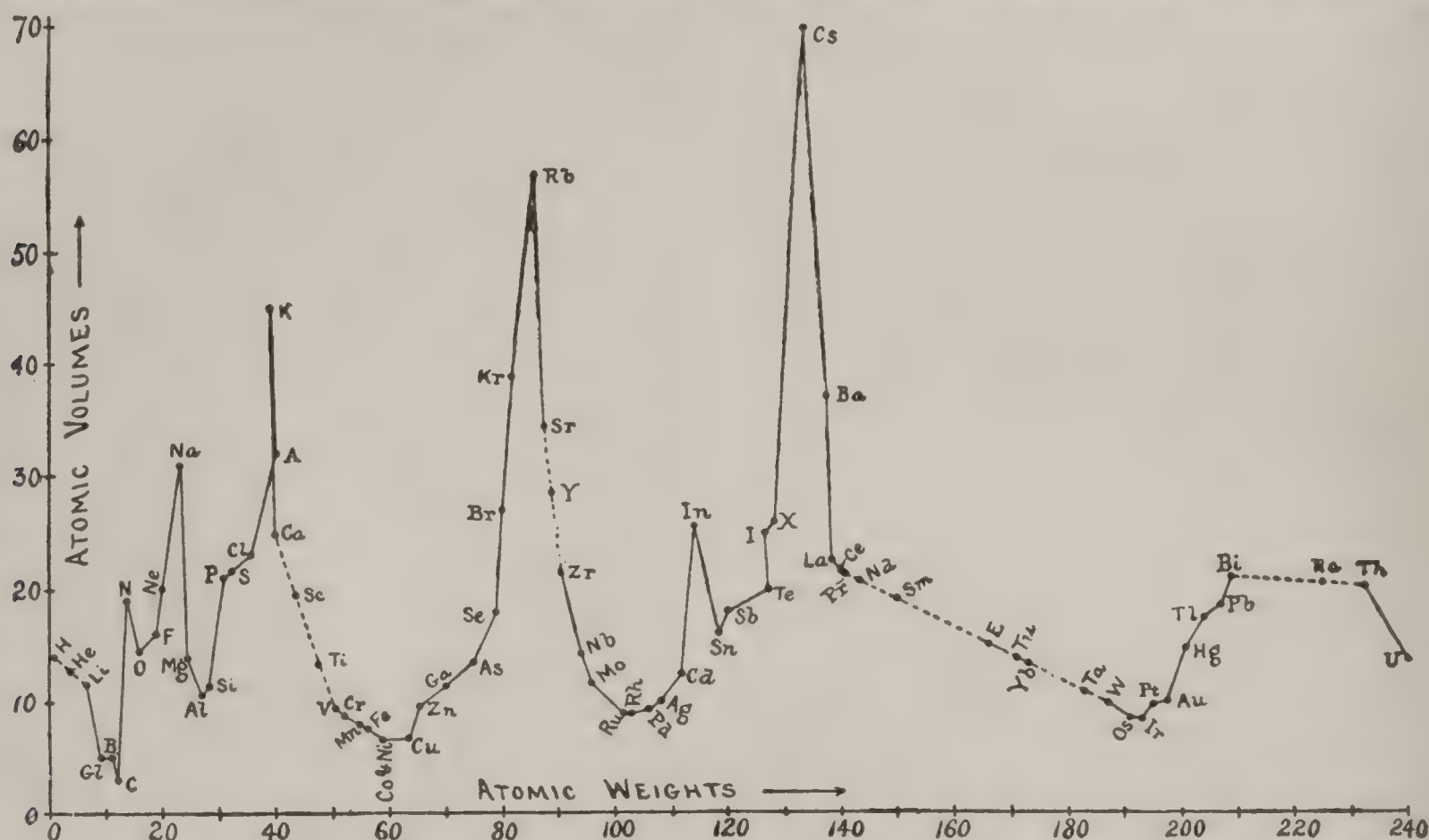


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lurium, however, is still more or less uncertain. According to some authorities, it is actually less than that of iodine, so that the slight discrepancy here shown disappears altogether.

It will be seen that the broken line exhibits a marked tendency to vary in height in a periodic manner, now rising to a strongly accentuated maximum height, and again sinking to a minimum that is less distinctly emphasized. The irregularities are doubtless due in part to the imperfection of our data; but many of them, without doubt, are real, and due to causes that we cannot yet understand. At the highest points of the diagram we find the metals of the alkalis,—sodium (Na), potassium (K), rubidium (Rb) and cæsium (Cs)—whose physical and chemical properties are strikingly similar. Passing down the line to the right of these several elements, the first points that we come to are those corresponding to magnesium (Mg), calcium (Ca), strontium (Sr) and barium (Ba), which also form a group with markedly similar properties.

“series,” each of which is entered upon one horizontal line. The atomic weights increase across the table from left to right. The elements in any one column are similar to one another in many ways, the resemblance being sometimes very striking. Copper, silver and gold, it will be seen, are entered both in the first group and in the eighth one. This is because their true positions are doubtful, some considerations indicating the first group, while others point equally well to the eighth. The eighth group is an anomalous one at best, for the metals that compose it are so similar that it appears necessary to arrange them in threes (or fours), each little group of this kind being considered as lying upon one and the same horizontal line of the table. “Didymium” is given in this table as an element, although it is believed to be compounded of two others (neodymium and praseodymium), which are omitted. Erbium is omitted altogether, partly because its position is uncertain, and partly because its elemental character is not yet really



Relation of Atomic Volumes to Atomic Weights, according to Meyer, Ramsay and Travers.

If we pass downward to the left from the highest points, we first come to the group neon (Ne), argon (A), krypton (Kr) and xenon (X), which are distinguished by their singular chemical inertness. Beyond these, on the left, comes the group fluorine (F), chlorine (Cl), bromine (Br) and iodine (I); and next beyond these come oxygen (O), sulphur (S), selenium (Se), and tellurium (Te). Many other singular correspondences may be observed on the diagram; and as it is highly improbable that these are merely accidental, we must conclude that some fundamental unity, either of structure, material, or internal motion, pervades the substances that we call “elements.”

Mendeléeff (and Meyer also) arranged the elements in tabular form, in such a way as to bring out their correspondences quite clearly. Mendeléeff’s arrangement (with some modifications and additions) is presented herewith. The elements, it will be seen, are divided into nine groups, each of which is entered in a separate column. They are also divided into twelve

proved. In any given group, the elements of the even series (2, 4, 6, 8, 10, and 12) resemble one another, as a general rule, more closely than they resemble those in the odd series of the same group; this fact (which is not true in all parts of the table) is indicated by indenting the odd and even series differently.

The full significance of Mendeléeff’s table cannot be understood without an exhaustive study of the chemical deportment of the elements classified. At the top of the table, and immediately under the group number, formulæ are given which indicate the character of the compounds that the elements of the corresponding group form when combining directly with hydrogen. Thus, in combining with hydrogen alone, carbon yields the saturated compound  $\text{CH}_4$ ; nitrogen yields  $\text{HN}_3$ ; oxygen yields  $\text{OH}_2$ ; and fluorine yields  $\text{FH}$ . The elements of groups I, II and III, either do not combine directly with hydrogen, or they form compounds which are unstable; and the elements in group IX do not form any compounds at all. Most of the



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elements combine with oxygen in more than one proportion; but there is usually one oxid which may be regarded as characteristic of the element. The formulæ of these oxids for the different groups are given in the second line under the group number. In some cases the general formula for the oxid does not correspond to the particular oxid that is commonly regarded as typical of the element in question. The oxids of manganese, for example, are analogous to those of lead in many respects; and yet manganese appears in the seventh group, and lead in the fourth. But it should be observed that manganese has an oxid of the form  $Mn_2O_7$ , while lead has not, so far as is known; and in this sense, at least, the oxid  $R_2O_7$  may be said to be characteristic of manganese. The oxids of group VIII do not, in general, correspond to the typical formula  $RO_4$ ; though osmium and ruthenium have oxids of this form. It must be remembered, throughout, that the "periodic law" is more or less elastic, and that in classifying the elements in groups we have to consider their properties as a whole, and not simply some one of them, nor some few. In Mendeléeff's arrangement, for example, attention has been paid to the melting points, boiling points, spectra, and magnetic properties of the elements, as well as to the colors and heats of formation of their salts. Other physical and chemical properties have likewise been examined in the light of the "periodic law," and the arrangement here suggested is that which appears to best represent the entire mass of relationships.

It is evident that if an erroneous atomic weight were assigned to any element whose place in the periodic scheme is definitely fixed by its general physical and chemical properties, the error would be detected if it were great enough to transfer the element in question to a position already occupied by another element, or to a group in which it manifestly did not belong. Several instances could be given in which a disagreement of this kind has led to further research, followed by the improvement of the atomic weight of an element in the direction indicated by the periodic law. The atomic weight of titanium, for example, was formerly taken as 52, this being the result indicated by actual analysis of its compounds. But with this atomic weight it did not fit into the general classification, which called for an atomic weight of about 48. Thorpe, by a new investigation, showed that 48 is correct. The atomic weight now assigned to argon (40) is likely to be diminished by future researches; for it is manifestly impossible either to remove potassium from group I, or to admit argon either to group I or to group II.

Mendeléeff found it impossible to construct his table without leaving many of the spaces in it vacant. He considered these vacancies to correspond to elements which were not then known, but which would probably be discovered in the future. In 1871 he wrote a paper upon this subject, in which he essayed to predict the general properties that three of these unknown elements must have, in order to fit well into the periodic scheme. It is gratifying to record that he has lived to see all three of them discovered, and to know that his predictions have been verified with extraordinary accuracy. The metals so predicted are now called "gallium," "scan-

MENDELÉEFF'S TABLE OF THE ELEMENTS (modified and extended).

Series	GROUP I. ..... $R_2O$	GROUP II. ..... $RO$	GROUP III. ..... $R_2O_3$	GROUP IV. $RH_4$ $RO_2$	GROUP V. $RH_3$ $R_2O_5$	GROUP VI. $RH_2$ $RO_3$	GROUP VII. $RH$ $R_2O_7$	GROUP VIII. $RO_4$	GROUP IX. ..... .....
1.	Hydrogen = 1.								
2.	Lithium = 7.	Glucinum = 9.1	Boron = 11.	Carbon = 12.	Nitrogen = 14.	Oxygen = 16.	Fluorine = 19.		Helium = 4. Neon = 20.
3.	Sodium = 23.	Magnesium = 24.4	Aluminium = 27.	Silicon = 28.	Phosphorus = 31.	Sulphur = 32.	Chlorine = 35.5	Iron = 56. Nickel = 58.5	Argon = 40.
4.	Potassium = 39.	Calcium = 40.	Scandium = 44.	Titanium = 48.1	Vanadium = 51.2	Chromium = 52.3	Manganese = 55.	Cobalt = 59.1 (Copper = 63.3).	
5.	Copper = 63.3	Zinc = 65.4	Gallium = 69.9	Germanium = 72.	Arsenic = 75.	Selenium = 79.	Bromine = 80.	Ruthenium = 102. Rhodium = 103.	Krypton = 81.6
6.	Rubidium = 85.4	Strontium = 87.5	Yttrium = 89.	Zirconium = 90.7	Niobium = 94.2	Molybdenum = 95.9		Palladium = 108. (Silver = 107.9)	
7.	Silver = 107.9	Cadmium = 112.	Indium = 113.7	Tin = 118.	Antimony = 120.3	Tellurium = 125.2	Iodine = 126.9		Xenon = 128.
8.	Cæsium = 133.	Barium = 137.	Lanthanum = 138.5	Cerium = 141.5	Didymium = 145.				
9.			Ytterbium = 173.		Tantalum = 182.8	Tungsten = 184.		Iridium = 193.1 Platinum = 194.8	
10.								Osmium = 200. (Gold = 196.7)	
11.	Gold = 196.7	Mercury = 200.4	Thallium = 204.1	Lead = 206.9	Bismuth = 208.				
12.		Radium (?) = 225.		Thorium = 233.4		Uranium = 239.			



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dium" and "germanium," respectively, for the three countries (Gallia, Scandinavia and Germany), in which the rare earths containing them were discovered. His predictions for scandium (which he provisionally called "eka-boron" from its position in the table, and denoted by the symbol Eb), may be compared with the actual properties of that metal in the following manner:

EKA-BORON ( <i>hypothetical</i> ).	SCANDIUM ( <i>actual</i> ).
1. Atomic weight about 44.	1. Atomic weight 44.
2. Oxid will have formula $\text{Eb}_2\text{O}_3$ ; will be soluble in acids, but insoluble in alkalis; specific gravity of oxid about 3.5; analogous to $\text{Al}_2\text{O}_3$ , but more basic; less basic than $\text{MgO}$ .	2. Oxid has formula $\text{Sc}_2\text{O}_3$ ; is soluble in strong acids, but insoluble in alkalis; specific gravity of oxid = 3.8; analogous to $\text{Al}_2\text{O}_3$ , but more decidedly basic.
3. Salts of Eb will be colorless, and will yield gelatinous precipitates with $\text{KOH}$ , $\text{K}_2\text{CO}_3$ , $\text{Na}_2\text{HPO}_4$ , etc.	3. Solutions of Sc salts are colorless, and yield gelatinous precipitates with $\text{KOH}$ , $\text{K}_2\text{CO}_3$ , and $\text{Na}_2\text{HPO}_4$ .
4. Sulphate will have the formula $\text{Eb}_2(\text{SO}_4)_3$ , and will form, with $\text{K}_2\text{SO}_4$ , a double salt which will probably not be isomorphous with the alums.	4. Sulphate has the formula $\text{Sc}_2(\text{SO}_4)_3$ , and forms, with $\text{K}_2\text{SO}_4$ , the double salt $\text{Sc}_2(\text{SO}_4)_3 \cdot 3\text{K}_2\text{SO}_4$ , which is not an alum.

Of the discovery of the periodic law, whose antecedents are briefly mentioned above, Mendeléeff says: "Neither De Chancourtois, to whom the French ascribe the discovery of the periodic law, nor Newlands, who is put forward by the English, nor L. Meyer, who is now cited by many as its founder, ventured to foretell the *properties* of undiscovered elements, nor to alter the 'accepted atomic weights,' nor, in general, to regard the periodic law as a new, strictly-established law of nature, as I did from the beginning (1869)." He claims the discovery of the law for himself, on the ground that it was he who first established it in such a way that it can be used to correct the results of direct observation, to predict new elements and their properties, and (in his own words) to "permit the invisible to be seen, and the unknown known."

One of the most interesting things about the periodic law is that it appears to indicate a finite limit to the number of elements existing. Thus if all the vacant spaces in the table were filled, the number of elements would still be less than 120. It does not appear probable that other elements will be discovered whose atomic weights are less than that of hydrogen. On the other hand, it appears from considerations entirely foreign to the periodic law that elements having atomic weights materially greater than that of uranium would not be stable. Modern research indicates that radium, thorium and uranium are all on the verge of instability, and perhaps just over the verge.

For detailed information regarding the periodic law, consult: Lothar Meyer, 'Modern Theories of Chemistry'; Mendeléeff, 'Principles of Chemistry.'

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**Periodical Literature.** In the general acceptance of the term a periodical is any publication other than a book or a daily newspaper. Usually the term comprises those serial publications the principal object of which is the circulation of interesting essays, tales, poems, and useful information of a literary, scientific, or artistic character. Periodicals are, furthermore, generally distinguished from newspapers by the

greater care and reflection commonly bestowed upon their articles, and by their shape, which is always such that the numbers may be easily and conveniently bound and preserved in the form of books. Periodical literature embraces two classes of publications, the first devoted to literature or criticism, and the second to the sciences, the arts, or to special branches of knowledge. Periodicals exclusively devoted to criticism are generally called reviews, and those whose contents are of a miscellaneous and entertaining kind magazines; but there is no great strictness in the use of the terms. The spread of knowledge during the 18th and 19th centuries, and the multiplication of books rendered it impossible for the scholar to inform himself of the progress of learning in various countries, or to purchase and read more than a small portion of the works published; hence the necessity for critical serials, magazines and other productions in the field of periodical literature. In the United States and in Great Britain most periodicals are issued either weekly or monthly. In France, Italy, and Belgium the fortnightly is regarded as the natural form of the high-class periodical. Outside these countries the fortnightly is practically unknown. In Russia, Germany, Scandinavia, and in Spain and Portugal the periodicals are monthly. The periodical had its genesis in France in 1665, and Italy and Great Britain followed soon afterward. But rather than deal with the subject chronologically, it would seem better for the sake of convenience to tell the life history of the periodical by an alphabetical arrangement of countries.

**Australia.**—The British periodical, circulating largely in Australia, curtails to a great extent the native product. In Melbourne is published the 'Imperial Review,' issued quarterly, and there is a similar periodical in Sydney. The 'Monthly Review' is published in New Zealand. There are several religious magazines, illustrated weeklies and sporting journals issued in Melbourne and Sydney.

**Belgium.**—From 1772 to 1818, the 'Esprit des Journaux,' a literary miscellany of considerable value, was published in Belgium, but it was not until the separation from Holland that a distinctive periodical literature appeared. In the early years of the 19th century the 'Messages des Sciences' was edited by Saint Genois, while the 'Nederdeutsche Letteroeffningen' made its appearance in 1836. The well-known scholar, Willems, edited the 'Belgisch Museum' from 1836 to 1846. Among other publications were the 'Kunst- en Letterblad' and the 'Vlaemsche Rederyker' and several miscellanies.

**Denmark.**—The first literary journal in Denmark was the 'Loerde Tidende' published from 1749 to 1766. The 'Minerva' appeared from 1785 to 1819, followed by the 'Danske Tilskuer,' the 'Skandinavisk Museum' and the 'Loerde Efterretninger.' In 1836 the 'Athene' was issued, and in 1840 the 'Historisk Tidskript.' Other more modern periodicals were the 'Universitets Tidskript,' the 'Dansk Maanedskript,' the 'Hjemme og Ude,' the 'Nord og Syd,' and the 'Litteratur Tidende.'

**Canada.**—Like Australia, Canada has been dependent upon the mother country, and has also looked to the United States for her periodical literature. A number of religious journals are published in Toronto and Montreal, and the



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'Canadian Magazine' has flourished for a dozen years. In 1880 a humorous weekly called 'Grit' was published in Toronto. The 'Bystander,' a unique magazine edited, written and owned by Goldwin Smith, and 'Once-a-Week' were short-lived Toronto publications.

*England.*—With the possible exception of the 'Philosophical Transactions of the Royal Society,' which first appeared in 1665, the earliest English periodical seems to have been the 'Weekly Memorials for the Ingenious,' the first number of which is dated January 1681. It was followed by several other periodicals, the most noteworthy being the 'History of the Works of the Learned' (1699–1711); the 'Memoirs of Literature' (1709, continued under different titles till 1743). In the same century the nearest approach to the review, as differing from the magazine proper, was made by the 'Monthly Review' (1749–1844), which was followed by the 'Critical Review' (1756–1817), to which Smollett largely contributed; the 'British Critic' (1793–1843); the 'Anti-Jacobin Review and Magazine' (1798–1821). In 1809 appeared the 'Quarterly Review,' successively edited by Gifford, Coleridge, and Lockhart, who were assisted by the contributions of Scott, Southey, Croker, Heber, etc., who wrote in the Tory interest. In 1824 the 'Westminster Review' was started by Bentham as the organ of utilitarianism and radicalism in politics, and has numbered among its contributors Bowring, Grote, Carlyle, John Sterling, Mill, Bain, etc. To provide critical literature at shorter intervals there was started in 1865 the 'Fortnightly Review,' which for a short time appeared twice a month, since then only once. It was followed by the 'Contemporary Review' (1866) and the 'Nineteenth Century' (1877—since 1901 the 'Nineteenth Century and After'). Among the more recent periodicals of this class are the 'National Review' (1883), a Conservative organ; the 'Review of Reviews' (1890), giving analyses of the current periodicals generally; the 'New Century Review' (1897); and the 'Monthly Review' (1900). The 'Athenæum' (1828) and the 'Academy' (1869) are weekly journals devoted to the criticism of new books, paintings and sculpture, music and dramatic works and performances, with information on matters connected with literature, science and art. The 'Saturday Review,' 'Spectator,' and 'Speaker' (all weekly) combine the character of the review proper with more or less of that of the newspaper. The first English magazine, properly speaking, may be said to be the 'Gentleman's Journal, or Monthly Miscellany,' commenced in 1692. The well-known 'Tatler' (1709–10), 'Spectator' (1711–12, revived 1714) and 'Guardian,' as well as Johnson's 'Rambler' (1750–51) were periodicals of a special kind. In 1731 appeared the 'Gentleman's Magazine,' published by Cave, and contributed to by Johnson and other eminent writers. It brought a fortune to the lucky publisher, at whose death it was continued by Henry and Nichols. The success of Cave's venture brought out a host of imitators. The 'London Magazine' (1732–84), the 'European Magazine' (1782–1826) and the 'Monthly Magazine' (1796–1829) were among the chief of this class which were originated in the 18th century. In 1832 'Chamber's Journal' made its appearance, marking the commencement of a new and more

popular era. It was published weekly, but was also issued in monthly parts. 'Cassell's Family Paper' (now known as 'Cassell's Family Magazine') was not started till 1853. The old 'Penny Magazine' (1832), published by the Society for the Diffusion of Useful Knowledge, deserves honorable mention. It was succeeded by the 'Leisure Hour' in 1852, still one of the best illustrated sixpennies, published by the Religious Tract Society. Charles Dickens founded 'Household Words' in 1850, and 'All the Year Round' in 1859. A new era in this kind of literature was inaugurated by the shilling monthlies, some of them with excellent illustrations, the first being 'Macmillan's Magazine' (1859); 'Cornhill Magazine' (1860); 'Temple Bar' (1860); closely followed by a number of others. Another step in the direction of cheapness was shortly afterward made by the publication of monthly magazines at sixpence, including 'The Argosy,' 'Good Words,' the 'Sunday Magazine,' etc., followed at a long interval by 'Longman's Magazine,' 'Murray's Magazine,' 'English Illustrated Magazine' (1883); 'Ludgate' (1891); 'Strand Magazine' (1891); 'Idler' (1892); 'Woman at Home' (1893); 'Windsor' (1895); 'Englishwoman' (1895); 'Lady's Realm' (1896); 'Pearson's Magazine' (1896); 'Temple Magazine' (1896); 'Girl's Realm' (1898); and 'Wide World Magazine' (1898). Threepenny and fourpenny monthly magazines such as 'The Young Man' (1887), 'Young Woman' (1892), 'Harmsworth Magazine' (1898) and 'Royal Magazine' (1898) have become prominent in recent years. 'Cosmopolis' (1896) has sections in French and German. There are innumerable religious magazines. The Roman Catholic Church is represented by the 'Month,' the 'Lamp,' the 'Lyceum,' and 'Saint Peter's' (1898). The Wesleyan Methodists and the Primitives publish quarterlies. The 'Jewish Quarterly' is read by many who are not Jews. The Salvation Army has a monthly in 'All the World'; Mr. Spurgeon established 'The Sword and Trowel'; the 'Animal World' is the organ of the Society for the Prevention of Cruelty to Animals, and 'The Child's Guardian' of the Society for the Prevention of Cruelty to Children. 'The United Service Magazine' is a monthly, the 'Navy and Army' a weekly. The 'Badminton' is devoted to sport.

*France.*—In January 1665, Denis de Sallo, assuming the name of the Sieur de Hédouville, issued at Paris the first number of the 'Journal des Savants,' the first periodical in France if not in the world. J. Doneau de Vise founded in 1672 the second literary periodical in France, the 'Mercure Galant,' which gave reviews of poetry and the drama. Its title was changed in 1717 to the 'Mercure de France,' and it was conducted with ability by Marmontel and others until 1818. In 1701 a society of Jesuits at Trévoux began the 'Memoires pour servir a l'Histoire des Sciences et des Beaux-Arts,' more commonly known as the 'Mémoires de Trévoux.' It was characterized by the excellence of its critical judgments, and by the zeal with which it combated anti-Jesuitical opinions; it lasted until 1767. The other noteworthy literary journals of France in the 18th century were the 'Année Littéraire' of Fréron (1754–91); the 'Magasin Encyclopédique,' begun in 1795, the second series of which was called the 'Annales



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Encyclopédiques,' and the third the 'Revue Encyclopédique'—it was suspended in 1832, and a last attempt was made to re-establish it by Didot in 1846, but failed. In the 19th century the 'Revue Française,' the 'Revue de Paris,' the 'Revue Indépendante' and many more have appeared and been discontinued. But the 'Revue des Deux Mondes,' begun in 1829, and from 1831 issued fortnightly, was marked by an ability which rendered it permanent, and placed it in the front rank of the critical journals of the world. In 1852 appeared the 'Revue Germanique,' devoted to German literature; the 'Revue des Races Latines' (1857) appropriated to the arts and letters of those nations having a Latin origin; and of the 'Revue Européenne' (1859). Other important French periodicals include the 'Nouvelle Revue,' 'Revue Politique et Littéraire,' 'Grande Revue,' 'Revue de Famille,' 'Revue Illustrée,' 'L'Illustration,' 'Revue des Lettres et des Arts,' 'Figaro,' etc. To the admission of poetry and tales into the reviews, and to the publication by almost every newspaper of a literary *feuilleton*, must be ascribed the almost total want in France of serials exactly corresponding to the English and American magazines.

*Germany.*—The first periodicals in the German language were written in the form of dialogues; they were the 'Monatsgespräche' (1688–9) and the 'Monatliche Unterredungen' (1689–98). Under the title of 'Gelehrte Zeitung' almost every large town had at some period of the 18th century its literary journal, such, for instance, as those published at Frankfurt (1736–86), Halle (1766–92), Gotha (1774–1804), and others. But of more importance than all these was the 'Göttinger Gelehrte Anzeigen,' begun in 1739. In 1766 Nicolai founded the 'Allgemeine Deutsche Bibliothek,' which lived over 49 years; the more valuable 'Briefe, die neueste Literatur Betreffend,' supported by Lessing, Mendelssohn, and others, had an existence of only six years (1759–65). Among the other notable periodicals established in the 18th century and in the beginning of the 19th were the 'Allgemeine Literatur-Zeitung' (1785–1848); the 'Jenaische Allgemeine Literatur-Zeitung' (1804–48); to which the great literary circle of Weimar, of which Goethe was the centre, contributed. The 'Leipziger Literatur-Zeitung' (1800), the 'Wiener Jahrbücher der Literatur' (1818), 'Hermes' (1819), and the 'Jahrbücher für Wissenschaftliche Kritik' (1827). The leading existing critical authorities are the 'Heidelberger Jahrbücher der Literatur' (1808), the 'Deutsche Vierteljahrsschrift' (1838), modeled upon the English review, and the 'Gelehrte Anzeigen.' Of a more popular tone are the 'Blätter für Literarische Unterhaltung' (1833), the 'Deutsches Museum' (1852), the 'Grenzboten' (1841), 'Westermanns Monatshefte' (1855), and many more of the magazine kind. The 'Illustriertes Familien-Journal' of Leipsic is of the 'Penny Magazine' school, and enjoys a very large circulation. Of more recent date are 'Die Gegenwart' (1872), the 'Literaturzeitung' (1874), the 'Deutsche Rundschau' (1874), 'Die Neue Zeit' (1872), 'Nord und Süd' (1878), 'Die Nation' (1888), 'Die Zukunft' (1892).

*Holland.*—In 1684 appeared the 'Mercure Savant' at Amsterdam, and in the same year the 'Nouvelles de la Republique des Lettres,' which

was continued with great success until 1718. Then came the 'Boekzal van Europa' (1692–1708), which was excelled by the 'Republijk der Geleerden' (1710). J. van Effen produced his 'Hollandsche Spectator' (1731) with marked success; but a new era in criticism was introduced in 1761 by the 'Vaderlandsche Letteroefningen.' The 'Allgemeene Konsten Letterbode' (1788) maintained for many years a high rank. The 'Recensent' (1803) superseded by the 'Nieuwe Recensent,' proved itself a powerful rival to the 'Letteroefningen.' Other periodicals are the 'Nederlandsche Museum' (1835), the 'Tijdstrom' (1859) and the 'Navorscher.'

*India.*—The best known of early periodicals in India were the 'Calcutta Monthly Register' (1798); the 'Oriental Magazine and Indian Hurkaru,' which began at Madras in 1819; the 'Madras Miscellany'; the 'Calcutta Review' (1844); a valuable existing quarterly; and the 'Bombay Quarterly Review,' which dated from 1855. At Singapore the 'Journal of the Indian Archipelago,' began in 1847, while the 'Chinese Repository,' begun by Morrison at Canton, was from 1832 to 1851 filled with valuable articles relating chiefly to literature and history. To-day India has the 'Calcutta Review' (quarterly) and the monthlies, the 'National Magazine,' the 'Indian Magazine and Review' and 'Allahabad Review.'

*Ireland.*—The 'Literary Journal' was published in Dublin in 1744, the first periodical in Ireland. In 1836 the 'Dublin Review' was established by O'Connell and his friends as the organ of the Roman Catholic party. The 'New Ireland Review' appeared in 1894. There are many lesser periodicals in Cork and Dublin.

*Italy.*—In 1668, the 'Giornale de letterati' was commenced at Rome by Nazzari, and published until 1679. Under the same title literary periodicals were afterward issued at Parma (1686), at Venice (1719), at Florence (1742), and finally at Pisa in 1771. The 'Biblioteca volante' (1676) was of a less solid character, but the 'Novelle letterarie,' published for several years subsequent to 1740, was marked by much erudition. Distinguished at a later period were the 'Biblioteca Italiana' (1816) of Milan; the 'Antologia' (1821) of Florence; the 'Giornale Arcadico' (1819) of Rome; the 'Giornale Enciclopedico' (1806) of Naples, which was followed in that city by the 'Progresso delle Scienze' (1833), the 'Museo di Scienze e Letteratura,' and several minor ones, like the 'Poligrafo' (1811), and 'Magazzino Pittoresco,' and the popular 'Album' (1824) of Rome. The chief critical serials are the 'Rivista Contemporanea' (1852) of Turin, the 'Politecnico' (1839) of Milan, which was suppressed in 1844, and revived in 1859; the 'Giornali degli Eruditi' (1883); the 'Nuova Revista Internazionale' (1879) and the 'Revista Internazionale' (1883). There are 332 monthlies in Italy, of which 300 are read by no one outside Italy, and by probably fewer than 300 subscribers within the peninsula.

*Russia.*—In point of size the Russian periodicals excel all others. Among the early publications were the 'Yezhemyesyatchniya Sotchineniya' (Monthly Essays), edited by Muller from 1755 to 1764. Soon afterward commenced Sumarakoff's 'Industrious Bee' (1759) and Keraskoff's 'Leisure Hours' (1762). Superior



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to these, however, was the 'Vvestnik Europi' (European Intelligence), founded in 1802 by the historian, Karamsin, and subsequently (1808) edited by Zhukovsky. To this succeeded the 'Ruskoy Vvestnik,' conducted from 1808 to 1820 by Glinka, Gretch, and Polevoy, and which, after having been suspended for some years, was revived at Moscow in 1856 by Katkoff. One of the ablest publications was the 'Sin otchets-tva' (Son of the Fatherland), founded in 1812, with which was united in 1825 the 'Severnoy Arkhiv' (1822) or 'Northern Archives.' Among later day periodicals in Russia is the 'Pantobiblon,' a magazine published in Saint Petersburg in no fewer than 15 different languages. It aims at providing professional and scientific men of all countries with a guide to the periodical literature, technical and scientific of the world.

*Scotland.*—The 'Scots Magazine' first appeared in 1739 and the 'Edinburgh Review' in 1802. In 1817 William Blackwood began the famous 'Blackwood's Edinburgh Magazine,' which soon distanced all its predecessors and took rank as the first serial of the kind in Great Britain. It was contributed to by Wilson (Christopher North), James Hogg, Lockhart, Wordsworth, Coleridge, Lamb, Maginn, De Quincy, Landor, and a host of other great literary names of a former generation; while in more recent times the productions of Professor Aytoun, Jerrold, Lord Lytton, George Eliot, etc., have enriched its pages. In 1830 came 'Fraser's'—a magazine which, after many vicissitudes under many editors, is now extinct, while 'Blackwood's' still flourishes.

*Spain and Portugal.*—Spain has been represented in periodical literature by the 'Diario de los literatos' (1737), the 'Pensador' (1762), the 'Seminario erudito' (1755), the 'Memorial literario' (1784–1807), and the 'Variedades,' which acquired a considerable reputation. The 'Cronica cientifica y literaris' (1834) subsequently became a political sheet. The 'Censor' (1820) was for some years the best periodical which Spain had seen; this was finally superseded by the 'Revista Española' (1831), which successively changed its title to 'Revista Europea' and 'Revista de Madrid.' Later were the 'Cartas Españolas' (1831), the 'Antologia Españolas' (1848), the 'Revista de Espana,' the 'Seminario pintoresco' and the 'Revista de ambos mundos.' The 'Journal da Coimbra' in the early part of the 19th century was the first and for a long time the only literary organ of which Portugal could boast. In 1837, however, the 'Panorama' was founded, and in 1842 the 'Revista universal Lisbonense' was established. Other publications of the literary class are the 'Journal da sociedade dos amigos das letras' and the 'Bibliophilo.'

*Sweden.*—The 'Svenska Argus' (1732) was the earliest notable addition made by Sweden to learned periodical literature. In 1742 Celsius founded the 'Tidningar om den lardes Arbeten'; but the first comprehensive critical journal was the 'Svenska Mercurius' (1755), the 'Phosphorus' (1810), and the 'Iduna' (1811). Both wielded a powerful influence in the literary circles of Sweden, and originated two different schools of poetry and criticism. Among other periodicals were 'Polyfem' (1810), 'Svea' (1818), 'Journal for

Litteraturen' (1809), 'Skandia' (1833), 'Literatur-Foreningens Tiding' (1833), and the 'Literaturblad' (1838). The best of a later date are the 'Tidskrift for Literatur' and the 'Nordisk Tidskrift.'

*Switzerland.*—In Switzerland the 'Bibliothèque Britannique' (1796–1815) and its successor, the 'Bibliothèque Universelle' (1816), which was published in two parallel series, one scientific and the other literary, were widely circulated both at home and abroad. The 'Revue Suisse' has been conducted with much success at Neuchâtel since 1837.

*United States.*—American periodical literature dates from 1741, when Franklin issued the 'General Magazine and Historical Chronicle' at Philadelphia; but it existed only half a year, while the 'American Magazine,' begun in the same year, by Webbe, was still less successful. The other issues of the kind prior to the Revolution were the 'American Magazine and Historical Chronicle' (Boston, 1743–6), the 'Boston Weekly Museum' (1743), the 'Independent Reflector' (New York, 1752–4), the 'New England Magazine' (Boston, 1758), which ceased after the appearance of a few parts; the 'American Magazine' (Philadelphia, 1757–8), the 'North American Magazine' (Woodbridge, N. J., 1758), the 'American Magazine' (Philadelphia, 1769), the 'Royal American Magazine' (Boston, 1774), and the 'Pennsylvania Magazine' (Philadelphia, 1775). Before the end of the century came the 'Columbian Magazine' (Philadelphia, 1786), the 'American Museum' (1787), the 'Massachusetts Magazine' (Boston, 1789), the 'New York Magazine' (1790), the 'Farmer's Museum' (Walpole, N. H., 1793), the 'United States Magazine' (Philadelphia, 1796), the 'American Universal Magazine' (Philadelphia, 1797), and the 'Monthly Magazine and American Review' (New York, 1799–1800), founded by the novelist Brown, but carried on afterward as the 'American Review and Literary Journal' (1801). Early in the 19th century came the 'Port Folio' (Philadelphia, 1801), the 'New York Weekly Museum' (1814), 'Graham's Magazine' (1840–50), 'New York Mirror,' 'Southern Literary Gazette,' 'Gentlemen's Magazine,' 'The Dial,' 'Putnam's Monthly,' 'The Galaxy,' 'Littell's Living Age,' 'Harper's Magazine,' and the 'Eclectic.' Then came the 'Atlantic Monthly' (Boston, 1857), edited by J. R. Lowell, supported by original contributions from some of the foremost American and English novelists, essayists, and poets. The review literature of the United States begins with the 'American Review of History and Politics' (Philadelphia, 1811), but the ablest and most permanent publication of this sort has been the 'North American Review' (1815), which has constantly maintained a high character both for the style and critical ability. Still later appeared 'Lippincott's Monthly Magazine' (1868); 'Scribner's Magazine' (1887); the 'Century Magazine' (1881); 'Arena' (1889); 'Cosmopolitan' (1887); 'Forum' (1886); 'McClure's Magazine' (1893); 'New England Magazine' (1886); 'Overland Monthly' (1868); 'Munsey's,' 'Everybody's,' 'Metropolitan,' 'Review of Reviews,' 'Collier's Weekly,' 'Harper's Weekly,' 'Leslie's Weekly,' 'The Outlook,' 'Independent,' 'Saint Nicholas,' 'Youth's Companion,' 'Country Life in America.'



## PERIÆCI — PERIPATETIC PHILOSOPHY

'Woman's Home Companion,' 'The Black Cat,' 'World's Work,' 'Ladies' Home Journal,' and a host of ten cent and five cent periodicals. The more technical or specialist periodicals include the 'Yale Review,' 'Engineering Magazine,' 'Metaphysical Magazine,' 'Scientific American,' 'Political Science Quarterly,' 'Psychological Review,' 'Quarterly Journal of Economics,' 'American Catholic Quarterly Review,' 'Architectural Record,' 'Bookman,' the 'Reader,' 'Literary World,' the 'Critic,' the 'Lamp,' 'Book News,' 'Booklover,' and many others.

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**Periæ'ci**, the term used in Laconia and other ancient Dorian lands to designate the descendants of the ancient inhabitants of those countries. The Periæci were freemen, and strictly speaking not vassals, much less serfs, like the Helots, but they were considered inferior to the Spartans in regard to social rank and political rights. They were only allowed to occupy the inferior lands, and were employed as artisans, merchants, and sailors, and had at times a minor share in the government. At some periods they were allowed to intermarry with the Dorians, and they served in war even as hoplites, though they were compelled to form corps of their own, not being allowed to serve in the same corps with the Dorians. They were in many cases people of wealth and refinement.

**Per''iopthal'mus.** See MUD-SKIPPER.

**Perios'teum**, the fibrous membrane investing the bones, and serving as a medium for the transmission of the nutritive blood-vessels of the bone. It firmly adheres to the surface of bones, save at their gristly or cartilaginous extremities, and it becomes continuous with the tendons or ligaments inserted into bones. In young bones the periosteum is loosely attached to the shaft, and between the growing bone and the periosteum a layer of soft blastema or formative matter is interposed, this layer contributing to the formation of new bone on the outer surface of the structure. As the bone advances in development, and in adult life, the periosteum grows much thinner, and it becomes in time more or less firmly adherent to the bone. When the periosteum, through disease or injury, becomes affected, the blood-supply and nutrition of the bone suffer, and in consequence the bone-tissue dies or becomes necrosed, and is exfoliated or thrown off in the form of a sequestrum. The alveoli or sockets of the teeth are lined by periosteum, and this membrane is reflected on to the tooth, and invests it as far as the neck. The periosteum at the neck of the tooth merges with the fibrous structures of the gums. When a bone is fractured the periosteum plays an important part in the repair of the injury, new osseous material being deposited by the membrane.

**Per''iosti'tis**, inflammation of the periosteum (q.v.), a painful ailment frequently brought on by sudden exposure to cold after being heated. Various constitutional diseases, such as scrofula, syphilis, tuberculosis, or gout, may produce chronic periostitis. This disease

may end in necrosis or caries. The diagnosis that detects the originating disease will also lead to the indicated treatment, which is to be applied chiefly to that cause of the periostitis.

**Per''ipatet'ic Philosophy**, the philosophy of Aristotle, which received this name from the shady avenues (Greek *peripatoi*) in which that philosopher was accustomed to walk with his disciples, while expounding to them his doctrines. Philosophy, that is, scientific knowledge in general, he regarded as made up of theoretical, practical, and poetical philosophy, by the last of which he meant that which treats of the principles both of the useful and of the fine arts. Theoretical philosophy was divided by Aristotle into mathematics, physics, and what he called first philosophy (*prôtē philosophia*), and was afterward called metaphysics. This division does not include (at least expressly) the science of logic, that science which is so peculiarly Aristotelian that it is instanced by Kant as having been begun and completed by Aristotle himself. The reason of this omission is that he did not make any distinct separation between logic and metaphysics. The philosophy of Aristotle starts from his criticism of the Platonic doctrine of ideas. The Eleatics had asserted the unity, and hence the unchanging permanence of all real existence. But this implied the denial of real existence to the world of sense, which is indisputably manifold and changing. Seeing this, Heraclitus opposed to the principle of the Eleatics the doctrine of constant change, as the true account of the universe. These were the two leading views that characterized Greek philosophy down to the time of Socrates and Plato, and it was these two views that Plato attempted to harmonize in his doctrine of ideas. Socrates in his teaching had laid great stress on the formation of notions, as the means of arriving at true scientific knowledge in the shape of general truths. Plato pointed out that the fact of there being such general truths, permanently and unalterably valid, overthrew the Heraclitan doctrine that there is nothing really permanent in nature. It is true that individual existences are constantly changing, constantly perishing; but this, according to Plato, does not destroy the reality of permanent beings, else how could we make propositions which are permanently true of the classes or genera to which the individuals belong? To this doctrine Aristotle objects that the ideas of Plato are nothing else than the things of sense immortalized and eternalized. Plato has not shown the connection between his ideas and the things of sense, nor has he explained the changes which take place in the things of sense, which he yet admits to be actual.

Aristotle then proceeds to give his own account of the ideas and of the mode in which changes originate, and in doing so is led to the fundamental antithesis of his philosophy, that between matter and form (*hylē* and *eidos*). The notion or idea of a thing is not, he says, a separate existence numerically different from the thing itself, but is related to the thing only as form to matter. Every sensible thing is a compound (*synolon*) of matter and form, the matter being the substance of which the thing consists, while the form is that which makes it a particular thing (a stone, for example, and not



## PERIPATUS

a tree), and therefore the same as its notion or idea. The form is the true nature of a thing (so far he agrees with Plato); but substance (*ousia*) in the principal and proper sense of the word belongs only to the individual and concrete, that is, to the *synolon*. The opposition between matter and form is the leading conception of Aristotle's whole metaphysical system. Aristotle next deals with the difficulty of origination, change, that which Plato had left unsolved with his fixed ideas. It is quite true, he says, that nothing can originate from what is, nor from what is not; but origination is not creation, it is merely matter acquiring form, it is merely a transition from potential to actual existence. Everything that actually exists, as an *ousia* or *synolon*, previously existed potentially in the matter of which it is composed. Matter is thus related to form as potentiality to actuality (*dynamis* to *energeia* or *entelecheia*). This relation is not, however, a fixed one. A thing may be matter in one relation and form in another. The matter from which one *synolon* proceeds may be itself a *synolon*. Thus, wood is the matter of a boat, but it is itself a *synolon*, and is form with relation to a growing tree. It is only when we descend to the simplest *synolon* that we can say that the matter of which it is composed is nothing but matter, and is not form in any relation whatever. This first matter (*prōtē hylē*), although a mere abstraction, with no existence in the world of sense, is not, as Plato attempted to maintain in spite of his recognition of the manifold and changing, absolutely non-existent. It exists in relation to form as a privation (*sterēsis*), inasmuch as it deprives of actual existence all the things which it potentially contains. As there is, on the one hand, this formless matter, which is mere potentiality without actuality, so, on the other hand, there is a pure form (*prōton eidos*), which is pure actuality without potentiality. This pure form is the eternal Being, who is variously styled by Aristotle the first mover (*prōton kinoun*), since actuality, the formal cause, is, as we have seen, the necessary presupposition of all movement from the potential to the actual, the absolute notion, and the absolute end. The whole of nature forms a scale rising from the lower to the higher of these extremes, from pure matter to pure form, and the whole movement of nature is an endeavor (incapable of realization) of all matter to become pure form. Motion is the transition from the potential to the actual. Space is the possibility of motion. Time is the measure of motion.

Practical philosophy is divided by Aristotle into ethics, economics, and politics. In his Nicomachean ethics he expounds his ethical system, and in his politics he makes a detailed examination of political systems. We have no treatise of his on the subject of economics. His moral system treats of two ideas, happiness and virtue. Virtue (in the agent) is defined by Aristotle as a direction of the will confirmed by habit (*hexis proairetikē*) toward the mean fixed for us by reason, or that which the man of understanding (*ho phronimos*) would determine. All action, he explains, may err either by excess or by defect. Right action is accordingly that which avoids both these extremes, and every (objective) virtue lies between two vices. Thus, courage is the mean between fearing and

rash daring, liberality between niggardliness and profuseness. But the virtues belonging to different stations and relations are different. That of a freeman is not the same as that of a slave; that of a man is not the same as that of a woman; that of a father as that of a child; and so on. Aristotle mentions another class of virtues, the dianoetical, or virtues of the reason (*nous*), the highest of which is philosophic contemplation (*theōria*).

For the attainment of the practical ends of life it is necessary for man to live in society and form a state, the object of which is the protection of the individual members, and the affording of opportunities for the assistance of others and the practice of virtue, and ought also to be the development of virtuous habits in all its members. Which form of government is best adapted to fulfil these ends Aristotle does not say. The best form of government is determined by the particular circumstances of the society for which it is intended. The government may be in the hands of a single individual, in the hands of few, or in the hands of many, and in all these cases it may be both good and bad. The good forms of government are monarchy, aristocracy, and timocracy (a republic in which the state offices and honors are distributed according to a rating of property); and the bad forms are tyranny, oligarchy, and democracy.

The poetic philosophy of Aristotle has been worked out only in the case of poetry in the narrower sense of the term, which forms but a small part of all that belongs to this branch of inquiry, which includes, as already stated, the useful as well as the fine or imitative arts. The aim of the latter, according to Aristotle, is threefold: first, they are a means of recreation and refined enjoyment; secondly, they emancipate the soul from the mastery of the feelings by a temporary and beneficial excitation of them; and thirdly, they promote moral culture.

Consult: Grote, 'Aristotle' (1872); Grant, 'Ethics of Aristotle' (1877); Newman, 'Politics of Aristotle'; Wallace, 'Psychology of Aristotle' (1884); Lewes, 'Aristotle' (1864); Siebeck, 'Aristotéles' (1899).

**Perip'atus**, a genus of animal, somewhat resembling the cylindrical myriapods, first described as mollusks, then transferred to the annelids, and later regarded as arthropods, when Moseley discovered that they respired by tracheæ, resembling those of the insects. The animals have a wide but discontinuous distribution, being found in South and Central America, the West Indies, Cape of Good Hope, Australia, New Zealand, etc., living in decaying wood and feeding upon the insects found there. This distribution is indicative of great antiquity, but we cannot hope to find fossils of the group since all hard parts are lacking. The animals have cylindrical, worm-like bodies, without external segmentation, supported on numerous fleshy feet, the number varying with the species. The head has a pair of primitive eyes, a pair of ringed antennæ and a pair of jaws, while on either side of the mouth are the openings of a pair of slime-glands, the secretion of which is exceedingly sticky. The nervous system is very primitive. The respiratory organs, as mentioned above, are air-tubes or tracheæ which, unbranched, arise in scattered bunches from the skin. The excretory system is much like that of the annelids and con-



## PERISSODACTYLA — PERITONÆUM

sists of a pair of *nephridia* in each segment. The sexes are separate; the reproductive organs opening below just in front of the anus. The young are born alive. The different species show great differences in their development. There is great uncertainty as to the position of these forms, which are usually regarded as a class variously called *Malacopoda*, *Onychophora* or *Protracheata*. By some they are regarded as the stock from which the insects have sprung, by others the resemblances between the *Malacopoda* and *Insecta* are regarded as homoplastic. The original genus *Peripatus* has recently been divided into several genera. Consult Sedgwick, 'Quarterly Journal of Microscopical Science,' 1885-6.

**Perissodac'tyla.** See UNGULATA.

**Peristal'sis**, vermicular or peristaltic motion or contraction of the stomach and intestines; a kind of undulation or worm-like movement beginning at some point in the wall of a tubular viscus and extending from above downward toward or to the end of the hollow organ. Its object is to propel forward the contents of the viscus. The movement is a series of gentle but strong contractions, associated and alternating more or less with contractions of the longitudinal fibres. Peristalsis in the stomach and intestines pushes the food along so that it can come in contact with the digestive juices, and its waste be cast out of the body. In very thin persons peristalsis of the small intestine is sometimes so conspicuous that the ignorant have inferred the presence of a live snake within the abdomen. Food, after it leaves the grasp of the constrictor muscles of the pharynx, is pushed through the œsophagus or gullet and into the stomach by the peristaltic movements of the œsophagus. Urine and sometimes calculi are propelled from the kidneys into the bladder by the peristalsis of the walls of the ureters. Sometimes there is an inverse action of the muscular fibres of a hollow viscus, producing anti-peristalsis. Peristalsis is involuntary, and mainly under the control of the ganglionic division of the nervous system, and may continue for a time after death. See DIGESTION.

**Peristerop'odes**, a division or sub-order of the *Gallinæ*, including the curassows and mound-builders, distinguished by having the hind toe long and on a level with the others as in pigeons. It is contrasted with *Alectoropodes*, or true fowls, which have the hind toe short and elevated.

**Per'istyle**, in architecture, a name given to a range of columns surrounding anything, as the cells of a temple, or any place, as a court or cloister. It is frequently but incorrectly limited in signification to a range of columns round the interior of a place.

**Per'it, Pelatiah**, American merchant: b. Norwich, Conn., 23 June 1785; d. New Haven, Conn., 8 March 1864. He was graduated from Yale in 1802, taught for a year, entered business in Philadelphia and in 1809 settled in New York where he engaged with a firm of shipping merchants. He was a member of the firm in 1817-63 and in 1853-63 was president of the chamber of commerce. In that position he rendered important service to the government by leading in the movement which put the United States treasury

on a basis to meet the heavy expenses of the Civil War. In 1857 he served as a police commissioner and did much to restore the security of New York city, which was endangered by the contest between the "Municipal" and the "Metropolitan" police. He was a benefactor of many educational and charitable institutions and was deeply interested in Christian missions.

**Per'itonæ'um**, the most extensive serous membrane in the body. It lines the abdominal cavity in mammals, and in general the body-cavity of other vertebrates. In man it forms a closed sac; in the female it communicates with the interior of the uterus through its Fallopian tubes. It partially invests all the viscera in the abdominal and pelvic cavities, forming the visceral layer of the peritonæum; the portion reflected upon the internal surface of the walls of the abdominal and pelvic cavities is the parietal layer. The cavity enclosed by these two layers is the peritonæal cavity, which in health contains just sufficient serous fluid to moisten its surfaces. The free or inner surface of the peritonæum is moist, smooth, and glistening, and covered by a layer of flattened endothelial cells; its attached or outer surface is rough, being connected to the viscera and the walls of the abdominal and pelvic cavities, by means of the subperitonæal alveolar tissue. Various reflections of the peritonæum, such as the broad folds known as the mesenteries (the mesentery proper, the mesocolon, etc.) and the narrow ones forming ligaments (of the liver, spleen, bladder, and uterus), hold the viscera in position, and enclose vessels and nerves, while admitting free movement of certain of the viscera.

The pancreas, kidneys, and suprarenal capsules lie behind the peritonæum; the liver, stomach, spleen, a large part of the small and large intestine, and the uterus and ovaries are almost entirely invested by it; the remaining viscera are partially invested. Duplicatures of the peritonæum extending from the stomach to adjacent organs are called omenta. The largest peritonæal fold is the great omentum, enfolding the transverse colon and reaching in front of the small intestine as low down as the pelvis, forming a sort of apron. A fold of peritonæum between the rectum and vagina forms a pouch or cul-de-sac known as the rectovaginal pouch. In the male foetus a lengthened pouch of peritonæum accompanies the testicle at the time of its descent, the upper part of the pouch becoming obliterated just before birth; in the female there is a similar pouch, sometimes persistent.

The peritonæum may become inflamed from various causes, constituting the disease known as peritonitis. It may be injured by contusions and wounds of various kinds, or it may be the seat of morbid formations, such as deposits of fat in the great omentum, or of new growths, tuberculous and cancerous. Peritonitis is always serious, and in its acute form, especially if extensive and associated with rupture of the intestine or other viscera, frequently proves fatal. An injury to the peritonæum from without may not prove dangerous unless it induces hemorrhage or severe inflammation. But the introduction of foreign material, such as food, fæces, calculi, pus, and bile, into the peritonæal cavity by perforation and rupture is a grave complication. Chronic inflammations of the peritonæum,



## PERITONITIS — PERITYPHLITIS

and some acute forms, sometimes produce false membranes which bind some of the abdominal and pelvic viscera, restraining their necessary movements and inducing chronic and troublesome disorders.

Surgeons formerly did not consider it a legitimate operation to open the abdomen for the removal of diseased organs, etc., so great was the dread of establishing a severe inflammation. At the present time many lives are saved by such operations. With antiseptic precautions, the opening of the peritonæal cavity is now considered a reliable mode of procedure in many cases.

**Per''itoni'tis**, inflammation of the peritonæum. It is either acute or chronic. The acute form is always serious and often quickly fatal; the chronic is sometimes of little consequence, sometimes grave, but may end in great improvement or practical recovery. The symptoms and prognosis of this disease depend upon the extent and degree of the inflammation, whether it is general or local, circumscribed, and partial, and also upon the cause, predisposing or exciting. The diagnosis, except in typical cases, is sometimes obscure; the disease may be latent, or subacute at the outset and for a considerable period. The principal dangers of the disease are great depreciation of the vital forces, with impairment of the blood in extensive inflammation; shock to the nervous system from perforations; and impairment of the necessary movements of abdominal organs from fibrinous exudations. Perforation is the result of an ulceration, and may occur from ulceration of the small intestine in typhoid fever, chronic ulcers of the stomach, ulceration in dysentery and in appendicitis, ulceration of softened solid abdominal organs, of cysts, of aneurismal sacs, of pulmonary abscesses through the diaphragm, etc. Sometimes the localized thickening of the peritonæum resulting from the inflammation of a threatening ulceration prevents a perforation, and the already existing peritonitis becomes less dangerous. Urine and unhealthy pus are especially dangerous, if introduced into the peritonæal cavity. Idiopathic or spontaneous peritonitis, resulting from such causes as cold, or excessive eating or drinking, is rare, though it sometimes occurs. Acute peritonitis is more common among women than among men, as the result of extra-uterine pregnancy, or ovaritis, or the extension of gonorrhœal or other forms of inflammation from the uterine cavity, etc. It is usually due either to wounds, perforation from ulceration or severe injury, or to obstruction or irritation, the result of the presence of morbid products. While the peritonæum is frequently cut or aspirated by the surgeon with safety, sometimes a slight penetrating wound, especially if air and septic material accompany it, proves fatal. Violent blows upon the abdomen may not only excite peritonitis, but may rupture solid or hollow viscera, causing blood and other foreign material to escape into the peritonæal cavity, usually with fatal results. Distention of the peritonæal sac in ascites, morbid deposits, such as cancer and tubercle, mechanical pressure or friction, extension of a local inflammation of the uterus, liver, etc., or from a pleurisy, a pericarditis, or a strangulated hernia, are among the causes of peritonitis. The internal marks or characteristics of acute peri-

tonitis are hyperæmia and infiltration, more or less marked, of the peritonæum; sometimes small extravasations of blood; serous effusion containing flakes of fibrin; sometimes pus in considerable quantity, especially in the pelvic cavity, occasionally dangerously infectious; and thin layers of soft fibrinous material coating one or more of the viscera; or firm fibrinous exudations. The first symptom usually noticed by the patient is pain in one spot, which pain gradually spreads and becomes intense, and is aggravated by movements either of the bowels or the body. The pain may be preceded by shivering. The patient lies for the most part upon the back with the knees drawn up to relieve tension. The abdomen gradually becomes distended with gas, and is tympanitic; soreness and tenderness are more or less marked; the pulse reaches to 120 or more, and is small; the tongue is very red, and is covered in part with fur; thirst and vomiting are not infrequent; bowels are usually constipated, but sometimes there is diarrhœa; there is more or less difficulty in urinating; fever is high; the face wears an anxious expression; and perspiration is sometimes profuse. A chill in the course of the disease indicates either a perforation or other serious complication. In latent acute peritonitis pain may be slight and there may be no tympanites.

While acute peritonitis is a very dangerous disease, especially if perforation occurs, its treatment is now much more successful than it was before 1842, when Alonzo Clark, in this country, demonstrated the power of opium to relieve pain and calm nervous and muscular irritability. Absolute rest in bed, hot applications, easily digested food, attention to the tongue, bowels, and bladder, and quiet surroundings are additional remedies.

Chronic peritonitis may be the result of an acute peritonitis, but in the majority of cases is due to the deposit of tubercular material, mostly in the mesenteric and intestinal mucous glands, of cancerous material in abdominal organs, or to chronic ulcerations of the stomach, to renal disease, etc. The history is obscure; the symptoms are a feeling of tightness or of dragging; a dull pain, aggravated by movement; a poor appetite; more or less diarrhœa and constipation; dryness of the skin and its earthy hue; gradual emaciation, bed-sores, etc. The principal evidence of chronic peritonitis is fibrinous exudation. The prognosis is, as a rule, unfavorable if the inflammatory products are extensive. The disease may last a long time.

Bright's disease, low forms of fever, erysipelas, and a tuberculous tendency are predisposing causes of peritonitis.

**Per''ityphli'tis**, inflammation of the connective tissue behind and around the cæcum. The most frequent cause is an extension of inflammation from the cæcum (typhlitis), or the vermiform appendix, but it may result from the extension of inflammation from more distant parts of the body. External injury, such as blows, kicks, or severe compression of the lower part of the body, are some of the exciting causes. Prognosis depends upon the severity of the inflammation and the local lesions resulting. If an abscess forms and discharges into the peritonæal cavity, death results. The diagnosis of perityphlitis is more or less difficult.



## PERIWINKLE — PERKINS

**Per'iwinkle**, a genus (*Vinca*) of the order *Apocynaceæ*. The species, of which 10 have been described, are erect or trailing herbs or subshrubs with opposite leaves, and rather large axillary, solitary, salver-shaped flowers. Four species are cultivated in gardens and greenhouses. The common periwinkle, running, blue or trailing myrtle (*V. minor*) is a hardy, evergreen, trailing herb common in shady cemeteries, gardens, etc. It is typically blue-flowered, but some of its varieties have white, others pink flowers. Some have variegated foliage. The larger periwinkle (*V. major*) is larger in stem, leaf, flower, etc., than the preceding species, but is less hardy in the north. Some of its variegated varieties are exceedingly popular for window-boxes, hanging-baskets and vases, being able to withstand untoward conditions with respect to heat and drought. The Madagascar, Cape, or rose periwinkle (*V. rosea*), is a tender, ever-blooming species cultivated in greenhouses. It is also popularly called old maid. The herbaceous periwinkle (*V. herbacea*) is a hardy species which sheds its leaves in winter. The flowering shoots which appear in spring are followed by leafy stems that root at the tips. It is valued for its free-flowering qualities. All these species are readily propagated from cuttings or seeds and will thrive in almost any kind of soil.

**Per'jury**, in law, is an offense defined as a wilful false oath on a point material to the question by one lawfully required to state the truth in any judicial proceedings. In a number of jurisdictions statutes are in effect which provide that oath or declarations on specified occasions shall be considered as perjury. Whether or not one testified voluntarily or under compulsion does not affect the question of perjury. Under a Federal statute one is guilty of perjury who falsely states, certifies to, or declares, falsely before a tribunal, or a person authorized under a law of the United States, relating to any material matter which he does not believe to be true. Generally perjury is a misdemeanor and punishable as such, but in some States it has been made a felony; the offense takes place immediately upon completing the false oath before a court, person, or officer, lawfully authorized to take same; and one is not liable for perjury on a voluntary oath, or one not required by law, or upon a false statement, or one made under mistake, or unusual circumstances such as excitement, or fear, or without knowledge of the falsity of the statement; whether any injury resulted from the false oath, or the same was credited or not, is not material to the charge. Perjury must be proven beyond all reasonable doubt and cannot be established by the proof of one witness; the punishment therefor must be only as provided by law, and is usually prescribed by statute. Damages cannot be recovered in a civil action on account of the commission of perjury, or procuring another to commit perjury. A person procuring another to commit perjury is guilty, if the perjury is actually committed, of subornation of perjury; this may be proven by one witness, and the person found so guilty may be convicted. If one attempts to procure another to commit perjury, but perjury is not actually committed, he is guilty of incitement to commit perjury and may, under some statutes, be indicted and punished.

**Per'kins, Charles Callahan**, American art critic: b. Boston, Mass., 1 March 1823; d. Windsor, Vt., 25 Aug. 1886. He was graduated from Harvard in 1843, studied music and art in Europe and became widely known as an art critic and writer and was one of the first to practise the art of etching in this country. He was elected to the French Legion of Honor in 1867, corresponding member of the French institute in 1868, was president of the Boston art-club in 1869-79, one of the founders of the Boston Museum of Fine Arts, and occasionally he conducted the performances of the Handel and Haydn society of which he was president in 1875-86. He was critical editor of Champlin's 'Cyclopædia of Painters and Paintings' (1886-7) and wrote: 'Tuscan Sculptors' (1864); 'Art in Education' (1870); 'Raphael and Michelangelo' (1878); 'Ghiberti et son Ecole' (1886); etc.

**Perkins, Jacob**, American inventor: b. Newburyport, Mass., 9 July 1766; d. London, England, 30 July 1849. He was early apprenticed to a goldsmith and at 15 invented a method of plating shoe-buckles, which he manufactured successfully. At 21 he was engaged in making dies for the copper coinage of Massachusetts, shortly after inventing a machine which cut and headed nails at one operation. He gained no pecuniary advantage from this invention owing to the mismanagement of his partners, but soon afterward originated the idea of substituting steel for copper plates in banknote engraving, thereby greatly lessening the expense of the operation, and later invented a method of transferring the costly engraving from one plate to another by means of pressure. He removed to Philadelphia where he was associated with a firm of banknote engravers and in 1818 went to London and obtained the contract for supplying the bank of Ireland with plates. Later he became interested in steam artillery and constructed a gun in which steam was used for the propelling power in place of powder. He also invented an instrument for measuring the depth of water, called the bathometer, and the pelometer for measuring the speed at which a ship is moving. Science also owes to him its knowledge of the fact that water is compressible.

**Perkins, Justin**, American Congregational clergyman and missionary: b. West Springfield, Mass., 12 March 1805; d. Chicopee, Mass., 31 Dec. 1869. He was graduated from Amherst in 1829 and later studied at the Andover Theological Seminary. In 1833 he was ordained to the ministry and sailed for Persia where he established a mission. He translated the Bible into modern Syriac and wrote a commentary on Genesis and Daniel, meanwhile aiding in the establishment of missionary schools and directing general missionary work. He wrote: 'A Residence of Eight Years in Persia' (1843); 'Missionary Life in Persia' (1861); etc.

**Perkins, Thomas Handasyd**, American merchant: b. Boston, Mass., 15 Dec. 1764; d. Brookline, Mass., 11 Jan. 1854. He entered a counting-house in Boston when very young and later joined his brother in mercantile business in Santo Domingo. He returned to the United States and then went to China and East India in order to attain a thorough knowledge of the trade, finally settling in Boston where he



amassed a large fortune. In 1805 he was elected to the legislature of Massachusetts where he served for many years. He was deeply interested in philanthropic enterprises, founded the Perkins Institute for the Blind at Boston, contributed generously to various public institutions, among them the Massachusetts General Hospital and the Boston Athenæum. He was a projector of the Quincy Railroad, the first railroad built in the United States.

**Perkins, William Oscar**, American composer: b. Stockbridge, Vt., 23 May 1831; d. Boston, Mass., 13 Jan. 1902. He engaged in teaching in Boston, became known as a musical conductor, and organized the Mendelssohn Vocal Quartet, believed to be the first male quartet for concert singing organized in the United States. In 1858 he was conductor of the Boston Music Hall, conducted different musical festivals, and was a member of the governing board of the Handel and Haydn Society. He lectured and wrote on musical subjects, composed many songs and hymns, and compiled and edited 60 volumes of vocal music. His last composition was 'The War in South Africa, or Boer and Briton' (1900).

**Perm, pĕrm**, Russia, (1) the capital of an eastern government on the Kama, at the confluence of the Chusovaya, about 250 miles due north of Ufa, with which it is connected by rail via Ekaterinburg and Cheliabinsk. It was founded in 1781, has straight and spacious streets, and a number of handsome public buildings, among them the cathedral. There are also a gymnasium, a theological seminary, several other educational and scientific institutions, a civil and military hospital. The chief employment is in connection with the iron smelting and refining works. There is a considerable trade with the inland districts, and an increasing river traffic. The great highway connecting Moscow with Siberia passes by way of Perm. Pop. (1897) 45,403.

(2) A government of Eastern Russia, politically attached to European Russia, but topographically Asiatic and almost enclosed by the Ural Mountains. Area 128,211 square miles. While lumbering, agriculture, and stock raising are considerable industries, Perm's commercial importance is due to its vast mineral wealth, consisting of iron, coal, salt, zinc, copper, nickel, platinum, silver, and gold. Pop. (1897) 3,003,208. See RUSSIA.

**Per'manent Way**, a term used in Great Britain to designate the finished roadbed and track of a railway, including bridges, viaducts, crossings, and switches. The term is used in contradistinction to a temporary way, such as is made in construction, for removing the soil and making fillings.

**Permanent White**, a white pigment consisting of sulphate of barium precipitated from the chloride by adding dilute sulphuric acid. It is used as an adulterant of, and as a substitute for, white-lead.

**Permanganate**. See MANGANESE.

**Permian**, in geology, the name given to the last of the smallest time divisions of the Palæozoic, which are of worldwide recognition. The rocks of this age were first studied by Murchison, Dr. Verneuil and Keyserling, in

the Russian province of Perm, whence the name. In Germany they are also known by the term "Dyas," proposed by Geinitz on account of their well-marked division into two groups—the Rothliegende and Zeckstein. In Europe these rocks overlie the Carbonic for the most part unconformably, but in North America there is no sharp line of demarkation between them. This has led to a difference in grouping of the time division in question, and the formations belonging to it. English and Continental geologists consider the Permian a distinct division, equivalent to Siluric, Devonian, or Carbonic (Carboniferous), while in America it is generally made the terminal subdivision of the Carbonic era. Its best development in this country is in the Middle West. According to the latest studies of Puer, the Permian of Kansas consists of a lower marine series—"Big Blue series," and an upper non-marine series, "Cimarron series." In Pennsylvania, Ohio and West Virginia the deposits of this age are known as the Upper Barren Measures or Dunkard Creek series. They are non-marine beds of sandstones, shales and calcareous layers, with some thin seams of coal. The greatest thickness is not much over 1,000 feet. Palæontologically the Permian deposits are especially interesting from the presence of amphibians and of primitive reptiles.

**Permutation**. See COMBINATION.

**Pernambuco**, pĕr-nām-boo'kō (Port. pĕr-nān-boo'koo), a maritime state of Brazil, and its capital city. (1) The state of Pernambuco is bounded on the north by the states of Parahyba, Rio Grande do Norte and Ceará, on the east by the Atlantic, on the south by Alagoas and Bahia, and on the west by Piahy; lies between 7° and 10° 40' S. and between 34° 45' and 42° 10' W.; has an area of about 50,000 square miles, with a low coastal plain reaching 30 or 40 miles inland, and back of that plateaus and mountains. The Sierra dois Irmaos on the western frontier is the watershed of the Parahyba and São Francisco, and into the latter river the inland waters of Pernambuco flow, neither they nor it being navigable because of rapids and cascades, notably the falls of Paulo Affonso (see SÃO FRANCISCO). The climate varies greatly in the two diverse zones, being moist in the Matta, or "forest," which follows the sea coast, is fertile and settled, whereas the Sertão, or "desert," up-country is dry, arid, and almost uninhabited. The alluvial Matta grows sugarcane, cotton, tobacco, cacao, coffee, red-wood, cocoanuts, and among many important drugs ipecacuanha. There is a little gold and a great deal of excellent marble. Rum and hides rank next to cotton and sugar as the most valuable staples. Recife, or Pernambuco (see below), is the most important port; there are good harbors at Tamandaré, Porto de Galinhas, and Porto do Rio Formosa, and the cities of Goyana, Timbauba, Limoeiro, Caruaru, and Palmares, all connected with the capital by rail, should also be mentioned. There are 186 miles of railroad in the state. Its exports in 1900 amounted to nearly \$15,500,000; the imports to about \$13,700,000. Pop. (1890) 1,030,224. The region was first settled at Iguarassu and Olinda by the Portuguese in 1534. The Dutch held it 1630-54, and founded Moritzstadt, now the capital. (2) The city of Pernambuco, called by the Brazilians Cidade do Recife, that



## PERNAMBUCO WOOD—PERPENDICULAR STYLE

is, Reef City, the third city of the republic, being ranked in population and wealth only by Rio Janeiro and Bahia, is an Atlantic port, cut into three parts by the Rio Capiberibe and the Rio Beberibe, Recife occupying the northeast part parallel to the coast reef, and São Antonio being an island southwest of it and southeast of the mainland, on which is the third section, Bôa Vista. Two bridges join Recife and São Antonio, and three connect São Antonio and Bôa Vista. Recife is the old city, is poorly built, and contains the great business houses. São Antonio has the theatres, government buildings, customs house, and Parliament; is well built; and has many traces of Dutch occupation. Bôa Vista is largely residential with tropical one-story houses and beautiful gardens; it contains the archiepiscopal palace. The harbor is protected from the sea by a long reef; the water is deep enough for the average ocean steamer; and plans are on foot to improve the port by excavation. The city is now a regular port for 10 steamship lines. Four railroads connect the city with various parts of the state. There are cotton factories, oil mills, machine shops, shipyards, cigar manufactories, sugar refineries and manufactures of glassware and shoes. Pop. 190,000.

**Pernambuco Wood.** See BRAZIL WOOD.

**Pernicious Anæ'mia** (also called PROGRESSIVE PERNICIOUS ANÆMIA, MALIGNANT ANÆMIA, IDIOPATHIC ANÆMIA, ESSENTIAL ANÆMIA, etc.), a severe blood-disease, a progressive and usually fatal form of anæmia. It was first described in 1855, by Addison, as an idiopathic or self-originated anæmia, hence the term idiopathic or Addison's anæmia. In 1868 it was more closely studied by Biermer, especially as to the post-mortem appearances; and when these are distinctive the disease is sometimes spoken of as Biermer's anæmia. The disease is characterized by a great destruction of the red corpuscles of the blood and lesions of the blood-making organs. The red corpuscles are mixed with megalocytes, microcytes, and poikilocytes. There is no increase of leucocytes. Post-mortem shows that the skin is pale lemon-colored; fat is yellowish pale; there is little loss of subcutaneous fat, but fatty degeneration of organs is common; heart-muscles are light-colored, flabby, and fatty; other muscles may be red; the cavities of the heart contain a little light-colored blood. There is fatty degeneration in the liver, kidneys, gastric and intestinal walls; extravasation of blood in the retinae, serous and mucous membranes, and skin; swelling and redness of lymphatic glands; and commonly sclerosis of the posterior and to some extent of the lateral columns of the spinal cord. Deposits of iron, probably due to the great destruction of the red corpuscles, are found in the liver, spleen, pancreas, kidneys, etc. The bone-marrow is frequently very red.

The etiology is obscure. There is undoubtedly hæmolysis or disintegration and degeneration of the blood. This may be caused by long-continued loss of blood, by splenic, miasmatic, glandular, strumous, or malignant disease, by intestinal parasites, etc. Bad hygienic conditions, especially impure air and poor and insufficient food, are predisposing causes. The disease most often appears in middle life, and is some-

times almost endemic. The symptoms, which develop slowly, are pallor, shortness of breath, palpitation, muscular weakness, œdema about the ankles, colorless lips and gums, gastro-intestinal disturbance—diarrhœa, dyspepsia, nausea and vomiting or constipation, with loss of appetite—aneurosis, dark urine of low specific gravity, slight fever, though at night the temperature may be 102° F., rapid pulse (100 to 120), soft or full, and sometimes ecchymoses. Death usually occurs in from two months to a year. The treatment is only palliative—rest in bed, nourishing and easily digested food, gentle massage, etc. Transfusion of milk and blood seem to be of little avail.

**Perosi**, pā-rō'zē, **Don Lorenzo**, Italian composer: b. Tortona, Piedmont, Italy, 20 Dec. 1872. He was educated at the Milan Conservatory, studied for the priesthood and was ordained at 23. His compositions are exclusively confined to religious subjects and have gained for him much fame throughout Italy, though they are less successful with English and German critics. He was appointed honorary maestro of the Papal Choir in 1898. He has composed many masses and among his other compositions are: 'La passione de Cristo' (1897); 'La risurrezione di Lazaro' (1898); 'Il natale del Redentore' (1899); etc.

**Perowne**, pē-rown', **John James Stewart**, English Anglican prelate: b. Burdwan, Bengal, 13 March 1823. He was educated at Norwich Grammar School and Corpus Christi College, Cambridge, ordained in 1847, and appointed curate at Tunsted the same year. He was assistant master in King Edward's School, Birmingham, in 1849, for a time a lecturer in divinity at King's College, London, and from 1862 to 1872 vice-principal of Saint David's College, Lampeter. He was one of the Old Testament Revision Committee (1870-84), and in 1875-8 was Hulsean professor of divinity at Cambridge. From 1878 till 1891 he was Dean of Peterborough, and in the last named year was consecrated bishop of Worcester. He resigned his see in 1901 and was succeeded by Charles Gore (q.v.). His published works include: 'The Book of Psalms,' a new translation, with notes (1864); 'Immortality' (1868); 'The Church, the Ministry, and the Sacraments'; an Arabic grammar. He edited the 'Cambridge Bible for Schools' and the 'Cambridge Greek Testament' for schools.

**Peroxides**, binary compounds of oxygen containing the greatest amount of that element; thus of the two oxides of hydrogen, H<sub>2</sub>O and H<sub>2</sub>O<sub>2</sub>, the latter is the peroxide; of the two oxides of sulphur, SO<sub>2</sub> and SO<sub>3</sub>, SO<sub>3</sub> is the peroxide; and so on.

**Perpendic'ular**, in geometry, a line falling directly on another line, so as make equal angles on each side; called also a *normal line*. These lines may be straight lines or curves. A plane is perpendicular to another plane if a line drawn on one of them, perpendicular to the line of intersection, is at right angles to a line on the other plane perpendicular to the line of intersection.

**Perpendicular Style**, a variety of pointed or Gothic architecture, the latest to be introduced. It prevailed in England about the end of the 14th to the middle of the 16th century,



## PERPETUAL MOTION — PERRAULT

the period during which the flamboyant style prevailed in France. It is chiefly characterized by the predominance of straight lines in its tracery. The mullions of the windows are vertical, generally rise to the main arches, and are often crossed by horizontal bars or transoms. The mechanical simplicity of this kind of tracery enabled the architects of the period to increase the size of the windows without difficulty or danger, and large windows are accordingly another distinctive feature of this style. The roof of such buildings is often among their most striking parts, being either vaulted or supported by open timber work. Another characteristic of the perpendicular style is its extensive use of paneling. Nearly all the colleges of Oxford and Cambridge are in this style, and it is also exemplified more or less in many of the English cathedrals and principal churches.

**Perpetual Motion**, literally, a device or mechanism capable of maintaining its own state of internal motion forever, without depending upon a supply of energy from external sources. In this sense, the heavenly bodies constitute a system which approximates very closely to perpetual motion, since their movements would probably continue forever if it were not for the dissipation of energy due to their slight tidal influences upon one another, and to the possible existence of some unrecognized resisting medium in space. The phrase "perpetual motion" is not commonly used in this sense, however; for a "perpetual motion" is technically and almost universally understood to be a device or apparatus which is capable of performing an indefinite quantity of mechanical work, without absorbing an equivalent quantity of energy from external sources. (See **ENERGY**; **MECHANICS**.) The search for a device of this sort was begun many centuries ago, and although educated physicists have now pronounced perpetual motion (in the more limited technical sense) to be impossible, there are still many persons who are hopefully engaged in the search for it. When the fundamental principles of mechanics were unknown, and it was believed (for example) that heavy bodies, even in a vacuum, fall faster than light ones, there was nothing unreasonable in the hope that a machine might be devised which should furnish energy enough, not only to keep itself going forever, but also to run other machines, and thus do useful work. Further study of the behavior of bodies and forces led to the discovery of certain laws of motion which clearly indicated the impossibility of solving the problem of perpetual motion by any combination of cranks and levers and gears, or by any arrangement of water wheels and pumps, or other simple mechanical devices. It is true that these laws of motion are based upon experimental evidence, and hence their truth may be legitimately questioned; but it must be remembered that all of the great advances in applied mechanics have been based upon the assumption that they rigorously exact, and it is suggestive to note that whenever a machine is constructed so that it demonstrably violates one of these laws, it does not work. Many of those who still persevere in the search for perpetual motion are ignorant of the laws of mechanics, or fail to appreciate the vastness of the experimental evidence upon which they are based. Others take refuge in the more recondite forces of nature. Driven from the field of simple me-

chanics, they seek, in the less explored fields of physics and chemistry, for principles that may conceivably accomplish what they perceive it is hopeless to search for in better explored regions. Electrical and magnetic devices, in particular, have been exploited in great numbers, and a favorite object of search is some sort of a shield which will be impermeable to magnetism. As time has gone on, and the investigation has been prosecuted in every imaginable field, it has become increasingly evident that the problem of perpetual motion has no solution. It will still appeal to many minds as a logical possibility; but thoughtful men, who are educated in physics and mechanics, have come to the conclusion, almost without exception, that there is something about perpetual motion which is incompatible with the general principles that underlie the universe as it is actually constituted. It is certainly safe to say that perpetual motion can never be attained by the hap-hazard methods that its seekers have usually adopted. If attained at all, it must be by mastering all the known principles of physics and mechanics that now indicate its impossibility, and then analyzing these and discovering some flaw in the vast mass of experimental evidence upon which they are based.

Consult: Dircks, 'Perpetuum Mobile'; Balfour Stewart, 'The Conservation of Energy.'

**Perpetual Screw.** See **ENDLESS SCREW**.

**Perpetu'ity.** See **ENTAIL**.

**Perpignan**, pĕr-pĕn-yŏn, France, capital city of the department of Pyrénées Orientales, on the right bank of the Tet, and seven miles from where that river empties into the Mediterranean. It is a fortified city of the first class, with walls dating back to Charles V. The city itself is supposed to have been founded in the 10th century; a charter was granted it by Peter II. of Aragon in 1197; and in 1408 the Council of Perpignan met here at the summons of the Antipope Benedict XIII. and attempted to bring the great schism to an end. The University, founded in 1349 by Peter IV. of Aragon, the Cathedral of St. John, begun in 1324, and Le Castillet, a château in the Moorish style, built in 1319 and now a military prison, are among the interesting public edifices. The present city is a garrison town, and manufactures woollens, silks, playing cards, cigarette paper, chocolate, leather goods, and corks, besides trading in wines, olive oil, honey, and many Mediterranean products. Pop. (1901) 29,274, and with the rest of the arrondissement of Perpignan 36,157.

**Perrault**, Charles, shărl pā-rŏ, French poet: b. Paris 12 Jan. 1628; d. there 16 May 1703. He was a man of erudition, but of little taste, whose verses have not outlived his day. Colbert availed himself of his assistance and made him comptroller-general of the King's buildings. His mediocre poem, 'Le Siècle de Louis le Grand,' which he read before the Academy in 1687, gave rise to the famous controversy on the comparative merits of the ancients and moderns. In his 'Parallèle des Anciens et Modernes' (1688-91), in the form of a dialogue, he maintains that the moderns have carried art and science, which were in a state of infancy among the ancients, to the highest perfection, and have excelled them in their works. This opinion was answered by Boileau in the 'Reflections on Longinus.' Perrault was also author of 'Les Hommes Illustres



## PERRIN—PERRY

du XVII. Siecle' (1696-1701). His 'Contes de ma Mere l'Oye' (1897) ('Tales of Mother Goose') have procured for him the title of "inventor of the French Fairy Tales," and have secured for him a more enduring reputation than any of his other works.

**Per'rin, Bernadotte**, American educator: b. Goshen, Conn., 15 Sept. 1847. He was graduated from Yale in 1869, studied in the universities of Leipsic, Tübingen, and Berlin, and in 1881-93 was professor of Greek in Western Reserve University, since when he has occupied that chair at Yale. He has written extensively on Greek and Roman history, and has edited many text-books, among them are: 'Cæsar's Civil War' (1882); 'School Odyssey,' 8 vols. and vocab. (1897); 'Plutarch's Greek Lives' (1901); etc. He is associate editor of the 'Twentieth Century Series of Text-Books.'

**Per'ry, Arthur Latham**, American political economist: b. Lyme, N. H., 27 Feb. 1830; d. Williamstown, Mass., 9 July 1905. He was graduated from Williams College in 1852, and became professor of history and political economy there in 1853, which position he held till 1891, when he was made professor emeritus. He published 'The Elements of Political Economy' (1865), a work which passed through 20 editions; 'Introduction to Political Economy' (1877); 'Principles of Political Economy' (1891); 'Williamstown and Williams College' (1900).

**Perry, Bliss**, American educator and editor: b. Williamstown, Mass., 25 Nov. 1860. He is a son of A. L. Perry (q.v.), was graduated from Williams College in 1881 and was professor of English there 1886-93. He was professor of oratory and æsthetic criticism at Princeton University (1893-9), resigning to become editor of the 'Atlantic Monthly,' which post he now (1904) holds. He has published 'The Broughton House' (1890); 'Salem Kittredge, and Other Stories' (1894); 'The Plated City' (1895); 'The Powers at Play' (1899); 'A Study of Prose Fiction' (1902).

**Perry, Isaac Newton**, American banker: b. Oneida County, N. Y., 20 Feb. 1846. He was educated at Jennings Seminary, Aurora, Ill., began his business career as clerk in a dry goods store in Aurora, later obtained a position in the First National Bank there; and then established a dry goods firm in Rochelle, Ill., under the name of the Perry Brothers. He disposed of his interests in this business, however, to take the position of cashier in the National Bank of Rochelle, holding that office for 12 years. In 1885 he organized and became cashier of the Union National Bank in La Crosse, Wis., which under his management became one of the strongest banks of the State. From there he went to Chicago in 1891 as vice-president of the Continental National Bank of that city. In 1902 he was offered the presidency of the National Bank of North America, then being organized in Chicago, and accepted the position.

**Perry, John**, English physicist: b. Ulster, Ireland, 14 Feb. 1850. He was educated at Queen's College, Belfast, was assistant master at Clifton College 1870-4, professor of engineering in Japan (1875-9), and in London Technical College, Finsbury (1881-96). He is now (1904) professor of mechanics and mathe-

matics at the Royal College of Science, South Kensington. He has published 'The Steam Engine' (1874); 'Practical Mechanics' (1883); 'Spinning Tops' (1890); 'Cantor Lectures, Hydraulics' (1882); 'Calculus' (1897); 'England's Neglect of Science' (1901); etc.

**Perry, Matthew Calbraith**, American naval officer: b. Newport, R. I., 10 April 1794; d. New York city 4 March 1858. He was a brother of Oliver Hazard Perry (q.v.). He entered the navy in 1809, served in the War of 1812, and in 1813 was promoted to the rank of lieutenant. In 1819 he was executive officer of the Cyane, which convoyed the first colonists to Liberia, and in 1821 and 1822 was active in protecting commerce from the West Indian pirates. He was then with the Mediterranean squadron for a time; in 1826 was promoted to the rank of commander, and in 1832 was again on duty in the Mediterranean in command of the Concord. He was next stationed at the Brooklyn Navy Yard (1833-43), and took an important part in the organization of the steam naval service. The Fulton, the first steam vessel of the navy, was built under his direction; and when in 1837 he was promoted to the rank of captain, he handled her with such skill that he fully proved the utility of steam vessels for naval purposes. In 1838 he was sent on special duty to England and France to investigate the steam vessels of their navies. In 1841 he was promoted commodore, and later assigned to command the squadron on the African coast for suppressing the slave trade. In 1846 he was appointed second in command of the squadron in the Gulf of Mexico, and in 1847 succeeded Commodore Conner in command. In 1852 he was entrusted by President Fillmore with a letter to the ruler of Japan for the purpose of establishing diplomatic and trade relations, and was given command of a squadron which reached Japan in July 1853. He delivered President Fillmore's letter at Kurihama, and returning to Japan early in 1854 concluded, at Yokohama, the treaty which inaugurated a new era in the history of Japan. He gave the Japanese an industrial exposition of American products and manufactures, including an illustration of the railway and telegraph at work. On 14 July 1901, saluted by the guns of three American war vessels under Commodore Frederick Rodgers, grandson of Perry, and of a fleet of Japanese vessels, graded from gunboat to battleship, a superb monolith of Sendai granite, inscribed in letters of gold, written by the Marquis Ito, and to which the emperor himself had subscribed a thousand yen, was unveiled in Perry Park at Kurihama, where the President's letter had first been delivered. Beside many brief biographies in Japanese, see 'Matthew Calbraith, a Typical American Officer,' by William Elliot Griffis (1887).

WILLIAM ELLIOT GRIFFIS,  
*Author of 'The Mikado's Empire.'*

**Perry, Nora**, American poet and prose writer: b. Dudley, Mass., 1832; d. there 13 May 1896. She was for several years the Boston correspondent of the *Chicago Tribune* and the *Providence Journal*, but in her later years her writing was principally confined to stories for girls, in which field she was particularly suc-



## PERRY — PERRYVILLE

cessful, her books of this description being marked by lively narrative and attractive character study. It is as a poet, however, that she will be longest recalled, the earliest of her poems to attract attention being the graceful lyric 'Tying Her Bonnet Under Her Chin.' Another popular poem by her was 'After the Ball.' Her published books include 'After the Ball and Other Poems' (1874); 'Her Lover's Friend,' verse (1879); 'The Tragedy of the Unexpected and Other Stories' (1880); 'Book of Love Stories' (1881); 'For a Woman,' a novel (1885); 'New Songs and Ballads' (1886); 'A Flock of Girls' (1887); 'Lyrics and Legends' (1890); 'Hope Benham' (1894); 'The Youngest Miss Lorton'; 'Those Little Daughters of the Revolution' (1896).

**Perry, Oliver Hazard**, American naval officer: b. South Kingston, R. I., 23 Aug. 1785; d. Trinidad 23 Aug. 1819. He entered the navy as a midshipman in 1799, cruised among the West Indies, served in the war against Tripoli, and in 1807 was promoted lieutenant, and in 1809 given command of the schooner *Revenge*, which in 1811 was wrecked on Watch Hill Reef near Stonington, Conn. An official court of inquiry acquitted him of all blame. At the outbreak of the War of 1812, he was in command of a division of gunboats at Newport, R. I., but in February 1813 was transferred, at his own request, to Lake Erie under the command of Commodore Chauncey. He was then ordered to Presque Isle (now Erie) to superintend the construction and equipment of a fleet; and by August had built and manned nine vessels. Taking advantage of the temporary absence of the British squadron which had been watching him, he succeeded in getting his fleet out of port, and brought the British to an engagement on 10 September, which resulted in a complete victory for the Americans. (See *ERIE, LAKE, BATTLE OF*). Perry immediately sent to General Harrison the dispatch which has become famous in American history, "We have met the enemy and they are ours." This battle was most important as giving the Americans the control of Lake Erie, and enabling Perry to co-operate with General Harrison and the land forces in the operations which resulted in the English evacuating Detroit and the victory at the Thames River. Perry became in the estimation of the people one of the chief heroes of the war, and high honors were paid him wherever he went. Congress gave him a gold medal in recognition of his services, and he was promoted captain. In 1814 he was appointed to command the *Java*, then being equipped at Baltimore; and as the Chesapeake was closely blockaded, he found it impossible to get to sea, but was actively engaged in the defense of Baltimore. After the war he cruised in the *Java* on the United States coast, and in the Mediterranean with Decatur's squadron. He was appointed commodore, and in 1819 given command of a squadron for the West Indies and South America. In July of that year he ascended the Orinoco River to Angostura, and on leaving the river was seized with yellow fever, which caused his death on the day that his ship reached Port Spain, Trinidad. He was buried there, but in 1826 his remains were transferred in the *Lexington* to Newport, R. I. Statues of him have been erected at Newport

and at Cleveland, Ohio. Consult: The 'Life' by A. S. Mackenzie (1843); Cooper, 'Lives of Distinguished Naval Officers'; Barnes, 'The Hero of Erie' (1898).

**Perry, Thomas Sargent**, American educator and critic: b. Newport, R. I., 23 Jan. 1845. He was graduated at Harvard in 1866; was tutor in German there, 1868-72; and instructor in English, 1877-81. He has spent much time abroad, and his writings which are mainly critical and historical include 'Life and Letters of Francis Lieber' (1882); 'The Evolution of the Snob' (1887); 'English Literature in the 18th Century' (1883); 'From Opitz to Lessing' (1884); 'History of Greek Literature' (1890).

**Perry, William Stevens**, American Protestant Episcopal bishop: b. Providence, R. I., 22 Jan. 1832; d. Dubuque, Iowa, 13 May 1898. He was educated at Harvard College, where he was graduated in 1854; prepared for the ministry at the Virginia Theological Seminary, was ordained deacon in 1857 and priest in 1858. After holding various charges in New England, and for a time editing the 'Church Monthly,' published in Boston, he became rector of Trinity Church, Geneva, N. Y., in 1869. Here he remained for the next seven years, during the last six months of which time he was also president of Hobart College. He had already acted as professor of history there 1871-3, and had been in 1868 appointed, in succession to Dr. Hawks, historiographer of the Episcopal Church, a position which he held until his death. In three successive General Conventions, beginning with the year of this appointment, he was secretary of the House of Clerical and Lay Deputies. In 1876 he entered the Upper House by his consecration as bishop of Iowa. In addition to his ordinary episcopal labors, he was in general demand as a preacher, and continued during the rest of his life his historical studies. The fruits of these remain especially in the valuable 'Historical Collections,' illustrating the history of the Episcopal Church in various States, and the publication of the journals of the General Convention with notes and appendices, at first in collaboration with Dr. Hawks, and afterward independently. He published also a connected 'History of the American Episcopal Church 1784 to 1884' (1885); and other works.

**Perry**, Okla., city, county-seat of Noble County; on the Atchison, Topeka & Santa Fé railroad; about 25 miles northeast of Guthrie. It is in an agricultural region, in which stock-raising is an important industry. The chief manufactures are flour, feed, machine repair-shops, and cigars. It has an extensive trade in grain and live-stock. A United States land-office is stationed here. Pop. (1900) 3,351.

**Perry**, a fermented beverage made from the juice of pears.

**Perryville, Battle of, and the Kentucky Campaign of 1862.** After the expulsion of the Confederate army from Corinth, Miss. (q.v.), 29 May 1862, Gen. Halleck's large army of 137,000 men was divided, and the army of the Ohio, under Gen. D. C. Buell, 10 June, was ordered to move on Chattanooga, the movement beginning next day along the line of the Memphis & Charleston railroad. The Union arms had opened the Mississippi to Memphis and Vicksburg, and all the country north of the



## PERRYVILLE

line of the Memphis & Charleston railroad and Tennessee River, as far east as Bridgeport, Ala., and following the Cumberland Mountains northward, to the Ohio River, had come into Union possession. The two great States Kentucky and Tennessee, except the eastern part of the latter, and the key to the railroad system of the South were held by Union troops. The advance of the Union armies on Chattanooga and Knoxville, in June and July, led to prompt reinforcement of Chattanooga and Knoxville, and Gen. Braxton Bragg was authorized to make a counter movement into Middle Tennessee and Kentucky. The idea obtained in the South that the people of Kentucky would rise and swell the Confederate ranks, and at Richmond it was thought that Bragg could march through Tennessee and Kentucky to the banks of the Ohio and beyond. Bragg was then at Tupelo, Miss., and Gen. E. Kirby Smith was in command of the department embracing Chattanooga and Knoxville. Information led both to believe that, if properly armed, at least 25,000 in Kentucky and Tennessee would join their armies. At the same time Generals Earl Van Dorn and Sterling Price were to move from Mississippi into West Tennessee and Bragg thought that all his forces would unite in Ohio. On 21 July he ordered his own army from Tupelo to secure Chattanooga against Buell's advance, and to prepare for movement to the Ohio. Bragg divided his army into two wings, the right commanded by Gen. L. Polk, the left by Gen. Hardee. He crossed the Tennessee at and above Chattanooga on 24 August, and his column of 30,000 men took up the march over Waldon's Ridge and the Cumberland Mountains. Turning Buell's left, whose advance was at McMinnville and Altamont, it threatened Nashville; whereupon Buell ordered a concentration of his army at Murfreesboro. Hearing there of Nelson's defeat at Richmond, Ky. (q.v.), he fell back to cover Nashville and his connections with Louisville. Bragg now turned northward for Louisville and the Ohio. He entered Kentucky 5 September, about 45 miles above Nashville, and halted at Glasgow. On the 13th he found that Buell was ahead of him on the railroad from Nashville to Bowling Green. Bragg, however, marching from Glasgow across the country, captured Munfordsville, with over 4,000 men, 17 September, and took up a strong position on the south side of Green River, intending to give Buell battle, but owing to want of supplies he changed his mind.

On the night of the 19th Bragg abandoned his position, which Buell, marching from Bowling Green, was about to attack, and marched for Bardstown, thus leaving the road to Louisville open to Buell, who entered the city on the 25th. Meanwhile E. Kirby Smith had occupied Lexington, Paris, Frankfort, and Cynthiana, and sent Gen. Heth to threaten Covington and Cincinnati. On 18 September Smith was in motion to join Bragg at Shelbyville, but hearing of Gen. Geo. W. Morgan's evacuation of Cumberland Gap (q.v.) and retreat northward, he suspended his movement westward and marched his entire army east toward Mount Sterling, to intercept Morgan. In this he failed, and as Bragg reports: "The delay caused by the necessity of Smith's going prevented his forming junction with my forces at Shelbyville, and enabled Gen. Buell to reach Louisville before an

assault could be made by the combined force." Smith next marched back to the vicinity of Frankfort, Bragg in person joining him from an inspection tour, with the information that Buell was moving out of Louisville.

On reaching Louisville Buell was reinforced by over 30,000 men, increasing the army of the Ohio to nearly 100,000. The army was ready to march against Bragg at Bardstown, when on the 29th Buell was handed an order from Washington relieving him from command and assigning Gen. Geo. H. Thomas to succeed him. Thomas protested against the change of command, and the order was suspended, Thomas being announced in orders as second in command. The three corps of the army were commanded by Gens. A. McD. McCook, T. L. Crittenden, and C. C. Gilbert. On 1 October Buell's army of 58,000 men moved out of Louisville in three columns against Bragg at Bardstown. Gen. Sill with his own division and Dumont's marched direct to Frankfort to threaten E. Kirby Smith. Bragg, at Frankfort, believing that Sill was but the advance of Buell's main body marching for that place, ordered Gen. Polk to move the entire army from Bardstown toward Frankfort and to strike Sill and Buell in flank, while E. Kirby Smith, advancing from Frankfort, met the Union column in front. But Polk disregarded Bragg's order and retired slowly by way of Perryville toward Harrodsburg, where he thought that the entire Confederate army in Kentucky would be concentrated. When Bragg heard of this, 4 October, he, Smith, and others were formally inaugurating a secession governor of Kentucky, a ceremony that was cut short upon the announcement that Sill was rapidly approaching Frankfort. Smith, accompanied by the newly inaugurated governor, retreated in haste toward Lexington. Dumont's division occupied the city, and Sill slipped away on the 8th to join Buell. Smith took position near Versailles, to cover Lexington and watch an advance from Frankfort. Polk, with two divisions, was ordered to join Smith. Hardee, with his two infantry divisions and Wheeler's cavalry, was left to hold Perryville and cover the depot of supplies at Camp Dick Robinson.

Meanwhile Buell's three columns were approaching Perryville. Gilbert, with the centre, preceded by a brigade of cavalry, drove back Wheeler, and on the night of the 7th went into camp four miles from Perryville, about 40 miles south of Frankfort. Crittenden, with the right, was to have encamped at Hayesville, but finding no water, he marched three miles to the west. McCook, with the left, after some resistance, reached Mackville, 10 miles from Perryville, the same distance from Harrodsburg, and six miles in rear and to the left of Gilbert. Late in the afternoon Bragg, at Harrodsburg, heard from Hardee that he was being pressed by Gilbert, whom the Confederates supposed to be isolated from the rest of Buell's army and ordered Polk to join Hardee with Cheatham's division and attack Gilbert. Hardee and Polk urged a union of Bragg's and Smith's armies before giving battle. Early in the morning of the 8th, when it was seen that the Union forces were advancing, Polk, correctly informed that the greater part of Buell's army was in his front, determined to disregard Bragg's order to attack, and after consultation





COMMODORE PERRY MEETING THE IMPERIAL COMMISSIONERS OF JAPAN, JUNE 8, 1854.







## PERSEPHONE

with Hardee and other officers, he concluded "to adopt the defensive-offensive." The battle began in an effort of the Federals to get water, in quest of which Col. Dan McCook's brigade advanced at 3 A.M. of the 8th and took position in advance of Chaplin's River. After daylight it was joined by the remainder of Sheridan's division, followed by Mitchell's and a brigade of Schoepf's. Sheridan moved up the road, driving back strong skirmish-lines, and nearly a mile in advance, with Mitchell on his right, he formed line of battle on ground overlooking a branch of Doctor's Creek. It was nearly 11 A.M. when Rousseau's division, the advance of McCook's corps, came up on the left of Sheridan, about 400 yards from him. Lytle's and Harris' brigades were put on the right. Terrill's brigade of Jackson's division on the left, Webster's brigade of Jackson's division in rear of Rousseau, and Starkweather's brigade of Rousseau's division, with two batteries on high ground, to the left and rear of Terrill's brigade. Soon infantry and artillery on both sides were engaged. The battle was mainly fought on McCook's line. Buell's army numbered about 58,000 men, and was confronted by 16,000.

Gen. Bragg came upon the field from Harrodsburg about 10 A.M., and was surprised and angered when informed by Polk that he had assumed the defensive-offensive, made some changes in the disposition of the troops, by moving Cheatham's division from the left to the right, and ordered Polk to open the attack. Polk was dilatory, and Bragg led the entire line forward, his left striking Sheridan, and the centre and right falling furiously upon McCook at 2 P.M., immediately involving his entire line in a desperate struggle. Terrill's brigade, on the left, but partially formed, received a heavy blow from Cheatham's division and Wharton's cavalry; Gen. Jackson, the division commander, was killed at almost the first fire, while directing the fire of Parson's battery; and the brigade, composed of raw troops, after inflicting severe loss on Maney's brigade, was routed, abandoning seven of Parson's eight guns. The Confederates, advancing, struck Starkweather to the rear and left of Terrill, and were checked and repulsed by the fire of his two batteries and unyielding infantry, the attacking brigades of Maney and Stewart losing nearly half their men. Later in the action Starkweather was obliged to yield some ground, and Gen. Terrill, in a vain effort to rally a part of his brigade on him, was mortally wounded. From the attack upon Terrill the battle rolled down the line upon the brigades of Lytle and Harris, of Rousseau's division, the greater part of Buckner's division attacking them with fury and, taking advantage of an interval of 400 yards between the right of Rousseau and the left of Sheridan, pressing their attack at this point. Col. Webster sprang to Rousseau's support and was killed; his brigade, with those of Lytle and Harris, were soon overpowered and forced back nearly a mile; Lytle was seriously wounded and taken prisoner; and the three brigades, terribly thinned, were about to dissolve in fragments, when Col. Gooding's brigade, of Mitchell's division, came up from the right, made a gallant charge, and after nearly an hour's contest, in which it lost 499 killed and wounded, one third of its strength, checked the Confederate ad-

vance and then threw it back. Soon after, about sunset, Steedman's brigade arrived; Lieut. F. G. Smith's battery, supported by the 18th U. S. infantry, was pushed forward and opened with canister; but it soon grew dark and the firing ceased on both sides. On McCook's right Sheridan was attacked by a part of Buckner's division and that of Anderson. He had a good position and, beside checking the assault on his own front, helped McCook by turning his artillery upon the flank of the troops opposing him; but unfortunately Gilbert, his corps commander, ordered him and Mitchell to fall back, thus uncovering McCook's right. However, he soon advanced, held his ground, though severely pressed, and as his right was strongly threatened, Mitchell sent Gen. Carlin's brigade to his assistance. Carlin formed on his right and, making an impetuous charge, broke the Confederate lines and drove them back through Perryville, capturing in the town 15 to 20 caissons and wagons, loaded with ammunition, and a guard of 140 officers and men. This was about nightfall and ended the battle on that part of the field. Crittenden's corps, on the right, was not engaged and had but two men wounded. Of Buell's 58,000 men on the field less than half were engaged. The Union loss was 845 killed, 2,851 wounded, and 515 missing, an aggregate of 4,211. The Confederate loss was 510 killed, 2,635 wounded and 251 missing, an aggregate of 3,396.

During the night Bragg, abandoning his dead and many wounded, and 13 of the 15 guns he had captured, withdrew from the field, and at daylight he retreated to Harrodsburg, where he was joined by E. Kirby Smith, raising his command to over 60,000 men. Buell awaited the arrival of Sill's division, which arrived on the 11th, and next day advanced and maneuvered to turn Bragg's left. Bragg fell back to Bryantsville, and on the 13th he began his retreat from Kentucky by way of Cumberland Gap. Buell pursued, the bulk of his army stopping at Crab Orchard, the advance going as far as London, where pursuit ended, and Buell moved back to the line of the Louisville and Nashville railroad. Bragg continued his retreat, passing through Cumberland Gap 19-24 October.

The Confederate campaign into Kentucky was a failure and a sore disappointment to Gen. Bragg and his government. In his report Bragg says: "The campaign was predicated on a belief and the most positive assurance that the people of this country would rise in mass to assert their independence. No people ever had so favorable an opportunity, but I am distressed to add there is little or no disposition to avail of it. Willing perhaps to accept their independence, they are neither disposed nor willing to risk their lives or their property in its achievement. With ample means to arm 20,000 men and a force with that to fully redeem the State, we have not yet issued half the arms left us by casualties incident to the campaign." Consult: 'Official Records,' Vol. XVI.; Fry, 'The Army under Buell'; the Century Company's 'Battles and Leaders of the Civil War,' Vol. III.

E. A. CARMAN.

**Persephone**, pēr sēph'ō-nē (Greek Περσεφόνη; Lat. *Proserpina*; other Greek forms appear), in Greek myth, according to some the daughter of Zeus and Styx, or, according to the more usual



## PERSEPOLIS — PERSEUS

tradition, the daughter of Zeus and Demeter (Ceres). Pluto carried her off, with the consent of Zeus, and made her his wife. This fable has been treated by several poets and adorned in different ways. In Homer, where she bears the name of Persephoneia, no mention is made of her having been carried off by Pluto against her will. She is simply represented as the majestic and awful wife of Pluto and queen of the lower world. According to the later story Persephone was once dancing in the choir of nymphs led by Athena and Artemis in a grassy meadow. Leaving the dancers she went with some of her companions to gather flowers. At the prayer of Pluto, and with the consent of Zeus, the earth produced 100 blooming narcissuses from one root, and gods and men were astonished at their beauty and delighted by their odor. The maid eagerly gathered them, and, beguiled by their magic power, wandered from her companions. Suddenly the earth opened, and Pluto, rising from the chasm with his immortal steeds, seized Persephone, and carried her in a golden chariot to the lower world. She called loudly on her father for protection, but in vain; no one heard her cries except Hecate and the Sun.

In vain did Zeus attempt to obtain her mother's consent to her marriage with Pluto, and he at length granted her permission to return to the upper world provided she had not tasted any of the food of the gods. But while walking through the lovely fields of Elysium she had eaten a pomegranate, and all that Zeus could grant to the prayers of her afflicted mother was that she should spend the spring and summer of each year in the upper world. (See DEMETER.)

The chief seats of the worship of Persephone were Attica and Sicily, although her worship was not wholly neglected in any part of Greece or in any of the Greek colonies. Sometimes she shared the honors paid to her husband, sometimes those paid to her mother, and sometimes particular celebrations were dedicated to her alone. In Attica she bore the name of Kore, that is, the daughter, namely, of Demeter, who is sometimes called *He Meter*, the mother; and the Eleusinian mysteries (q.v.) held in September, were sacred to both. The story of Persephone in the simple form in which it is given by the Greek poets is universally held to be a mythical account of the changes of the seasons, and this interpretation is so obvious that the ancients themselves saw in the abduction of Persephone a symbol of autumn, when the fruits of nature disappear; and in her return a symbol of spring. This idea of the myth is beautifully worked out in Schiller's ballad, 'Klage des Ceres.'

**Persepolis**, pèr-sěp'ō-līs, in ancient geography, a capital of the Persian empire, near the junction of the Araxes River (now the Kur) and the Medus (now Polvar), and 35 miles northeast of the modern city of Shiraz. Persepolis is Greek for "Persian City"; the form of the Persian name is unknown, but as the earlier notices in Greek authors call it Persæ, and as it succeeded Pasargadæ (q.v.), whose name possibly means "the city of the Persians," it may be conjectured that the Greek name is a translation of the Persian and not a new appellation. The city, probably already a great

one, became the Persian capital under Darius I. Both Darius and Xerxes did much to build up and beautify the city, which was strongly fortified with a triple wall about the citadel, on which were the royal palace and treasury. This part of the city was destroyed by Alexander the Great (about 330 B.C.); but the northern part, the real city, was unharmed and retained some importance down to the 1st century B.C. About 200 A.D. Istakhr arose here and became a royal city of the Sassanids down to 632 A.D. The ruins of Persepolis are among the most important of the remains of ancient Persia. They lie in the desert plain of Merdasht, nearly hemmed in by mountains, which are sufficiently described in the native name of Seh Gumbeddan, that is, "the three cupolas"; the natives call the ruins Takhti Jemshed ("Jemshed's Throne"), Tchil Minar ("Forty Pillars"), and Nakshi Rustem ("Rustem's Picture"). The first two names are variants and are applied to the buildings topping three terraces, up which lead a double staircase, broad enough for 10 men to pass abreast, with a slope so gentle that it is easy to ride up on horseback over the 106 steps. The second terrace, 35 feet high and 550 feet long, has at the entrance of a great propylæa, attributed to Xerxes, portals with four figures of winged bulls, two of them with men's heads, closely resembling the Assyrian statues in Nineveh. Southeast of the propylæa is Xerxes' throne room, with 13 great columns 64 feet high and 29½ feet apart, still standing; it seems to have been open to the air. At one side is the enclosed pavilion of Darius, 250 feet square, which had 100 columns. North of Takhti Jemshed are the tetragonal pyramidal remains of an ancient fire temple. Consult: Curzon, 'Persia' (1892); Dieulafoy, 'L'Art antique de la Perse' (1884-9) and Mme. Dieulafoy, 'La Perse, la Susiane et la Chaldée'; Fergusson, 'The Palaces of Nineveh and Persepolis Restored' (1851); Stolze and Andreas, 'Die achämenidischen und sassanidischen Denkmäler und Inschriften von Persepolis' (1882); and Stolze, 'Persepolis' (1892).

**Perseus**, pèr'sūs, last king of the Macedonians, son of Philip V.: b. about 212 B.C.; d. Alba, Italy, about 163 B.C. He succeeded to the throne in 179 B.C., renewed the treaty with Rome which his father had been preparing to break, but continued the preparations for war in which he had been engaged. In 168 B.C. the Romans sent Lucius Æmilius Paulus against him, and after a campaign of 13 days the Macedonian army was routed. Perseus escaped to Samothrace, but was captured by the Romans and died in honorable captivity at Alba some years later. See Droysen, 'Geschichte des Hellenismus' (2d ed. 1877-8); Mahaffy, 'Alexander's Empire' (1888).

**Perseus**, fabulous Greek hero, son of Danaë and Zeus, and grandson of Acrisius. In consequence of an oracle which had foretold that Acrisius would die by the hands of a son of Danaë (see DANAË) he was sent to sea on his birth, in a chest with his mother. But the chest reached the Island of Seriphos, and on being opened both mother and son were found to be alive. Dictys, a fisherman who found them, conveyed them to his brother, Polydectes, king of the island, at whose court Perseus was



## PERSEVERANCE — PERSIA

brought up. Polydectes at first treated Perseus with kindness, but when he was grown up became anxious to get rid of him, as he thought he would prove an obstacle in the way of his gratifying a passion which he had conceived for his mother, Danaë. Under pretense, therefore, of suing for the daughter of Ænomaus, he requested from his friends presents of rarities to make his wedding feast more splendid; and when Perseus professed willingness to bring him anything that he desired, even the head of the Gorgon Medusa, bade him bring what he had mentioned. Conducted by Hermes and Athena he first went on to the western coast of the ocean, to the three Graiæ, who had but one eye and one tooth in common. Perseus got possession of these, and promised to restore them on condition that they would bring him to the nymphs, who kept the instruments which he needed in this enterprise—the talaria, or winged shoes, the bag, and the helmet of Pluto, which made its wearer invisible. Led by Hermes and Athena he reached the slumbering Gorgons. With his face averted he approached the monsters, whose look transformed the spectator into stone, saw the head of Medusa by reflection in his brazen shield, and cut it off. Upon his return, he transformed Polydectes, with all his associates, into stone; and having placed Dictys upon the throne of Seriphos, returned to Hermes the talaria, bag, and helmet, and gave to Athena the Gorgon's head which she fixed in the centre of her shield, or, according to some, on her breastplate. Perseus then went to Argos to visit his grandfather, Acrisius. To avoid the predictions of an oracle Acrisius had fled to Thessaly; but could not escape his destiny, for Perseus followed him there, and killed him accidentally with the discus, of which he was the inventor. In consequence of this event he refused to ascend the throne of Argos, which had thus fallen to him, and exchanged it for Tiryns, the kingdom of Megapenthes. Here he founded Mycenæ.

In astronomy, a northern constellation of Ptolemy, exceedingly rich in objects of interest. In a good telescope the double cluster in the Sword-handle appears wonderfully rich in stars. Perseus contains the variable star Algol (q.v.).

**Persever'ance**, or **Final Perseverance**, the teaching of Calvin that all the arrangements for the salvation of any individual have been absolutely fixed from eternity, and that after the work of salvation has actually been begun, it will be carried forward without fail to a successful termination without, however, interfering with human freedom.

**Per'shing, Cyrus L.**, American jurist: b. Youngstown, Westmoreland County, Pa., 3 Feb. 1825; d. Pottsville, Pa., 29 June 1903. He sustained himself as a clerk and teacher at Jefferson College, Pa., where he was graduated in 1848, and was admitted to the bar in 1850. He practised his profession in Johnstown, Pa., and was elected to the Legislature in 1861, 1862, 1863, 1864, and 1865. In October 1872 he was elected president judge of Schuylkill County, presiding during the trial of the members of the "Molly Maguire" association, and was nominated for the governorship of his State by the Democrats

in 1875. He was a frequent contributor to the law journals of Pennsylvania.

**Persia** (Persian, *Irán*), a country of western Asia extending from Afghanistan and Baluchistan on the east to Turkey on the west. On the north it has Russia and the Caspian Sea, while its southern shores are washed by the waves of the Persian Gulf and the Arabian Sea. Having an area of 610,000 square miles, it occupies the larger part of the great plateau lying between the valleys of the Tigris and the Indus. The Russian Caspian survey gives to Mount Damávand an altitude of 18,600 feet and to Mount Savalan 14,000 feet. Sir Oliver Saint John who is a late recognized authority on this point claims that the chain of Kuh Dinár presents the highest continuous range in Persia many of the peaks having an altitude of 10,000 feet. To the Kúrú range between Ispahan and Kashan he assigns a height of more than 11,000 feet, while many points on the great plateau reach 8,000 feet. The lowlands are found near the sea shore of the Caspian on the north and the Gulf on the south.

**Rivers.**—The rivers of greatest importance are the Kizil Uzain, the Atrak and Gurgan, but there are many other streams; Saint John distributes the drainage as follows: (1) Those emptying into the Arabian Sea and Persian Gulf 130,000 square miles. (2) Into the Caspian and Aral Seas, 100,000. (2) Into the Sistan Lake, 40,000. (4) Into the great salt lake of Úrmiya, 20,000. (5) Interior drainage, 320,000. He points out that the area drainage into the ocean consists of a long strip nearly parallel with the Tigris and sea coast without a single protrusion inland.

**Minerals.**—Of the value and extent of mineral formations in Persia there is still much uncertainty. There are certainly deposits of iron, copper, lead, zinc, nickel, cobalt, manganese, and asbestos. But the difficulties of transportation combined with the scarcity of fuel and water have so far prevented much development of these natural resources. There are valuable turquoise mines lying north of Zamánabad, a village on the road from Mashhad to Teheran. In 1872 these were farmed by the government for 8,000 "tumans" per annum, or about \$16,000. There is also a quarry of Yazd marble between Yazd and Karman. The petrifications called Tabríz marble are also found on the road between these two places. The pearl fisheries of the Persian Gulf have an annual output of from \$1,000,000 to \$1,500,000.

**Climate.**—The climate varies greatly according to locality. In the absence of statistics there are no definite figures concerning the rainfall, but it is often scanty, and is sometimes estimated at only about five inches. Rain is more frequent in the Caspian provinces where it is hot, damp and unhealthy the greater part of the year. The cold is severe in the highlands and snow-clad mountains of the north, while the central portions of the country present a temperate climate with rich lands and fine agricultural products. In the south there may be found plenty of sand and parching heat, but there are also palms and fruits in great variety in some localities.

**Soil and Products.**—The greater portion of the table-lands are barren for the want of water and the same rule of course applies to the desert;



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but the soil responds to irrigation with a profusion of products. There are wheat and other grains, sugarcane, rice, opium, tobacco, cotton, and a great variety of fruits. Gilán is famous for its mulberry plantations and silk was long a valuable product, but of late years a disease among the worms has injured this industry for the time being and perhaps permanently. In the days of prosperous silk manufacture the exports of this staple represented an annual value of about \$3,500,000.

*Flora.*—Flowers are abundant, roses flourishing so profusely that they are cultivated in fields for the purpose of manufacture into perfumes. There are also narcissus, chrysanthemum, tulip and tuberoses, with lilies, hyacinths and many other flowers which are popular the world over.

*Fauna.*—In the Caspian provinces, most of the animals are nearly the same as those found in southeastern Europe. Horses, mules and oxen are used for domestic purposes, as well as the camel which has for centuries been the principal means of transportation across the great deserts. The Khorásán camel is of great size and strength; it bears cold and exposure better than the ordinary Persian or Arabian camel, and is able to carry almost double the load of either of the others. Among the wild animals are the lion, the wild ass, the tiger, leopard, wolf, wild sheep, mountain goat and deer.

*Population.*—In the absence of statistics there is much uncertainty about the number of inhabitants. In 1901 the total estimate of the population was between 9,000,000 and 9,500,000. The largest cities are Teheran with about 150,000; Tabriz, 120,000; Ispahan, 60,000. About 800,000 of the inhabitants are Mohammedans of the Shia'h sect. Next to these in numbers are the members of the Sunni, which is the other great branch of Moslem believers. This is the religion of the Turkish empire and other Mohammedan countries. Other religions are represented by Armenians, Nestorians, Greek Orthodox, Catholics, Protestants, Jews and Zoroastrians. Education is still in a backward state as a reading knowledge of the Koran is the highest attainment of a majority of the people. The administration of justice is in the hands of the imperial governors and the priesthood. The Shah is supposed to be the prophet.

*Commerce.*—The principal articles of import are textiles, hardware, petroleum, sugar, tea, coffee and drugs. The exports are principally opium, pearls, fruits, tobacco, gums, horses, cereals and wool. In 1901 the commerce of the Persian Gulf comprised imports to the value of \$13,854,820, and the exports \$7,103,795.

*Early History.*—There were two Iranian empires, the kingdom of Media and the dominion of Bactria which existed before Persia proper rose above the horizon. It appears that Cyrus, the conqueror, did not destroy the old Median empire; he merely transformed it and the early Persian empire was the result. In the year 546 B.C., Cyrus (or Kyros) marched from Arbela, crossed the Tigris and destroyed the last relic of Median independence. Eight years later after important struggles with the Greeks, the Persian army entered Babylonia from the south, and "the Lady of Kingdoms" became an easy victim. The fall of Babylon brought with it the submission of the tributary kings, including those of Phœnicia; but Cyrus died 529

B.C. and the Greek legends claim that he fell in battle with one of the wild tribes of the north-east. He was succeeded on the Persian throne by his son Cambyses who accomplished the conquest of Egypt in the spring of 525 B.C. Thus Egypt became a province of Persia, and it was followed by the submission of the Lybians and the Greek cities of Cyrene and Barca. A revolt, however, was soon fomented by the Median tribe of Magians, and the Magian Gomates seized the throne. In less than a year thereafter, Darius, the son of Hystaspes, with six other Persian nobles, killed the usurper, with all of his followers and tribesmen who were left in Persia. Darius was made king, but the spirit of revolt was abroad in the land. Susiana and Babylon shook off the Persian yoke. The first was soon reconquered, but it took longer to reduce Babylon. It was in June 519 B.C. that the Persians at last succeeded in penetrating the city. It was during the festival of Tammuz, the love-god, and the enemy surprised the revelers by marching through the partially dried channel of the Euphrates. After an exciting reign of 36 years which had been filled with revolts and conquests,—victories and defeats, Darius died 486 B.C. He was succeeded by his son Xerxes I. Greece was invaded under the new king; the battles of Thermopylæ and Salamis followed. The sole result of the attempt to enslave the Greeks was the foundation of the Athenian empire, when Athens took her position as the intellectual and artistic leader of the world. Xerxes was murdered by two of his courtiers 466 B.C., at the instigation, it was supposed, of his wife. His third son, Artaxerxes I. Longimanus was hardly enthroned when a second great revolt broke out in Egypt and the Athenians involved themselves in the struggle. The Greeks were virtually annihilated in Egypt, but afterward achieved victories by sea and land.

Artaxerxes died in 424, and was succeeded by his son, Xerxes II. But the new king was assassinated by his half brother 45 days after his accession. The murderer reigned six months and then in his turn was killed by another illegitimate son of Artaxerxes.

The last assassin came to the throne with the title of Darius II. His reign of 19 years was filled with a long series of revolts, the most of which were mercilessly crushed. Darius II. was succeeded by his son Artaxerxes II., Mnemon, 405 B.C., in spite of the efforts of the queen mother to substitute her younger son, Cyrus. Four years later Cyrus left his satrapy in Asia Minor and marched against his brother with about 13,000 Greek mercenaries and 10,000 native troops. In the battle of Cunaxa which ensued he lost his life as well as his cause, and the retreat of the 10,000 under Xenophon became one of the great events of history. But the authority of the Persian king was virtually gone in the west, Mysia, Pisidia and Paphlagonia being practically independent. A league was formed between Persia, Athens and other Greek states. The Long Walls were rebuilt at Athens with Persian money, and Sparta was forced to sign the disgraceful peace of Antalcidas 387 B.C. In the year 358 the king died at the age of 94, having reigned 46 years. His successor, Ochus, took the title of Artaxerxes III., but in 338 he was poisoned by his vizier who raised Arses, the youngest of the sons of Artaxerxes











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to the throne. Under this reign, a Macedonian army first crossed into Asia 336 B.C. after Philip had secured the position of General of the Greeks. The invaders gained some advantage, but the undertaking was checked in the same year by the death of Philip. About this time, Arses and his children were assassinated and he was succeeded by Codomannus who was a grandson of Darius II., and who reigned as Darius III.

Alexander crossed the Hellespont 334 B.C. and the Persian empire as such, was shattered by his attacks. Darius, the fleeing king, was murdered in Parthia before the pursuing conqueror had overtaken him. Thus ended the line of Achæmenian kings. (For the Macedonian period see ALEXANDER. For the Parthian period see PARTHIA.)

*The Sásánian Period.*—Ardashír, who was to the Sásánian period what Cyrus had been to the Achæmenian empire, probably came to the throne about 211 A.D. He slowly arose from the position of king of Persis to that of the king of the kings of Irán, a title which he gained when the last Parthenon ruler fell about 225 A.D. He first conquered Kermán, Susiana, and the petty states at the mouth of the Tigris. He made an unsuccessful attack upon the strong walls of Hatra, but conquered Media and gained the greater part of the Iránian highlands. The nominal capital was at Istakhr where the heads of conquered kings were hung up in view of the people. But the real metropolis was the Arsacid capital of Ctesiphon, just across the Tigris. Ardashír died in 241 or 242 A.D., after having won a great empire and consolidated it so well that it held together for four centuries.

He was succeeded by his son, Shapur I., who had for a time shared the throne with his father. Shapur with an invading host penetrated far into Roman territory and succeeded in taking captive the emperor Valerian. But he was afterward defeated by Odænathus at the head of his Palmyreans. (See PALMYRA.) Before the end of his reign, however, there were great changes in the east and Palmyra probably fell before his death. He was succeeded by his son, Ohrmazd I., who came to the throne about 272. His title—"the hero"—must have been won before his accession as he reigned only one year. His successor, Bahrám I., according to an inscription, was his brother. The reign of this weak and pleasure-loving prince was from 274 to 277. Of his son, Bahrám II. who reigned from 277 to 294, Persian tradition has preserved but little information. Bahrám III., called Sagan Shah, reigned, or at least held the capital for a very short time.

Narseh came to the throne in 293 and reigned ten years. He was defeated by the Romans who captured his wives and children. In order to regain his family he ceded much of his territory to Rome and the peace thus obtained lasted 40 years. Narseh's son, Hormizd II., was made king in 303 and was succeeded seven years later by his son Adharnarseh who was deposed and probably slain. The nobles were now in control of the government until Shápúr II. was old enough to assume charge of the empire. (For Perso-Roman relations of this period, see ROME under Constantine and Julian.) Shápúr II. died in 379 and was succeeded by his brother Ardashír II., who was an old man at the time and who was deposed in 383, having

placed himself in opposition to the nobles. His successor, Shápúr III., son of Shápúr II., sent ambassadors to Constantinople and made a treaty of peace. Four or five years later, however, he was murdered by the nobles. His successor (either a son or a brother) was Bahrám IV., who had ruled in Kirmán; he was therefore called Kirmán Shah. He kept peace with Rome, but was killed in 399. He was succeeded by Yazdegerd I., son of either Shápúr II. or Shápúr III. This ruler is represented as having been very shrewd and very wicked. He made a strong effort to keep peace with Rome, but died suddenly, probably by violence, in 420. Koshrau, a distant relative, succeeded, but was forced to give way to Bahrám, one of the sons of Yazdegerd. Bahrám V., surnamed Gor the Wild Ass, is the great hero of Persian fable. He soon began a systematic persecution of the Christians and commenced war with Rome. In 422, however, both parties were glad to make peace, religious freedom being given both to Christians in Persia and to Zoroastrians in the Roman empire. Bahrám V. dying in 438 or 439 was succeeded by his son, Yazdegerd II. The new king persecuted both Jews and Christians, married his own daughter and then murdered her. He died in 457 and was succeeded by his son Péróz, who continued his father's policy of persecution. His great battles were with the Hephthalites, and in 484 after a terrible fight he was missing. Balásh, his brother, came to the throne, but about 488 he was deposed and blinded. His nephew and successor, Kavádh I., found the realm full of rebellion. Having put it into a semblance of order he commenced a war with Rome in 502 which seriously weakened both powers.

In 531 he undertook a campaign against Syria. The Persians crossed the Euphrates and passed far to the northward, but were compelled to retreat in April of 531. Kavádh died the same year at the age of 82. Koshrau, his son and heir, received the title of "the Just." By carrying out his father's policy in relation to the land tax, he benefited his people as well as his treasury. In Babylonia his fiscal laws were successful down to the fall of the Sásánian empire. In 540 he led an invasion of Syria and marched through it, capturing and plundering the rich cities unless they bought him off. Antioch especially yielded much booty. It was burned and the people taken captive. Turning homeward, he traversed northern Syria and reached his metropolis in the autumn without having had a single pitched battle. The Romans paid large sums for immunity and in 562 a 50-years' peace was concluded, for which the Romans paid an annual subsidy. But Justin refused to pay tribute and in the last years of his reign, Khosrau had to face the Roman battalions again. There were alternate victories and defeats until the death of the Persian king in 579. Hormizd IV., son of Khosrau by a Turkish princess, put his brothers to death when he took the throne. It is said, however, that he upheld the cause of the poor against the great. The war with Rome went on with varying fortunes all through his reign, and he fought also with the Turks, from whom he succeeded in exacting tribute. He was put to death in 590. His son, Koshrau II., Parvez, was proclaimed king. He was immediately attacked, however, by Bahrám who seized the



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throne, and began to issue coin in his own name. But the nobles were opposed to the usurper and the next year the Roman host was upon him. The allies of the legitimate heir joined forces with the Romans, and Bahráh was conquered in a decisive battle near Zab in the summer of 591. Thus Koshrau was restored and peace with Rome followed. But he proved to be a coarse and pleasure-loving king, and although his armies covered the whole breadth of the Achæmenian empire, he was incapable of dealing with the disorder which surrounded him. He died by violence in 628. Kavádh II., Shéroé, now came to the throne. His first official act was the murder of 18 brothers, his second was the asking of peace from the Romans who were now avenging the violence which had ravaged their land for 20 years. The new Persian ruler lived only six months, during which time the principal event was a terrible pestilence. Arashír III., son of Kavádh, was now crowned king at the age of seven years. A time of trouble followed, the nobles disputing with each other for control of the government. Arashír was put to death in 630 while a reign of terror prevailed in the royal city. Bórán, daughter of Khoshrau II., reigned about a year, during which time a treaty of peace was concluded with Heraclius. She was succeeded by her sister, Ázarmídokht, probably after a short interval during which a certain Péróz reigned. The new queen was dethroned by Rustam, the Hercules of Persian legend and the hereditary marshal of Khorásán.

Our confused accounts of the period do not permit a clear chronological record of all the pretenders and disorders of the time. But about 632 Yazdegerd II., was acknowledged in the capital. He was a legitimate prince and it was hoped that he might be upheld by the powerful influence of Rustam. But a more dangerous foe than Julian or Heraclius was already at the gates of the decaying monarchy. The sons of the desert sprang to the saddle and rode to the conquest of Persia, the decisive battle being fought between 640 and 642. (See MOHAMMEDANISM.) Yazdegerd, the last king of the Sásánian empire, was murdered in 651 or 652 A.D. A fragment of Sásánian rule lasted for a time in the mountains of Mázandarán, to which the hereditary generals of Khorásán withdrew. The house of Karen reigned here, after a fashion, for 100 years, sometimes paying tribute to the caliphs. The conquest of Persia by the Arabs was more ruinous than that of the Macedonians—the Greeks only touched the surface of Persian life, but the country was almost metamorphosed by the Arabians who forced upon the people their language, literature, and religion.

*Modern Persia.*—After the fall of the Sásánian dynasty Persia was ruled by despots who were only celebrated for cruelty and incompetence. The first emperor who seemed to deserve in any measure the title of "The Great" was Tímúr. Besides exercising sovereignty over Transoxiana, the Caucasus, Astrakhan and the lower Volga, he overran Mesopotamia, Syria, Asia Minor, Afghanistan and India. He left his indelible mark upon Persia. It may be said that from north to south the whole country had been brought under his dominion. Tímúr died in 1405, but the throne was held by his family, the Timurides, until 1499. The Súfí

or Safawí dynasty then came into power with Shaikh Saifu 'd-Dín Izhák at its head. The rule of this house resulted in a division of Mohammedanism which was vitally momentous to the world of Islam. The new sect rejected the infallibility of human wisdom and threw suspicion upon the Sunni doctrines which had been the standard of Mohammedan countries. During this dynasty Persia was ruled by national kings. Such men as Isma'il, Tahmásp and 'Abbas were truly representative although the reign of the great 'Abbas is rendered mythical by crime. In 1721, Mahmúd invaded Persia at the head of a large army of Afghans, and in the following year he approached to within nine miles of the capital. A decisive battle was fought, 15,000 Persians remaining dead upon the field. Ispahan was then one of the most magnificent cities of Asia with about 600,000 inhabitants. The conqueror entered it in triumph with the captive Shah upon his left hand, and seating himself on the throne in the royal palace he was saluted as the sovereign of Persia.

Russia and Turkey at once availed themselves of the misfortunes of Persia and helped themselves to the richest and most important of her northern provinces. Meanwhile the cruel invader was deluging Ispahan with the blood of her people; at one time 300 of her nobility were invited to a banquet where they were all massacred. Mahmúd died in 1725 and was succeeded by an Afghan king whose reign was short. In 1727 the fugitive Shah was joined by Nádir Kúli, a famous robber chief who was destined to become the greatest conqueror of the age. He not only defeated the Afghan army but killed the old Shah and his legitimate heirs, after this he was proclaimed Shah of Persia in 1736. Under his rule India was invaded, her principal cities being sacked, and successful incursions in neighboring countries followed. An easy victory over the Turks gave him additional glory. But the last years of his reign were full of internal troubles, and he was assassinated by the captain of his guards in 1747. After his death there was a period of more than 40 years which was largely filled with anarchy and the struggles of rival princes. But for 19 years Kárim Káhn ruled with the title of *wakil* or regent over the whole of Persia except Khorásán.

*The Kajar Dynasty* was founded by Agha Muhammed, one of the most cruel and vindictive monarchs that ever disgraced a throne. Upon his conquest of the greater part of Persia in 1794, he ordered a general massacre; 20,000 women and children were sold into slavery and numberless other atrocities followed. He ordered 70,000 eyes of the inhabitants of Kermán brought to him on a platter, and on receiving them he counted them, touching each with the point of his dagger, then turning to his minister he said: "If one had been wanting I would have made up the number with your own eyes." After a reign of 18 years he was fortunately murdered by his own attendants in 1797. He was succeeded by Fath 'Ali Shah, under whose sanction many acts of cruelty and injustice were committed. He was followed on the throne by his son in 1834. The reign of Muhammed Shah was marked by difficulties with the British Government; by the rebellion of Agha Khán Mahlatí—"The Chief of Assassins"; by a new rupture with Turkey and the



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rise of the sect of the Bábís, who afterward led an insurrection. Muhammed Shah died in 1848 and was succeeded by his son Násru 'd-Dín Mirza.

It was during the reign of Fath 'Ali Shah that official relations began with England and British India. Mahdi 'Ali Káhn was entrusted by the governor of Bombay with a letter to the Shah. He was soon followed by an English envoy from the governor-general, Captain Malcolm of the Madras army. The results were a political and commercial treaty and a return mission to India from Fath 'Ali Shah. In 1887, Sir Henry Drummond Wolff was appointed as the British minister to Persia, Násru 'd-Dín seemed to lend a willing ear to his advocacy of the development of commerce, the construction of roads, and the abolition of various restrictions upon Persian merchants. In May of 1888 the Shah issued a proclamation assuring safety of life and property to all his subjects, and soon afterward declared the Karen River open to international navigation up to Ahváz. In the same year, the first railway in Persia was opened. It was a short line of five and a half miles from Teheran to Shah-abdul-Azim, built under the auspices of a Belgian company by virtue of a concession granted two years before. In 1873, Baron Julius de Reuter had become the owner of a concession for the organization of a Persian state bank, with exclusive rights for the issuing of bank-notes and also for the working of Persian mines. Russia then demanded what she considered a corresponding advantage but it was not until February of 1898 that Prince Dolgorouki, the Russian minister, obtained from the Shah a document which gave to Russia the refusal of any railway concession in the country for five years.

The Persian state bank was established by the British royal charter dated September 1889 and began business the next month as the Imperial Bank of Persia. In November the agreement with Russia concerning railroads was so changed as to interdict all railways whatsoever in Persia. In May of 1896 Násru 'd-Dín Shah was assassinated while paying his devotions at the holy shrine of Shah-abdul-Azim, a few miles from Teheran. He would have entered the fiftieth year of his reign in a few months. The assassin was a small tradesman of Kermán named Mirza Reza. He had lived for a short time in Constantinople and there imbibed anarchistic principles. He was hanged 12 Aug. 1896. There was but little serious commotion resulting from the assassination, dangerous rioting occurring only in Shíráz and Fárs where some of the citizens were killed and several caravans robbed. Some European firms who lost goods during these troubles were afterward indemnified by the Persian Government. The new Shah, Muzaffar-'d-Dín, was born 25 March 1853. He was at the time the governor-general of Azerbáijan residing at Tabríz where he received the notification of his accession on the day of his father's death. A few days later he proceeded to Teheran where he arrived 8 June. He was accompanied to the capital by the British and Russian consuls. In the autumn of 1896, the Grand Vizier encountered so much opposition from the various members of the Shah's entourage that he found it impossible to carry on his work, and resigned. The Shah immediately formed a new cabinet

composed mostly of the enemies of the retiring Grand Vizier, but in three months the affairs of state were in confusion. The public treasury was empty and the most important department, that of the Interior, was completely disorganized. In June Amin-ed-dowleh was made prime minister and in August raised to the dignity of Grand Vizier. Several reforms were now attempted with a view to the reduction of expenditures and the increase of the revenue, but these efforts seemed to result only in the unpopularity of the officer who instituted them.

During the financial embarrassment of 1892, Persia had contracted a six per cent loan of \$2,500,000 from London capitalists through the Imperial Bank of Persia. In 1897 various attempts were made to effect another foreign loan with the sole result of discrediting the Persian Government in Europe. In 1900 the Russian Government permitted the issue of a loan of \$12,000,000 at five per cent. This loan is guaranteed by all the customs receipts of Persia excepting those of Fárs and the Persian Gulf ports. The money was immediately remitted to Teheran and nearly all arrears were paid up, including the balance of the London six per cent loan. Russia now controls Persian finance, thus giving another severe blow to the influence of other powers. Since 1895 British influence there has been on the wane, and 1904 finds Russian domination constantly advancing. She now controls the commerce of the northern portion of the country. Public men in England realize the danger now threatening British interests in Persia. Unofficial but weighty opinion in 1902 pointed out the fact that Persia is rapidly being reduced to the position of a Russian vassal state, and that soon the Saint Petersburg Government will control the foreign relations of the Shah. The British consular report of 1902-3, received at the foreign office 15 June 1903, says: "The year ending March 1903 was, on the whole, a prosperous one as far as the trade of Kermánsháh is concerned, notwithstanding the fall in the value of the kran which greatly reduced the profits of the importing merchants. The English pound, which on 30 March 1902 stood at 55¾ krans, rose as high as 60 krans in November of the same year, but gradually fell to 57½ krans, at which rate it remained stationary for some time. Two years of continuous drought have certainly lessened the purchasing capacity of southeastern Persia, but fortunately the agricultural depression has been accompanied by a boom in the carpet trade without which there must have been a famine. In 1904 there was a great scarcity of grain and all bread was adulterated with barley flour."

*Bibliography.*—For Early Persia consult: Sayce, 'Ancient Empires'; Rawlinson, 'The Five Great Monarchies'; Spiegel, 'Iränische Alterthumskunde.' For the relations of the Sásanian empire with Rome, Clinton, 'Fasti Romani'; Saint-Martin, 'Hist. du Bas-Empire.' For Modern Persia, Malcolm, 'History of Persia'; Benjamin, 'Persia and the Persians,' and modern histories of Watson and Markham; Lady Sheil's 'Diary in Persia'; Erskine's 'Búbar'; Prof. Creasy's 'History of the Ottoman Turks'; and Ferrier's 'History of the Afghans.' The consular reports are invaluable.

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## PERSIA—PERSIAN ART

**Persia, Orders and Decorations.** See ORDERS, ROYAL.

**Persian Art.** The history of Persian art is divided into two periods by the Mohammedan conquest. In its earliest age it came from Babylonia through the medium of Susiana. It was therefore even more stiff and formal than that of the Babylonians. The palaces were raised upon lofty platforms like those from whence they were evidently copied. Their columns were surmounted with the figures of animals sitting back to back as at Nineveh. The colorings of walls and ceilings were evidently Babylonian, but the bas reliefs which were profusely used for ornamentation were much like those found in the palaces of Assyria.

The long processions of men and animals, the struggle between the lion and the bull, and the winged bulls which guarded the entrances of their palaces were all Assyrian. But the treatment was thoroughly Babylonian, and the primitive art of Persia must have been derived from this people who had themselves obtained much of it from ancient Accad.

In the Behistun inscriptions of Darius he is represented as "the king of kings," standing with his right foot on the prostrate form of a conquered foe, while nine captive kings stand before him with hands bound and heads uncrowned.

Figures of their kings have always been a favorite theme with Persian artists, and there is still a small painting about nine by six inches which represents the Nadir Shah in the early part of the 18th century. Time has mellowed its colors and added to the richness of its tones. In the centre of the foreground on a white horse, the old conqueror is the commanding figure. His officers are behind him, and around them are the bodies of the slain—both men and horses. In the distance a body of cavalry is still beating down the enemy, while at the feet of the king suppliant prisoners in bonds are pleading for their lives. It is not known who painted this picture, but he was no unworthy successor to the most celebrated battle painter of Persia, Alee Koolé Beg, who lived in the time of the first Shah Abbas (1585-1628).

The reign of this king is noted as that under which art received more encouragement than during any other period in the history of the country. Ispahân became the centre of artistic activity, but the capitals of other prosperous districts then acquired a reputation which they still retain for the production of articles of merit. This was the Periclean age of Persian art, but then as now it was largely developed along industrial lines. Ceramics received a great impulse from the Chinese artisans who were then invited to Persia.

The manufacture of reflêt pottery was resumed and continued until the invasion of Mamûd the Afghan (1722) when the secret was lost, perhaps forever. Other valuable wares of the period were the Kashee with its blue-black tints, and the pearl like porcelain which had been made at an earlier time.

Art in metals was carried to a high degree of excellence by the production of finely tempered and highly decorated weapons of warfare. They used iron, steel, gold, copper, silver and brass. The blades produced were scarcely inferior to those of Damascus. They are still formed in the shape of both scimitars and daggers. The

inlaying of helmets, shields and breastplates with gold and silver was carried to great perfection. Scarcely a hundred years have elapsed since the burnished helmets with coats of mail were laid aside by the Persians who then assumed the military accoutrements of Europe.

The productions of the metal arts in Persia consist largely of hammered ware or of designs chiseled or engraved in iron, brass, silver, copper and gold. Although many of the finest metallic vases, bowls and salvers are centuries old, the Persian artificers still exhibit a goodly degree of skill along these lines.

The finest enamels of Persia have been and still are produced at Behbahân near Shirâz. In wood carving they also have shown much taste and ability.

Portrait painting as a special branch of art has never attained great prominence, although much good work has been done in this line, and that too in spite of the denunciations of the prophet who decried all figure painting.

Nadir Shah, who was proclaimed in 1736, was a royal patron of art, and during his reign there were two celebrated artists who made a specialty of floral reproductions. Abah Ger and Mehemêt Housseïn have had many imitators but no rivals. Their work is often found on the mirror cases and it shows that they copied closely from nature. The exquisite arrangement of roses and lilies is often on a gold ground, which gives great brilliancy to their work. Nightingales were painted with great fidelity among the roses.

A vast amount of elaborate work was devoted to the illuminated manuscripts of the native poets, a single copy sometimes costing thousands of dollars. See PERSIAN LITERATURE.

Persian tapestries and brocades are wrought in silks of wonderful fabric and color. The richly embroidered shawls and portières of Kermân still present their delicate combinations of palm leaves with soft coloring of the floral borders. There are also elaborate embroideries wrought upon velvets with gold and crimson thread. When made for the royal family these superb works of art were sometimes embossed with precious stones.

It is well known that the silken rugs of Persia still lead the markets of the world. They are all made by hand, the basic warp being stretched upon frames and often a whole family will be engaged in working upon one of them. A design or a pattern rug lies before them and they follow the figures, with more or less precision; but the owner of an old Persian rug may be sure to find no others exactly like it.

The silken rugs are used mostly for hangings, although they are sometimes placed upon the floors. The woolen rugs are often heavy, and some of them never leave the country on account of their great bulk and weight. These felt carpets are called *namâds*.

The most important classes of Persian rugs are those from Feraghân, Kermanshâh, Kermân, Shirâz, Khorâsân, and Kurdistân. Many are also made in Turkistân, which was formerly a Persian province.

The colors are soft and rich as those of an old Dutch painting while their durability seems almost unlimited.

*Bibliography.*—Consult: Sayce, 'Ancient Empires of the East'; Reed, 'Persian Literature



## PERSIAN GULF—PERSIAN LITERATURE

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**Persian Gulf**, sometimes called Golfo di Bassora, an arm of the Indian Ocean, 520 miles long, 150 to 200 miles wide, with an area of 95,000 square miles, and a depth rarely exceeding 170 feet, and varying so slightly as to make navigation remarkably safe. The Straits of Ormuz, 30 to 60 miles wide, connect it with the Gulf of Oman, which opens directly from the Arabian Sea. The entire gulf is the product of the same geological force which traced the course of the Tigris and of the Euphrates. The coasts are calcareous, flat and sandy on the Arabian side and high and sheer on the Persian side. Among the islands of the gulf are Ormaza, Kishm, and the Bahrien Islands, the last being an early home of Chaldæan civilization and one of the traditional sources of the Phœnicians. The fauna contains some peculiar specimens; tiny sea-animals give the water not only a phosphorescent hue, but so green a tinge that the Arabs called it the Green Sea; and its economic importance is due to the excellent fishing, notably for pearl-oysters, which are annually worth about \$2,500,000 and employ 70,000 fishermen and 6,000 barks. Great Britain practically controls the Gulf. Russian influence in Persia is often reckoned as aiming at the concession of a port there to be reached by a railroad line from the Trans-Caspian province.

**Persian Literature.** This term in its broadest sense is applied to all the literary monuments of Irân, the great nationality which covers a period of nearly 2,500 years. It is evident that records and chronicles were written and kept long before the time of Xerxes I. from the fact that "the book of records of the chronicles" was brought to Ahasuerus and "read before the king" (Esther vi. 1). Ahasuerus has been identified by the inscriptions as being Xerxes I. — the great king.

*Old Irânian Literature* extends from at least the 6th century B.C. to nearly 300 A.D. It includes the Avesta or Bible of Zoroaster, and the ancient Persian inscriptions of the Achæmenian kings. Doubtless there were earlier annals or chronicles, with ballads, songs and mythical stories, but so far as our direct knowledge is concerned these are the earliest. The date of the inscriptions on the rocks are fixed by the time of the kings under whose direction the work was done, but we have no such guide concerning the date of the Avesta. The book represents a growth and development, but some parts of it, as the Gáthas or Psalms of Zoroaster, are assigned to about the 6th or 5th century B.C. The Avesta itself is but a fragment of a literature which once was probably encyclopædic in its character. Tradition has associated it with the name of Zoroaster, who is supposed to have lived between the 7th and 6th century B.C. Persian tradition claims that the original work comprised 21 *Nasks* or books. It is also asserted on Persian authority that most of them were destroyed by Alexander, when in his drunken fury he burned the palace of Persepolis. It was under the Sásánian kings of the 3d century A.D., that the fragments of the Zoroastrian Scriptures were collected and codified. In the

6th century, however, with the fall of the Zoroastrian creed at the hands of the Mohammedans, the literature was again scattered. That which still survives has been preserved largely through the efforts of the Parsís who left Persia on account of Mohammedan persecution and found a refuge in India. The Indian Zoroastrians now number nearly 90,000, while only about 10,000 may be found in Persia.

The language of the Avesta belongs to the Indo-Germanic family and in style much of the text is simple, but the Gáthas are difficult in form and substance. The burden of their teaching is the hope of another and better life — of the struggle that goes on in the world between the principle of good and that of evil — of the eternal reward of the righteous and the condemnation of the wicked.

*The Ancient Persian Inscriptions* which form the second great record of Irân consist of about 1,000 lines of cuneiform texts carved upon the face of the great rock at Behistun, and upon stone tablets or other hard surfaces. Mount Behistun rises sheer from the plain to the height of nearly 1,700 feet. A portion of its rocky side Darius had smoothed and prepared for his great record. Then his workmen carved the royal document which tells us that it was by divine right and his own power that Darius became king. It tells of the battles he fought, when he was victorious, the rebellions he had crushed, and the greatness of his empire. It is written in three languages, ancient Persian, Neo-Susian and Neo-Babylonian. These trilingual inscriptions have been of immense service to scholars in furnishing the key to the cuneiform inscriptions. The inscriptions of his successors, Xerxes II., and Artaxerxes I., II., III., are modeled in part upon those that preceded them, but are shorter; still they are of great interest to the philologist as evidence of the phonetic decay of the language.

*Pahlaví or Middle Persian Literature.*—The same energetic spirit which led to the collection of the fragments of the Avesta under the Sásánian kings, also stimulated other literary movements. Pahlaví means Parthian, and the works which were written during the early part of the rule of the house of Sásán show that literary interest must have lived to some extent under Parthian rule. Nearly 100 Pahlaví works survive and E. W. West, the most eminent Pahlaví authority, estimates its bulk at about 628,000 words. They are religious in their character and inspired with the spirit of Zoroastrianism.

*Modern Persian Literature* is very largely composed of poetry. It may be said to date from about the 9th century of our era. The first great poet was Firdausí, who has been called "the Homer of the East," as he occupied the same position in relation to other Persian poets that Homer has so long held in the west. Like Homer, too, he describes a rude age where muscular strength and animal courage were chiefly valued. It is true that Firdausí, like Chaucer, had his predecessors. In Persia the name of the Khorásánian Abbas of Mery (about 810 A.D.) and other early singers might be mentioned. Rúdagí of the 10th century is said to have written more than a million verses, while Firdausí's immediate predecessor, the poet Daqíqí, had undertaken the task of writing the annals of Persia in heroic verse when he was cruelly



## PERSIAN LITERATURE

murdered. Nevertheless, Abul Kásin Firdausí or "Paradise" (as the title of Firdausí signifies), is the name that opens this golden age in Persian letters. He lived about 940-1020 A.D. and more than 35 years of his life was spent in work upon his monumental poem, the 'Sháh Námah' or Book of Kings, producing an epic that makes his name immortal. He was the poet-laureate at the court of Mahmúd of Ghazni. The king commissioned him to do the work promising to pay him 1,000 drachms in gold for every 1,000 couplets. At the end of 35 years of hard work, the great poem was completed and consisted of 60,000 couplets but he was paid 60,000 drachms of silver instead of gold. The poet contemptuously threw the money away and wrote a bitter satire upon the humble birth of the king, and then fled from the Persian dominions before his latest work could reach the royal eye. The eulogistic and satiric vein of Firdausí lived again in Anvarí, who died about 1190, while his epic strain found an echo in Nízámí (1141-1203 A.D.). Nízámí was the author of the poetic legend of 'Koshnú and Shirín,' of the 'Iskandar Námah,' the story of Alexander the Great, and also the pathetic tale of 'Lali and Majnún,' which is one of the most beautiful poems in the Persian tongue. It is best known in Atkinson's translation. Omar Khayyám (q.v.), who died about 1123, was the astronomer poet who was called "King of the Wise." He was the author of the pessimistic 'Rubaiyát' or Quatrains. Persian scholars marvel at the popularity which this work has attained through the translation of Fitzgerald. Faríd ud-dín Attár, who was slain in 1230 A.D., was the author of 'Pand Námah,' or Book of Counsels, and also of the 'Mantiq attair,' or Colloquy of Birds. Jalál ud-dín Rúmi (1207-73 A.D.), the founder of the Maulavi sect of dervishes, was the author of a large collection of tales and precepts. His fame rests upon his 'Masnavi,' a work of six volumes, which is a series of stories with moral maxims, but he also wrote several lyrics which are worthy of preservation. Sá'dí, the great novelist and poet (born about 1176), was a native of Shíráz. He was an accomplished linguist and it is claimed he was the first to write verse in the Hindústáni dialect. He wrote freely, too, in Arabic as well as Persian. His style is vigorous and simple. The largest work from his pen is the 'Díwán,' a collection of lyric verse. His masterpieces, however, are the 'Bústán' or Garden of Perfume and the 'Gulistán' or Rose Garden. The former is written entirely in verse, the latter is prose with verse intermingled. They are both dedicated to the reigning king and are written in a moral and didactic tone, which in the Gúlistán is relieved by anecdotes and illustrations. His fame rests largely upon this work which contains 188 sketches with a final chapter devoted to "Rules for the Conduct of Life." Many of these rules (like some of those in the Dhama-pada of the Buddhists, appear to have been founded upon the Proverbs of Solomon. Háfiz was the pseudonym of Persia's greatest lyric poet, his true name being Shemsuddin Muhámmad. He was born in Shíráz early in the 14th century and died there about 1389 A.D. His style is clear, his imagery harmonious and his work had a fascination of its own for the Persians who are still charmed with the peculiar

accent of his rhythm. Jámí: b. 1414 A.D., was the last of the Súfís who was a prolific writer. This is also a pseudonym, the true name being Nuruddín Abdurrahman. He was a native of Jám, a small town near Herát, the capital of Khorásán; it was from this circumstance that he called himself Jámí, which means a drinking cup as well as a native of Jám. His principal works are 'Baháristán,' a Garden of Spring, 'Salámán and Absál,' a fable with a moral, the 'Haft Aurang,' or Seven Thrones, and a poem on 'Yúsuf and Zulaikhá,' a theme which had been previously treated by Firdausí. He was, however, a most prolific writer and Shir Káhn Ludí in his 'Memoirs of the Poets' claims that he was the author of 99 different works which are still admired in all parts of Irán and Hindústán. Jámí began his career as a student of science and attained considerable eminence in this field. His home was the resort of scholars, and kings and princes also came to him for advice. One of his books, 'Khorásán in Affliction' was transcribed at Lahore in the 16th century at an expense of many thousand dollars for the emperor of Hindústán. The calligraphy was the work of a famous scribe who was called "The Pen of Gold," and 16 eminent artists were employed in the work of embellishment. This elaborate work of only 134 pages was not only indicative of the great popularity of Jámí but it also shows the liberal patronage which was given to works of art under the princes of the house of Timúr. His grave is at Herát where he was laid at the age of 81 years, and this illustrious name is the last of the seven great poets who have been called "The Persian Pleiades."

*The Drama.*—So far as the drama is concerned it has never flourished in Persia until the beginning of the 19th century, and then it was connected with the Mohammedan religion. The great national play is the Tazieh, which is performed for ten successive days at the capital in the royal Takieh. In all parts of Persia this tragedy is produced with more or less power during the sacred months of mourning. It is the Passion play of a sect of Mohammedans and commemorates the massacre of Hossëin, the son of Alee, and his family. The solemnity of the occasion and the monotony which must result from the production of 20 successive acts in the afternoon and evening of 10 successive days is relieved by occasional episodes having apparently but a remote relation to the principal events of the drama. Thus the audience is carried along from scene to scene until the tenth day called "Gattle" or Day of Slaughter, when Hossëin is slain. At this time the excitement, not only of the audience, but also of the entire city, nearly borders upon frenzy.

*Decline of Letters.*—After the great poets were dead, there was for a time considerable activity along historical lines, and then in lieu of either poetry or history, the art of beautiful calligraphy was especially cultivated. At the beginning of the 19th century, a press with movable types was set up at Tabriz and a few books printed, but the art of printing met with no encouragement and the project was abandoned. Their ideal of book production is still that of beautifully written manuscripts and, failing in that, they content themselves with lithographed copies. Persia has had three successive periods of intellectual prosperity—three times



## PERSIAN MYTHOLOGY — PERSIGNY

has the national spirit awakened as from a torpor, and for a season it has gleamed like a star in the Orient, but three times it has either died out, or been crushed by the storms of conquest. Elated with their success under the brilliant leadership of Cyrus, a change that was almost fatal took place between his reign and that of Darius. Under the Sásánian kings, however, the national spirit revived and the literature of Persia sprang to life only to be trampled under the feet of the Arabian invaders. Toward the close of the 9th century, her world of letters again flourished under the various forms which have been discussed, but her glory was transitory.

*Possible Revival.*—During the 19th century there were three poets of considerable merit. Kááni of Shíráz, Yaghmá of Khorásán and Mirza Seruh of Ispahan have all done creditable work, although it is largely permeated with mysticism as embodied in the doctrines of the Sufís. Some critics claim that the productions of Kááni compare favorably with those of the most brilliant period—that his clearness of diction and elegance of style fall little short of that of Háfiz. Later we have a volume of poems by Kamul-ad-dín of Ispahan. It has been translated by Louis H. Gray of Columbia University, while an American woman, Mrs. Ethel Watts Mumford, has put the lines into verse. These quatrains of Kamul-ad-dín are love songs pure and simple, they are published first in London and afterward in America. While there may be a revival of letters in the "Land of the Lion and the Sun" it is probable that her national literature will always consist mostly of that which flourished during the flower of her age and her great classics will be those belonging to that period.

*Bibliography.*—For the 'Avesta' consult 'Sacred Books of the East' (Vol. IV.); The Inscriptions, 'Records of the Past' 1st Series, Vol. V.); 'Pahlaví, or Middle Persian Literature'; 'Sacred Books of the East' (Vol. V), translations by E. W. West. For the 'Sháh Námah,' the great masterpiece of Firdausí (Atkinson's Trans.); 'Lailí and Majnún' (Atkinson's Trans.); 'Rubaiyát' (Fitzgerald's Trans.); 'The Bústán' (Davies' Trans.); 'The Gúlistán' (Gladwin's Trans.); Háfiz and Jámí (Griffith's Trans.). For a popular survey of the subject, consult Reed, 'Persian Literature.'

ELIZABETH ARMSTRONG REED,  
*Author of 'Persian Literature, Ancient and Modern.'*

**Persian Mythology**, the series of religious stories or fables in which the ancient Persians embodied their beliefs with regard to their origin, their destiny, their gods, heroes and the supernatural powers that influenced or controlled their lives. The Persians, like other Aryans, worshipped one supreme god, Auramazda, (Oromasdes, Ormuz) "the Great Life-giver." According to the inscriptions "he gave the earth, he gave the heavens, he gave mankind, he gave life to mankind." Yet there are traces of an original polytheism, which crops up at times as the survival of a primeval creed. Oromasdes is "chief of the gods," but among these minor gods the most important is Mithra; he daily brings to men the light; he sees everything and is the guardian of truth in thought,

word, and deed. He is the valiant antagonist of the spirits of darkness. He appears as a warrior driving his white horses in a car of light, and undoubtedly is a personification of the Sun. In a relief in the Louvre he is represented as a young man, wearing a Phrygian cap. United with the worship of Mithra was that of Homa or Soma, the moon god, who gives its virtues to the soma,—a plant out of whose juices a sweet and intoxicating drink is made. With these gods must not be confused Ahriman, the "Dealer of Death"—most malignant of deities. From him, a self-existing evil spirit, proceed the evils and disasters of life,—death, and disease, sin, and poverty; frost, hail, tempest, and devastating conflagration. He had created cohorts of evil spirits to carry out his designs. He stands related to Oromasdes in the system of Persian dualism; but in the early parts of the Zend-Avesta, there are traces of nature worship, and the powers of nature are worshipped, not as persons, but as mere powers—sunshine, wind, earth, and fire. Among still lesser divinities are the good spirits headed by Sraosha and Fervers, invisible protectors of all living creatures, and serving under the control of Oromasdes. On the opposite side of the dualistic scheme appear the Divs or Devas, who must be considered distinct from the Devas (q.v.) of Brahmanism. It was one of these Divs that tempted mankind to sin after his creation in innocency; since that time every one must choose whether he will be a servant of Oromasdes the good or Ahriman the evil. The good after death are taken to Garô-Demanâ ("the House of the Angels Hymns"), Heaven; the wicked are cast into Drajo-Demanâ, the Abode of Demons, and of the priests of Deva. The Bridge of the Gatherer or Judge stretches between these two; only the just can cross it. After a general resurrection, Death, the arch demon of the world, is to be slain, and everlasting life in righteousness will succeed.

**Persian Powder.** See INSECTICIDES.

**Persian Wheel.** See NORIA.

**Persigny**, pĕr-sĕn-yĕ, **Jean Gilbert Victor Fialin**, Duc DE, French statesman: b. Saint Germain-Lespinasse, department of Loire, 1 Jan. 1808; d. Nice 13 Jan. 1872. Having entered the army he took part in a movement among a section of the troops in favor of the revolution of July (1830), and was dismissed from the service on the charge of insubordination. He then went to Paris and took up journalism, became a Bonapartist and was an intimate friend of Louis Napoleon. He was the instigator of the military rising at Strasburg in 1836, was arrested, but managed to escape; and in 1840 shared in the expedition to Boulogne, when he was again captured; and on this occasion condemned to 20 years' confinement, but his captivity ultimately resulted in nothing more than restriction to the town of Versailles. On the outbreak of the revolution of February 1848 he hastened to Paris, brought about an agreement between the members of the Napoleon family, collected their adherents, traveled over France on their behalf, and in various other ways largely contributed to determine the vote by which Louis Napoleon was elected president of the republic, on 10 Dec. 1849. He was also one of the most prominent actors in the *coup d'état* of 2 Dec.



## PERSIMMON — PERSONAL LIBERTY LAWS

1851. In January 1852 he was nominated minister of the interior, and in this capacity signed the decrees relative to the confiscation of the Orleans estates, and directing the first elections to the *corps législatif*. In 1855 he went as ambassador to London. In 1860 he was again minister of the interior, but in 1863 resigned his portfolio once more. He was elevated to the rank of duke in 1863. Consult: Delarva, 'Le Duc de Persigny et les Doctrines de l'Empire' (1865).

**Persimmon, or Date-plum.** These names are given to each of several trees and shrubs of the order *Ebenaceæ*. Like other members of their genus (*Diospyros*), of which there are about 180 mostly tropical species, these have deciduous or persistent entire leaves, diœcious or polygamous whitish or yellowish flowers in axillary cymes, followed by large juicy fruits (berries) containing from one to ten flat seeds. The best known species in America is the common or American persimmon (*D. virginiana*), which often reaches 50 feet in height and sometimes 100 feet, with a spreading, round-topped head and frequently drooping branches. It is found from Connecticut to Indiana and southward to the Gulf States. The plum-like fruits, to which the calyx is adherent, are usually about an inch in diameter, yellow with a pink cheek on the sunny side, and of variable flavor. Contrary to popular belief, they are not always astringent until frozen; nor does freezing make all persimmons edible. There are wild varieties which ripen in early autumn before frost, and others which continue unpalatable in spite of frost and sun. The tree will thrive as far north as southern Michigan and western New York. Though there are numerous native seedlings which bear good fruit, yet even in its most favored districts the tree has attracted little horticultural attention. Like other members of the genus, notably *D. ebenum*, which yields ebony, this species furnishes a hardwood useful for interior finish of houses, but ill adapted to resist moisture. Propagation is readily effected by means of seeds stratified out of doors during the winter and planted like peach-pits in the spring. Since they are exceedingly variable, they are usually grafted or budded when two years old, in early spring, with desirable varieties. Unless transplanted when very small, they are likely to fail because of their long tap-roots. Autumn transplanting is preferred, the top being cut back severely, but the roots retained as much as possible. The trees succeed best upon well-drained, rich, loamy soil well exposed to the sun.

The Japanese persimmon or kaki (*D. kaki*) is a smaller species than the American, rarely exceeding 40 feet in height, some varieties being under 10 feet. It is a native of Japan, China, and Korea, where it is one of the leading cultivated fruits. During the closing quarter of the 19th century it was successfully cultivated in the Southern States, and is making its way as a dessert fruit in northern markets. The fruits, which often resemble tomatoes in appearance, are several times larger than the native species. Some of them resemble apricots in flavor. They have been successfully cultivated in the Atlantic States as far north as Virginia; in the Gulf States, and in California. Usually they are propagated by budding or grafting upon

seedling stocks of the American species, like which they are cultivated.

Two other species are cultivated for their small black fruits: *D. lotus*, an Asiatic species, in China, Japan, and Korea; and *D. texana*, in Texas, New Mexico, and Mexico, where it is indigenous.

The persimmon is fairly free from insects, few of which are troublesome. The chewing species, such as caterpillars, can be controlled by arsenites; the sucking species, such as plant-lice and flea-lice, by kerosene emulsion. (See INSECTICIDE.) Consult: Watts, 'Persimmons,' Tennessee Agricultural Experiment Station Bulletin XI., No. 1; Hadley and Troop, 'The American Persimmon,' Indiana Agricultural Experiment Station Bulletin, No. 60; Bailey, 'Cyclopedia of American Horticulture' (1900-2).

**Persius Flaccus**, pèr'shī-ūs flāk'ūs, **Aulus**, Roman satirist: b. Volaterræ, Etruria, 34 A.D.; d. Rome 62 A.D. He was a pupil of the grammarian, Virginius Flavius, probably also of Remmius Palæmon, but above all of the Stoic Cornutus, whom he celebrated in his verse, and whose teachings he faithfully proclaimed and expounded. In Pætus Thræsea, the famous senator and lofty Stoic, he found a patron. His earlier poetic ventures he burned. But he left six satires, containing only between 600 and 700 lines, which, retouched by Cornutus, were published in a booklet by Cæsius Bassus, a fellow poet. These works won immediate and high reputation. Apparently the obscurity which had become felt as far back as Jerome, and made him "the paradise of commentators," was not sufficient to disturb contemporaries. This unintelligibility seems to be the result of an effort to condense into phrases more meaning than they may clearly bear. Whether or not this is a literary trick has been debated; but such certainly is its effect. Within a limited field Persius evinces keen insight, descriptive gift, and dramatic power. At times he gives interesting glimpses of his studious life, and his devotion to the noble interests of his philosophy. He was a persistent, though none too successful, imitator of Horace, playing generally unsatisfactory changes upon some 100 various lines of the earlier poet. He was seriously in earnest, and is practically without humor. Many of his pointed expressions have passed into the store of literary quotation. There are editions by Orelli (1833); Hauthol (1837); Jahn (1843; rev. by Bücheler 1886); and, with excellent notes, by Gildersleeve (1875). Conington made a prose rendering into English (1874). Consult also: Knickenberg, 'De Ratione Stoica in Persio' (1869).

**Personal Equation.** See EQUATION, PERSONAL.

**Personal Liberty Laws**, in American history, a general name applied to those statutes passed by the Northern States to protect the negroes within their borders. The first acts were passed about 1840, though Indiana and Connecticut had previously provided that fugitives might have a trial by jury. The Fugitive Slave Law (q.v.) of 1850 aroused the most violent opposition in the North, and before 1856 many of the States had passed personal liberty acts. Beside prohibiting the use of State jails, these laws forbade State judges and officers to



## PERSONALITY AND ITS DISORDERS — PERSPIRATION

assist claimants or issue writs. Trial was to be given all alleged fugitives. Heavy penalties were provided for the violation of these laws. Such acts were passed in Vermont, Connecticut, Rhode Island, Massachusetts, Michigan, Maine, Wisconsin, Kansas, Ohio, and Pennsylvania. Of the Northern States, New Jersey and California alone sanctioned the rendition of fugitives. See SLAVERY.

**Personality and its Disorders.** Personality is a loose term, sometimes equivalent to personal identity, or to individuality, and meaning the sum total of the normal conscious processes and their manifestations. Disorders of personality are extremely complex and difficult of analysis. The celebrated case of Dr. Jekyll and Mr. Hyde is an interesting literary study of one of the phases of so-called double or alternating personality. In a typical case of disordered personality minor changes in the general nervous system usually appear and cause the patient to make false interpretations of abnormal sensations. Often the patient feels himself changed and different. He becomes automatic, as though in a dream, and usually his imagination runs riot with his sensations, which are thereby distorted, perverted, and misinterpreted. In the severer grades of the disorder, or symptom—for it is but a symptom found in a number of diseases—these alternations in personality are indicative of grave nervous disorders. Obsessions, neurasthenias, epilepsy, hysteria, and the psychasthenias and insanities are the usual heads under which they may be classed. Many drugs—opium, cocaine, mescal, cannabis indica, etc.—can produce marked alternations in personality. Consult: Ribot, 'Disease of Personality'; Binet, 'Alternations in Personality'; Royce, 'Studies in Good and Evil'; James, 'Varieties of Religious Experience'; and Janet, 'Mental State of the Hysterical.' See EPILEPSY; GENERAL PARESIS; HYSTERIA; HYPNOTISM; INSANITY; NEURASTHENIA; PARANOIA.

**Person'ifica'tion**, the representation of things inanimate or of abstract ideas as living things or persons. This is a familiar practice in all the arts; thus we have the statue of liberty and the familiar 'My Country 'Tis of Thee,' both of them implying the personification of an idea which has no real human attributes. Fine examples of personification in poetry are the 'Passions' of Collins, and the odes of Gray. Michelangelo's statues of 'Night' and 'Morning'; Guido Reni's 'Dawn'; Titian's 'Beauty, Sacred and Profane' are noble examples of personification in art.

**Perspira'tion**, or **Sweat**, the fluid secretion of the sudoriferous glands (sweat-glands) of the skin. The term perspiration is, however, sometimes used to include all the secretions of the skin, such as those of the sebaceous glands or follicles, etc. The sweat consists of part of the watery constituents of the blood, separated therefrom by the sweat-glands, and eliminated on the surface of the skin in drops of fluid. The sweat-secretion, in ordinary circumstances, is evaporated from off the skin as fast as it appears. But after violent exercise, when the body is exposed to a great heat, even during periods of strong mental emotion, or in certain diseases, the perspiration may collect in greater quantity,

and appear in the form of visible drops of fluid. The sweat-glands are situated in the subcutaneous adipose or fat-tissue of the skin. Each consists of a coiled-up tube, forming a glandular structure, which is invested by a capillary network of blood-vessels. The tube is continued in a somewhat wavy course upward through the cutis or true skin. When it enters the epidermis it becomes spiral, and it continues to ascend through this superficial layer of the skin in a tortuous course till it opens on the surface in an oblique aperture. The duct is lined by epithelial cells, continuous with those of the epidermis itself. The openings of the sweat-ducts are the pores of the skin. The largest and most numerous ducts are situated in the palm of the hand. Their number in this situation has been estimated by different authorities at from 2,736 to 3,528 to the square inch. The sole of the foot is also as abundantly supplied; and these ducts and glands occur, in less numbers and of smaller size, over the entire body surface. In the neck and back they number only about 417 to the square inch and the entire number in the body is estimated at 2,381,428. If placed together, the openings of the entire sweat-glands would form, it is calculated, an evaporating surface of about eight square inches; that is, reckoning each orifice or sweat-pore to present a diameter of one fifty-sixth of a line. The line, as Krause estimates it, is equal to one tenth of an inch.

The insensible perspiration of the skin is a term used by physiologists to denote the matters evaporated from the skin, and which are thus continually being got rid of without being noticed. When the sweat collects in drops on the skin-surface, it is termed sensible perspiration.

The analysis of sweat has always formed a matter of dispute, chiefly from the difficulty of obtaining the secretion in sufficient quantity to make an exact estimate of its compounds. In ordinary sweat, water, carbonic acid, and sebaceous matter may be assumed to be the chief constituents. Thenard, analyzing the sweat obtained from a flannel shirt washed in distilled water, found chloride of sodium, acetic acid, phosphate of soda, phosphate of lime, traces of oxide of iron, and an animal substance. Berzelius obtained chloride of sodium, chloride of ammonium, and lactic acid, in sweat from the forehead. Anselmino, in the sweat collected from his own arm placed in a glass cylinder, found water, carbonic acid, and acetate of ammonia; and from the dried residue or ashes of sweat he obtained soda, in the form of the sulphate, phosphate, and carbonate, potash, chloride of sodium; phosphate and carbonate of lime; and oxide of iron (traces). A certain amount of urea is generally regarded as a normal constituent of sweat-fluid. Gorup-Besanez says that the general and ordinary composition of perspiration is included under the list of water, fat, urea, acetic, butyric, and formic acid, and salts—the latter being chlorides of sodium and potassium, earthy phosphates and sulphates; together with oxide of iron.

The quantity of sweat evolved from the skin has been estimated by Valentin at nearly 1½ pounds daily, or 11,744 grains. This calculation is based on the assumption that the exhalation from the respiratory organs and skin together amounted daily to 19,000 grains, or 2½ pounds.



## PERTH — PERTH AMBOY

From this total quantity 5,000 grains are subtracted for the pulmonary exhalation, and 2,256 grains for the excess of weight of the exhaled carbonic acid over that of the equal volume of inhaled oxygen; leaving a remainder of 11,744 grains. Lavoisier and Sequin calculated that 18 grains per minute represent the loss by pulmonary and cutaneous exhalation together. Of these 18 grains 11 are calculated to be exhaled by the skin and 7 by the lungs. The carbonic acid got rid of by the skin is calculated to amount to about  $\frac{1}{50}$ th of that exhaled by the lungs, this calculation applying to warm-blooded animals only. In amphibians (frogs, etc.), in which the skin plays a more important part in respiration, the amount of carbonic acid exhaled is much greater than that above stated to occur in warm-blooded animals. A frog, the lungs of which had been cut out, generated by its skin  $\frac{1}{4}$  cubic inch of carbonic acid in 8 hours. The amount of watery vapor secreted by the skin has been roughly calculated to amount to double of that exhaled by the lungs in the same or during any given time. The entire subject of transpiration by the skin shows how very closely connected is that function with respiration and excretion by the kidneys. See RESPIRATION; SKIN.

**Perth**, pèrth, Scotland, city, capital of the county of the same name, on the right bank of the Tay, here crossed by an elegant bridge of nine arches, a steel girder bridge (1900), and a railway bridge; and at the common junction of railways from Dundee, Aberdeen, Glasgow, Edinburgh, and Inverness, 33 miles north-northwest of Edinburgh. It presents a striking and attractive appearance, owing to the verdant slopes and well-wooded hills by which it is surrounded, and to its spacious and beautiful meadows, situated on the north and south sides, and called respectively the North and South Inch. Across the Tay is the suburb of Bridgend, and beyond it the steep Kinnoull Hill, rising to the height of 729 feet.

The town is laid out with considerable regularity, and contains several spacious streets, handsome terraces, and crescents. The public buildings include the municipal building, a handsome edifice in the Tudor style; the county building, an elegant Grecian structure, facing the Tay; the penitentiary or general prison; the city and county infirmary, the Royal Lunatic Asylum, finely situated on the north side of Kinnoull Hill; the public hall, in the Scottish baronial style; the water-house; the handsome new post-office; the Academy; Sharp's Educational Institution; and various other schools; the attractive building of the Antiquarian Society, called Marshall's Monument, which contains a public library, in addition to the museum of the society; the Sandeman Public Library; the railway station, the finest terminus in Scotland; the infantry and cavalry barracks, etc. Among ecclesiastical buildings are Saint John's church, an ancient structure in the pointed style, with a massive square tower, terminating in a spire, originally forming only one church, but now converted into three parish churches; Saint Paul's, also a parish church, of modern erection, with a lofty steeple; a handsome Episcopal cathedral, recently completed, and another Episcopal church; numerous United Free and other churches.

Of industrial establishments the chief are large dye works, iron-founding and engineering works, brass-foundries, works for manufacturing woolens, hosiery, fancy dress goods, etc., table linen; works for jute spinning, rope, and twine; and there are also breweries, bleach-fields, brick and tile works, and flour-mills. The river admits vessels of 600 tons to the town, but the shipping trade is small. There are extensive auction sales of cattle and other stock.

Perth was formerly known as St. Johnstoun. It was created a royal burgh in 1210 by William the Lion, and the Scottish parliament repeatedly assembled here. Among the most remarkable events connected with it are its capture and the carrying off of its records by Edward I. of England in 1298; the murder of James I. in 1437; the various events connected with the progress of the Reformation; the Gowrie conspiracy or Raid of Ruthven in 1600; the capture of the town by Montrose in 1644, after his victory of Tibbermuir; its capitulation to Cromwell in 1651, and its occupation, first by Viscount Dundee in 1689 and afterward by the Highlanders in 1715 and 1745. Pop. (1901) 32,872.

**Perth**, Western Australia, the capital of the state, on the Swan River, 12 miles above the port of Fremantle, which is situated at the mouth of the river. A macadamized road, constructed by convict labor, connects Perth with Fremantle, and there is also regular communication by water and rail. The city is built on a slope, washed at its base by a lake-like expanse known as Melville Water. The streets are regular and moderately wide. The principal public buildings are the city hall, the chambers of the Legislative Council of the state, an assembly room and offices, two cathedrals, one Protestant and one Roman Catholic, a hospital, government offices, pensioners' barracks, a handsome mint, a fine new music hall, a mechanics' institute containing a museum, the Victoria public library, the governor's palace, the high school, government and Roman Catholic schools, and some handsome hotels and private residences. There is telegraphic communication with the principal districts of the colony. In 1901, Fremantle had a population of 20,444, and Perth, 36,274.

**Perth, The Five Articles of**, a measure, passed in a general assembly of the Church of Scotland, convened 1618 at Perth by the order of James VI. The first required communicants to receive the elements kneeling; the second permitted the celebration of the Holy Communion privately in case of sickness; the third allowed private baptism on sufficient cause; the fourth required that children of eight years should be confirmed; and the fifth enjoined the religious observance of Christmas Day, Good Friday, Easter Day, Ascension, and Whitsunday. These articles were accepted by the Estates in 1621, but were opposed by the Presbyterians of Scotland. In the assembly held at Glasgow in 1638 the assembly of Perth was declared to be unlawful and null, and the Five Articles were formally condemned.

**Perth Amboy**, ăm-boi', N. J., city, port of entry, in Middlesex County; on Raritan Bay, at the mouth of the Raritan River, and on the Central of New Jersey, the Staten Island Rapid



## PERTHES — PERU

Transit, the Lehigh Valley, and the Pennsylvania R.R.'s; about 15 miles south of Newark and 25 miles in direct line south by west of Battery Park, New York city. It has extensive shipping interests on account of its good harbor. In the vicinity are valuable deposits of fire-clay. The first white settlement was made about 1683 at the site of an Indian village called "Amboy." The settlers were from Scotland and they named the place Perth, in honor of James, Earl of Perth. Soon after the Indian name "Amboy" was added. It was the capital of the province nearly all the time it was held as a colony of Great Britain. In 1776, William Franklin, the last British governor of the province, was captured here. It is a commercial and industrial centre of importance. The chief manufacturing establishments are large smelting and refining plants, ship-building yards, brick, terra cotta, iron and steel works, chemical works, copper works, and railroad shops and yards. There are about 3,000 employees in the manufactories. The city has a high school, public and parish schools, and a public library. The three banks have a combined capital of \$300,000. The city owns and operates the waterworks. Pop. (1890) 9,512; (1900) 17,699.

**Perthes**, pĕr'tēs, **Friedrich Christoph**, German publisher: b. Rudolstadt 21 April 1772; d. Gotha 18 May 1843. After carrying on business in Hamburg for many years, in 1821 he removed to Gotha and founded there a prosperous publishing business, chiefly of historical and theological literature. An uncle of his, J. G. Justus Perthes, was the founder of the firm Justus Perthes of Gotha, celebrated as the publishers of the famous geographical work 'Petermanns Mitteilungen,' and of the 'Almanach de Gotha.'

**Pertinax**, pĕr'ti-nāks, **Publius Helvius**, Roman emperor: b. Alba Pompeia, 126 A.D.; d. Rome, Italy, 28 March 193 A.D. He was well educated, entered the army and distinguished himself in the service, attracted the attention of Marcus Aurelius who elevated him to the consulate in 179. He was in command of the legions which crushed the revolt in Syria, was governor in turn of Mœsia, Dacia, and Syria, and under Emperor Commodus was placed in command in Britain. Later he became pro-consul of Africa and finally prefect of Rome. On the death of Commodus he was proclaimed emperor in 193 and immediately set about forming a government which was to reform the abuses countenanced by his predecessor. He was well received by the senate and the people, but failing to gain control of the Prætorian Guard he was assassinated by that body three months after his accession.

**Perturbations**, in astronomy, deviations in motion of planets or comets from their fixed orbits or from the regular velocity in those orbits. They are regarded not as drawing the planets out of their orbits, but more in the light of change in elements of the orbits themselves.

**Peru**, pĕ-roo' (Sp. pā-roo'), **Republic of**, a country of South America, bounded on the north by Ecuador and Colombia, on the east by Brazil and Bolivia, on the south by Chile, and on the southwest and west by the Pacific Ocean. The location of the northern boundary is a subject of dispute, both Peru and Ecuador (q.v.) laying claim to a

region, larger than Uruguay, adjoining the Marañon River. During 1903 the clashing of outposts of the forces of the competing nations in that region resulted in loss of life. On the south, Chile holds Tacna and Arica, which may still be returned to Peru (see below *History*). Thus, about one fourth of the national territory is subject to adverse claims; moreover no thoroughly reliable surveys of the eastern district have ever been made. Estimates of the total area are, therefore, naturally far apart:—378,000 square miles, or 480,000 square miles, the latter being preferred by the British authority, C. R. Markham. The Lima Geographical Society gives 695,733 square miles, and the government claims a part of Acre.

*Political Divisions.*—Departments are: Piura, 135,615 inhabitants; Cajamarca, 212,746; Amazonas, 34,284; Loreto, 61,905; Libertad, 147,336; Ancachs, 284,830; Lima, 225,800; Huancavelica, 103,069; Huanuco, 78,991; Junin, 209,759; Ica, 60,255; Ayacucho, 142,215; Cuzco, 243,032; Puno, 259,449; Arequipa, 157,046; Apurimac, 118,525; Lambayeque, 86,738; and Tacna (held by Chile), 36,009. These figures are taken from the census of 1876; since the war the population has increased but moderately; an estimate made in 1896 is unreliable. Provinces are: Callao, 48,118 (estimated); and Moquegua, 28,785. Lima, the capital, had 113,000 in 1896; Arequipa has 35,000; Cuzco about 30,000.

*Topography and Hydrography.*—The maritime cordillera, rising about 20 miles from the coast, and the great ranges of the Andes farther inland, divide Peru into three principal regions: (1) The central, called the sierra, including the parallel chains of mountains—the Maritime and Central Cordilleras and the Andes—together with transverse ridges, table-lands, deep gorges, and intermediate valleys; (2) the montaña, all that territory lying between the eastern Andean slope and the Brazilian and Bolivian frontiers; (3) the arid coast region. In the sierra the mountains of the western part are volcanic, while those of the east have an entirely different geologic history. To the former are ascribed the violent earthquakes which have so often afflicted the country; the latter are famous for the production of gold. Both western and eastern ranges show through their whole extent peaks of great height (16,000 to 22,000 feet). The heart of the sierra, where Inca semi-civilization arose, is in a comparatively limited section, measuring about 380 miles from south to north, between the great transverse ridge of Vilcañota and that of Cerro de Pasco. The main natural features of the montaña are the rivers Marañon, Huallaga, and Ucayali, each of these being navigable, and all uniting to form the stream which here is called the Marañon, but on its lower reaches the Amazon. The sources of the first two are in the interior of the sierra; on the other hand the lower portion of the montaña forms its rivers on the eastern slope of the Andes, and sends them as affluents to the Madeira system. The absence of rain on a large part of the Pacific coast is due to the fact, mentioned in the article SOUTH AMERICA (q.v.), that the prevailing winds from the east lose all their moisture in passing over the Andes. Numerous rivers, rising in the central or western Cordilleras, make their way to the ocean across this desert. Har



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bors are few and insecure, though that at Callao has been improved by extensive works. Principal lakes are: Titicaca, 12,545 feet above sea-level, about 80 miles in length and 40 in breadth, its southern portion enclosed in Bolivian territory; Titicaca, 12,545 feet above sea-level, 36 miles long by 7 wide; and Parinacochas, 12 by 6 miles.

*Mineral Resources.*—The latest report of the Department of Fomento of the Peruvian government contains the following interesting statement: "The chronicles of the discovery and exploitation of Peru's chief mining zones during the colonial epoch make the most important chapters in the history of that period. The development of this industry was stopped, first, by the abolition of compulsory Indian labor, and, secondly, by the revolt of the Indians and the prolonged war for national independence. . . . Later, the easy and sure exploitation of the fabulously rich guano deposits rendered it unnecessary to risk capital and spend energies in the hazardous and difficult mining industry. When the guano deposits began to be exhausted, the men who had been engaged in that industry turned their eyes toward the rich mineral deposits of Peru, and resolved to encourage their exploitation. The founding of the School of Mines in 1876, and the passage of the mining law of January 1877, which made the holding of mining property perpetual and irrevocable (contrary to the practice under the old Spanish codes), caused a renewal of this great national industry." This increase is indicated by the following figures: The number of claims registered in 1880 was 1,756; in 1902 the claims numbered 6,380. The export of ores for treatment in foreign countries increased from 15,000 tons in 1897 to 46,885 tons in 1901. Consular reports to the British Foreign Office (12 June 1903) say: "A salient feature during the year has been the influx of United States capital, which is being expended in the payment for hundreds of copper and silver mines. . . . To facilitate the transport of the ores to the coast the syndicate has in course of construction a railway from Oroya." The reports also refer to activity among the British and German mining companies. An immense area along the Pacific coast, which has not yet been carefully studied, produces oil. Deposits of iron are found in Piura and elsewhere; extensive coal fields in the departments of Ancachs, Huaigayoc, and Cajamarca. A region which is regarded at present as the richest in gold is in the southeastern part of the republic, comprising the provinces of Sandia, Carabaya, and Quispican-chis; four fifths of the total production of gold in Peru in 1901, namely, 87,500 ounces, having come from Sandia and Carabaya. The gold production in 1902 amounted to \$1,800,000. Silver ore occurs very generally throughout the entire Andean region, often combined with copper or lead; the district most famous in this respect is the Cerro de Pasco, department of Junin, which has produced since the date of its discovery by the Spaniards (1630) about 50,000 tons of silver. Other minerals are cinnabar, in Huancavelica, and borax, near Arequipa. True copper veins, containing only that metal and a small proportion of silver and gold, are found near the coast; copper ores containing sulphur, arsenic, and antimony in the sierra.

*Climate.*—The line of perpetual snow is usu-

ally about 16,400 feet, though in some situations only 15,400 feet, above sea-level. Plains stretching between the mountain-peaks are often exceedingly cold; the climate of the numerous deep valleys, however, is tropical, and that of the intermediate slopes temperate. The rarefied atmosphere of the cooler uplands is not healthful. Tropical conditions prevail in the montaña and coast region, but with a marked difference: the former is exceedingly rainy, and the latter, from November to April, has no rainfall whatever.

*Flora and Fauna.*—The cinchona tree, from which quinine is obtained; the India rubber, sarsaparilla, vanilla, etc., are characteristic of the montaña. Sugarcane, cotton, coca, cocoa, coffee, and tropical fruits are grown in the valleys; the sierra is said to be the original home of the potato. The fauna includes, besides species mentioned in the articles COLOMBIA and ECUADOR, the alpaca, llama, and vicuña. Among avifauna, the condor is conspicuous, and seabirds (the gulls, tern, etc.), in great numbers frequent the small islands near the coast.

*Agriculture.*—The sugar plantations give employment to 25,000 persons, and the total production in 1903 was 105,000 tons. Cotton is being cultivated on quite a large scale, that variety which is preferred for export growing in the department of Piura. Indian corn, which is indigenous to South America, thrives in all parts of Peru below the frigid table-lands. Cacao and coffee are both of excellent quality. The plantations of rubber are on the eastern slopes of the Andes, and in the region bordering on the large rivers of the department of Loreto. The supply is said to be so abundant that only one hundredth part of the trees can be used. Coca is sent chiefly to Germany, where it is valued on account of the cocaine which it contains. Other agricultural products are: Manioc, rice, tobacco, wine, wax, honey, etc.

*Commerce and Manufactures.*—The value of exports from Peru, as shown in the report of the Department of Finance, increased steadily from 1897 to 1900. In the first half of the year 1902 merchandise valued at \$7,391,681 was imported. The export of ores increased slightly, as compared with that of the previous year. The foreign commerce of the country in 1901 consisted of exports to the value of \$21,021,068, and imports \$13,487,715. President Romana, in his message of 29 July 1903, says: "The total value of imports during 1902 was \$15,488,297, and the exports amounted to \$18,878,441. The exports of sugar increased 2,000 tons, and the importation of machinery for agricultural, mining, and other industries has been doubled in the last four years." For the year ending 30 June 1902, commerce with the United States was represented by imports, \$2,500,000, and exports, \$3,200,000. Great Britain's trade with Peru is very much greater than that of any other country—even greater than that of Germany, the United States, and France combined. Articles manufactured in the republic are: Woollen fabrics, crude sugar, cotton cloth, straw hats, olive oil, cottonseed-oil cake, furniture, saddlery, etc.

*Navigation and Railways.*—The Peruvian ports on the Marañon and Huallaga rivers in the east are connected by steamers with those of Brazil. The chief Pacific ports are visited by vessels of the Chilean and Pacific Steam Navi-



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SEÑOR DON MANUEL CANDAMO,  
PRESIDENT OF PERU.







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gation companies. The railway system is being extended in connection with new mining enterprises (see above). There were in actual operation in 1902 about 1,035 miles of railway and 1,933 miles of telegraph; and in 1903 several companies made arrangements with the government for the construction of electric trolley lines.

*Weights, Measures, and Money.*—The Peruvian *libra* = 1.0143 pounds; *quintal* = 101.44 pounds; *arroba* = 25.36 pounds, or (liquid measure) 6.7 gallons; *vara* = 0.927 yard. Congress passed a law 14 Dec. 1901, providing for the adoption of the gold standard on 1 March 1903. That law has been put in operation: a coin has been adopted called the Peruvian gold pound (equivalent to the British pound sterling); silver has been demonetized, and gold is the legal tender for all sums over 100 soles (*sol* = \$0.487). The statement was officially made in August 1903 that "Ten silver *soles* are accepted and paid by the banks and everyone as the equivalent of the Peruvian or British sterling pound."

*Government.*—While in its main features the government resembles that of the United States, the differences are important. Thus, Congress consists of a Senate and House of Representatives, but Senators, as well as deputies, are chosen by direct popular vote, and the number of Senators representing each department in the national legislature is not invariably two, but from one to four, the larger number being conceded to departments which contain more than eight provinces. Again, the president is chosen by direct popular vote for four years, but he cannot serve for two successive terms; and, to provide for such contingencies as the death or disability of the chief executive, two vice-presidents are elected in the same manner. Official acts of the president require for their validity the signature of a member of his cabinet (compare PARAGUAY), the cabinet ministers being the officials in charge of the departments of Foreign Affairs, War and Marine, Interior, Finance and Public Works, and Justice, Worship, and Instruction. The choice of supreme court judges depends upon Congress and the executive; the latter selects judges of the lower courts from lists of the candidates proposed by the higher tribunals.

*Finances.*—The president's message to Congress (28 July 1903) gave a highly favorable account of the financial affairs of the republic, and included the statement that expenditures during the year had been less than those provided for in the budget, "leaving a favorable balance of £260,099." Now, the ordinary budget for 1903 may be summarized as follows:—income 15,396,682 *soles*; expenditures, 14,562,323.38 *soles*; surplus 834,358.62 *soles*. The extraordinary budget for the same period was: expenditures, 1,235,146.77 *soles*; surplus of the ordinary budget 834,358.62 *soles*; deficit, 400,787.15 *soles*. But the income proved to be less than the estimated amount: the surplus, therefore, appears to have been secured at the expense of some branches of the public service. A similar explanation has been commonly advanced with respect to the alleged "favorable balances" of the years 1899, 1900, and 1901. Nevertheless the actual, undisputed improvement in the financial policy of the country during recent years has been marked, and its good effects are already apparent. The chief sources of revenue are customs, taxes, the

salt monopoly, and posts and telegraphs. The Peruvian minister at Washington (1903) declared in a public address that "in 1890 our foreign debt was canceled." The facts are these: The foreign debt, consisting of loans contracted in England and large arrears of interest, at the beginning of 1890 amounted to £54,577,731. Railways, and certain rights over mines and lands, were ceded to the bondholders for a period of 66 years, as the only feasible method of obtaining relief. Internal and floating debts amount to about \$23,795,000.

*Army and Navy.*—Peru has a small but efficient army, in all about 4,000 men, including a regiment of artillery, trained by military instructors from France. Only two vessels of the navy were in good repair in 1903.

*Population.*—Though the Quichua language is still spoken by a majority of the people of Peru (of whom 57.6 per cent are classed as Indians, and 24.8 per cent mestizos), this linguistic unity by no means implies uniform characteristics; on the contrary, it is necessary to regard the present Indian population as descendants of many different native races of varying degrees of natural intelligence and physical vigor, the common tongue having been imposed by the conquering Inca tribe. Some of the Indians of to-day are found to be progressive—at least sufficiently so to encourage the hope that they may, little by little, become useful citizens in a civilized country; but other descendants of the aborigines seem utterly incapable and irresponsible. The negro and Asiatic elements are about equal, each a little less than 2 per cent; the white element 13.8 per cent. The total number of inhabitants in 1876 was found to be 2,660,881. No general enumeration has been made since the war.

*Education and Religion.*—The most ancient university in the New World, that of San Marcos at Lima, was founded in 1551; the university at Cuzco in 1598; the college at Arequipa in 1616. Like the neighboring republic of Ecuador (q.v.), Peru has been honored by the achievements of her historians and geographers, the Paz Soldans and others; writers on constitutional and legal subjects; poets and dramatists (comedies by Segura, etc.); and such naturalists as Rivero and Pinerola. The number of primary schools is given as 1,544; total attendance, 63,298; teachers, 1,991. Elementary instruction is compulsory; intermediate colleges or high schools are found at the departmental capitals; number of students at the universities mentioned above, and at the small institution at Trujillo, 876. (For school of mines, see *Mineral Resources*.) The bishopric of Cuzco was founded in 1537, and the see of Lima in 1541. The provisions of the constitution and laws in regard to worship are, naturally, comparable with those of Ecuador: recognition has been accorded to Roman Catholicism exclusively until recent years.

*History.*—Before the coming of the Spaniards, the sierra was held by Indians of the Inca tribe whose chief town was Cuzco. Chiefs of that tribe, "Incas" *par excellence*, had extended their conquests along the heights of the Andes, northward somewhat beyond Quito and southward into the Titicaca basin. Unquestionably, also, they held in subjection tribes of the Pacific littoral and montaña regions; their commanding position, relatively efficient military



organization, and use of the llama on long marches, enabling them to levy, even in remote communities, a tribute of "sun virgins" (female captives, destined ultimately for sacrifice to the national god), and of the precious metals, which were largely used, never as money, but for the interior decoration of temples and for domestic utensils. As for the social organization of the Incas, and the impressive accounts of the so-called dynasty which have been commonly accepted hitherto, it must be admitted that recent scientific researches conducted in the sierra have put the whole subject in doubt. It is quite certain, for example, that the "empire" was ruled, not by a succession of enlightened administrators, but by war-chiefs, whose office was not hereditary; that extravagant notions have prevailed in regard to the defenses of the capital, the system of roads, and the irrigation works; and that a reliable chronology begins with the Spanish conquest. On 14 Nov. 1524 Pizarro first sailed from Panamá. About three years later the Inca Huayna Ccapac died, and a civil war broke out between north and south, Atahualpa commanding in the former section, Huascar in the latter. This disruption proved to be the Spaniards' opportunity. In January 1530 Pizarro again sailed from Panamá, and, after long delays, reached the sierra. On 16 Nov. 1532 the Spanish force seized and imprisoned Atahualpa. Xeres, Pizarro's secretary, writes: "Atbaliba (Atahualpa) feared that the Spaniards would kill him, so he told the governor that he would give his captors a great quantity of gold and silver. The governor asked him: 'How much can you give, and in what time?' Atabaliba said: 'I will give gold enough to fill a room 22 feet long and 17 wide, up to a white line which is half way up the wall.' The height would be that of a man's stature and a half. He said that, up to that mark, he would fill the room with different kinds of golden vessels, such as jars, pots, vases, besides lumps and other pieces. As for silver, he said he would fill the whole chamber with it twice over. He undertook to do this in two months." February 1533 Almagro arrived; 3 May 1533 the gold and silver were melted; 29 Aug. 1533 Atahualpa was garroted. On 6 Jan 1535 the site of Lima was chosen; the city founded 12 days later. On 8 April 1537 Almagro seized Cuzco; 8 July 1538 he was condemned to death. Two years afterward, Gonzalo Pizarro started to explore the montaña. Sunday, 26 June 1541, Francisco Pizarro was assassinated. June 1542 Gonzalo Pizarro returned to Quito. (For Peru as a viceroyalty, see *Bibliography*.) From 28 Oct. 1745 to February 1746, earthquakes which destroyed Callao; 1780 to July 1783, rebellion of Tupac Amaru, descendant of the Incas; 3 Aug. 1814 the cry of independence was raised at Cuzco; September 1820, the Argentine general, San Martín, landed on the coast of Peru, Lord Cochrane and English officers accompanying him from Chile (q.v.); 25 July 1821, independence was proclaimed at Lima, after San Martín's entrance; 20 Sept. 1822, San Martín resigned protectorate; 1 Sept. 1823, Bolívar arrived at Lima; 6 Aug. and 9 Dec. 1824 the Spanish forces were defeated at battles of Junín and Ayacucho; 24 Aug. 1827, Gen. Lamar elected to presidency; 16 Oct. 1856 the exist-

ing constitution was framed, and 25 Nov. 1860 revised; 2 May 1866 a Spanish fleet, sent to enforce alleged claims, was repulsed at Callao; 13 Aug. 1868 and 9 May 1877 destructive earthquakes occurred; 5 April 1879 Chile declared war against Peru; 8 Oct. 1879 the Huascar was captured by Chilean ironclads; 17 Nov. 1879 battle of Tarapacá, the Peruvian province of that name falling into the hands of the Chileans; 26 May 1880, battle of Tacna; 7 June 1880, Chileans captured the port of Arica; the Peruvian army was nearly annihilated; Chilean ships desolated the whole coast; 13 and 15 Jan. 1881, Chilean invading force defeated Peruvians at Chorrillos and Miraflores; 17 Jan. 1881, Chileans entered Lima; 20 Oct. 1883, a treaty was signed, ceding Tarapacá to Chile, and providing for the occupation of Tacna and Arica by the Chileans for 10 years, at the end of which period the inhabitants should determine by vote whether they would belong to Chile or Peru. But it was also provided that the nation preferred by the voters should pay \$10,000,000 to the other nation; and when the time arrived for holding the plebiscite, Peru was unable to give attention to the matter and unprepared to pay the stipulated sum, in the event of a favorable decision. The last eight years (1895-1903) have been peaceful: for the first time in the history of the republic two consecutive changes of administration were effected without disturbance of the public order. On 25 Nov. 1901 an agreement was made with Bolivia for the settlement of boundary disputes by arbitration. On 18 Aug. 1903 Congress proclaimed Don Manuel Cándamo duly elected president for the four years beginning 8 Sept. 1903.

*Bibliography.*—American Republics, International Bureau of the, 'Bulletins' (1902-3); Dundonald, 'Narrative of Services in the Liberation of Chile, Peru, and Brazil'; Garcilasso de la Vega, 'Royal Commentaries of the Yncas'; Helps, 'Life of Pizarro'; Markham, 'History of Peru,' and 'Cuzco, Lima, and Peru,' which contains a sketch of the viceregal government; Pas Soldan, 'Geografía del Perú,' which includes history of the conquest and catalogue of the viceroys; Prescott, 'History of the Conquest of Peru'; Squier, 'Peru'; Xeres, 'A True Account of the Province of Cuzco.'

MARRION WILCOX,  
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**Peru,** Ill., city in LaSalle County; on the Illinois River and the Illinois and Michigan Canal, and on the Chicago, Rock Island & P. railroad; about 100 miles southwest of Chicago and 55 miles northeast of Peoria. It was settled in 1827 and founded as a village in 1834. It was granted a city charter in 1852. In the vicinity are mounds which contain relics of the ancient Mound Builders.

Peru is in a locality favorable for manufacturing, large bituminous coal fields are near, and deposits of white sand rock and cement rock. The chief manufacturing establishments are foundry and machine shops, planing mill, fertilizer works, grain elevators, breweries, clock factory, nickeloid works, zinc-rolling mills, scale works, plow and wheel works, furniture factory, and furnaces. The city has public parks, a Masonic temple, Turner hall, four bridges, and municipal buildings. It is the seat of Saint



## PERU — PERUGINO

Bede College, opened in 1891 by the Benedictine Fathers, and it has public and parish schools, and a free library. The city owns and operates the electric-light plant and the waterworks. Pop. (1890) 5,550; (1900) 6,863.

**Peru**, Ind., city, county-seat of Miami County; on the Wabash River, and on the Cincinnati, Richmond & M., the Wabash, the Lake Erie & W. R.R.'s; about 71 miles north of Indianapolis. It was settled in 1827, in 1834 was laid out as a town, and chartered as a city in 1852.

It is in an agricultural section of the State, and is the commercial centre for a large extent of country. The chief manufacturing establishments are confectionery factories, glass works, steel works, wagon and carriage factories, woolen mills, carbon works, bagging and basket factories, and railroad shops. It has a large trade in its own manufactures and in farm products. The city owns and operates the electric-light plant and the waterworks. Pop. (1890) 7,028; (1900) 8,463.

**Peru, Balsam of.** See BALSAMS.

**Perugia**, pā-roo'jä, Italy, (1) a city, capital of the province of the same name, on the side and summit of a lofty eminence washed by the Tiber, 84 miles north of Rome. It is surrounded by lofty walls, and defended by a citadel; has irregular but spacious streets, and many remarkably handsome buildings. Among its edifices are the cathedral, a bold Gothic edifice of the 15th century, possessed of a valuable library, rich in works and MSS. connected with biblical literature; the church of Sant' Agnese, adorned with frescoes by Perugino and his pupils; the oratorio of San Bernardino, with a magnificent façade in which colored marble and terra-cotta are employed; the convent of San Severo, now a college, containing the first fresco painted by Raphael; the church of San Pietro de' Cassinensi, an ancient building with a roof supported by marble and granite pillars taken from a heathen temple, and so rich in pictures as almost of itself to form a gallery; the church of San Domenico, with some fine monuments; the Palazzo Pubblico or town-house, a majestic edifice of the 13th century, containing a valuable picture-gallery and a library of 77,000 volumes; the Sala del Cambio or Exchange, no longer required for that purpose, but interesting from the number of fine frescoes with which Perugino has covered its walls; the prefecture, a handsome modern building; a fine public fountain; the Arch of Augustus, a fine ancient gate, built of massive blocks of travertine without cement. Perugia possesses a free university, founded in 1320, with a cabinet of antiquities, a botanical garden, etc. The manufactures, comparatively unimportant, consist of velvet, silk stuffs, brandy, etc. The trade is in corn, wool, spun silk, and cattle. Perugia under the Romans was one of the 12 principal cities of Etruria, and remains of the ancient necropolis with the tomb of the Volumnii, discovered in 1840, are to be seen three miles southeast of the city. Having taken the part of Mark Antony in the war between him and Augustus, it was sacked by Augustus. It had recovered from the disaster when Totila, one of the northern barbarians, took it after a siege of seven years, and put many of its inhabitants to the sword. Pepin le Bref, king of France, took

it in the 8th century, and made a present of it to the pope. It suffered much during the contests between the Guelfs and Ghibellines, and both in the 14th and 15th centuries was fearfully ravaged by the plague. The celebrated painter, Pietro Vannucci or Perugino, though born in Citta della Pieve, long made Perugia his adopted home, and died in it a victim of the plague in 1524. Pop. (1901) 61,453. (2) The province of Perugia or Umbria has an area of 3,748 square miles. It is traversed in all directions by offsets of the Apennines. The principal stream is the Tiber. The soil is fertile, producing in abundance corn, wine, fruits, oil, and silk. Pop. (1901) 667,210. (3) The LAGO DI PERUGIA or LAGO TRASIMENO, nine miles west of Perugia, is about eight miles long, varying in breadth from seven miles to four miles, and surrounded with olive plantations. It contains three islands — Isola Maggiore, Isola Minore, and Isola Polvese; and abounds in fish. It appears to have no natural outlet, and its shores used to be often overflowed, but this was remedied by an artificial outlet opened in 1896. Hannibal gained a signal victory over the Romans near this lake in 217 B.C. Consult: Cruikshank, 'The Umbrian Towns' (1901); Gordon, 'The Story of Perugia' (1898).

**Perugino**, pā-roo-jē'nō, easel name of PIETRO DI CRISTOFORO VANNUCCI, Italian painter: b. Citta del Pieve, near Perugia, 1446; d. Castello di Fontignano, near Perugia, 1524. According to Vasari he studied under Verrocchio at Florence, was a fellow-pupil of Leonardo da Vinci (1475), and gained much skill in tempera painting, though he was subsequently among the first Italians to use oil as a vehicle. In 1475 he painted frescoes in the town-hall of Perugia. He worked for Sixtus IV. in the decoration of the Sistine Chapel, where his 'Christ Delivering the Keys to Peter' and 'Baptism of Christ' are still admired (1480-90). At Perugia, to which city he finally returned and took up his residence, Raphael, then a boy of 12, became his pupil. His first easel pictures, two Madonnas, are now one in the Louvre the other in the English National Gallery and exhibit that tenderness and grace, yet strength of expression, which belong to all his works. While his earlier pictures belong to the Quattro-cento style his latter productions show the influence of Michelangelo and Leonardo, exponents of the Cinque-cento style. Among his best pictures, which he executed in this last manner (1490-1505), is 'The Marriage of the Virgin,' now in the Museum at Caen, and widely known through the Arundel print reproduction. To the same period belong 'The Ascension of Christ' in the Museum at Lyons, which is one of his masterpieces, combining strength of composition with intense religious feeling; and 'The Assumption of Saint Mary the Virgin' for the Church of Santa Maria Maddalena de' Pazzi at Florence. Among his last works were the 'Martyrdom of Saint Sebastian'; 'The Baptism of Christ'; 'The Transfiguration'; and 'The Birth of Christ' in the church at Fontignano. It was after completing this picture that he was struck with the plague from which he never recovered. He was a prolific and industrious artist, and even during his lifetime foreign merchants carried his pictures into every country of Europe, where they are to be found in all the great public and many



## PERUVIAN BARK — PESHWAS

private collections. He made a really original departure in the progress of Italian art, and molded the style of Raphael in its early stages, though the latter artist quickly developed a manner and spirit preeminently his own.

**Peruvian Bark.** See BARK, PERUVIAN; CINCHONA.

**Peruzzi**, pā-root'sē, **Baldassare**, Italian painter and architect: b. Accajano, near Siena, 1481; d. Rome 6 Jan. 1536. He settled in 1503 in Rome, where he began a study of the antique. He painted in the church of Santa Croce in Gerusalemme, and designed the Villa Farnesina (1509-10). In 1520 he succeeded Raphael in the construction of Saint Peter's, changing Bramante's plan from a Latin into a Greek cross. From 1527, when he was made architect to the city of Siena, he built many palaces there. He was again busy with Saint Peter's and Roman palaces from 1530. Of his paintings, special mention should be given to his fresco of the 'Sibyl Proclaiming to the Emperor Augustus the Coming of Christ,' in the Fonte Giusta Church of Siena. Consult the study by Redtenbacher (1877).

**Pesado, José Joaquin de**, hō-sā' hō-ä-kēn' dā pā-sā'dō, Mexican poet: b. San Agustin del Palmar, Mexico, 9 Feb. 1801; d. City of Mexico 3 March 1861. He was self-educated, acquired an extensive knowledge of languages, science, and history, and in 1833 entered public life as a member of the legislature of Vera Cruz. In 1834 he was elected governor of that state and in that year founded and conducted 'La Oposicion,' also writing a short novel. He was appointed minister of the interior in 1838, minister of foreign affairs in 1846, resigning in 1854 to accept the chair of belles-lettres at the University of Mexico. His poetry was of the neo-Catholic school established in France by Lamartine, but though excelling in biblical subjects his descriptions of nature are quite as deserving of attention. He published: 'Poesias originales y traducidas' (1839); 'La Revelación' (1856); 'Gerusalemme Liberata,' a partial translation of Tasso (1860).

**Pesaro**, pā-sā'rō, Italy, capital and port of the province of Pesaro e Urbino, situated at the mouth of the Foglia (which, like the town, was known in ancient times as Pisaurum) in a fertile plain backed by the Ardizi Hills, on the railroad between Bologna and Ancona. The castle and part of the mediæval walls are still standing; a bridge dating from Roman times crosses the Foglia; and the most important buildings are the ducal palace, built by the Sforza in 1455; the Palazzo Almerici, connected with which is the Ateneo Pesarese, containing a remarkable collection of majolica ware, a gallery of paintings, and the rich Olivieri library with 40,000 volumes and 3,000 manuscripts, including some of Tasso and Poliziano; the cathedral of S. Francesco, with a Gothic portal and a 'Madonna' by Bellini; and excellent schools, a theatre and an insane asylum, as well as a musical lyceum founded by Rossini, a native of the town. The grave of the Roman tragedian Accius (b. here 170 B.C.) is reputed to be about two miles from the city on Monte Santo Bartolo. Terra-cotta wares, silk, hemp and woolen textiles, sealing-wax, cream of tartar, ships, machinery, etc., are among the city's manufactures.

It exports the produce of the surrounding country, its figs, olives, and truffles being particularly prized. Pop. (1901) 25,103.

Settled by the Sicilians in early times, and then held by the Umbrians, Etruscans, and Senonian Gauls, successively, in 184 B.C. it became the Roman colony of Pisaurum; was destroyed by Vitiges, the Ostrogoth; was given by Pepin to the pope; and in 1631 again became a papal state, after being a possession of the Malatesta (1285), the Sforza (1445) and the Rovere (1512). Under the latter the city became a centre of art and literature through the patronage of Lucrezia d'Este; Bernardo Tasso wrote 'Amadis' here and the city was also the home of his son Torquato Tasso.

**Pescadores**, pēs-kä-dō'rēs, or **Peng-hu**, a group of 48 small islands in the Fu-kien strait between China and Formosa, forming an administrative dependency of the latter. Area, 85½ square miles. With Formosa they were ceded by China to Japan in April 1895 after the Chino-Japanese war. They are dangerous to ships passing through the strait, and are subject to stormy weather, on an average during 230 days of the year. Safe anchorage is obtainable at Makung on Hokoto the principal island. Pop. (1898) 51,719.

**Peseta**, pē-sā'ta, the chief Spanish monetary unit, equal to about 20 cents.

**Peshawar**, pē-show'ūr, or **Peshawur**, India, (1) a city, capital of the Northwest Frontier Province, and of the division and district of Peshawar, in a small plain near the river Bara, 12 miles east of the eastern extremity of the Khyber Pass (q.v.). It is surrounded by a mud wall and entered by 16 gates. The Kabul gate has been rebuilt as a memorial to Sir Herbert Edwardes. Just outside the wall on the northwest is the Bala Hissar, a fort built of sun-dried bricks, surmounting a small eminence, and completely commanding the town. The houses generally are built of brick and mud with wooden frameworks. The chief buildings and institutions comprise some handsome mosques, a clock-tower, English church mission, collegiate school, the Egerton hospital, Martin lecture hall and institute, etc. The town is well drained and has an ample supply of well and canal water. Outside the wall are gardens and pleasure-grounds, and two miles to the west are the extensive military cantonments, where most of the civil offices are situated. Peshawar is traversed by the great route from Khorasan and Kabul to India through the Khyber Pass; and has a good trade. It has direct railway communication with Lahore through Attock and Rawal Pindi. Pop. (1901) 95,147, including about 20,000 in the cantonments. (2) The division comprises the districts of Peshawar, Hazara, and Kohat, with the control of the hill tribes inhabiting the Khyber Pass. Area, 8,206 square miles; pop. (1901) 1,715,248.—Peshawar district is the central one of the division. Area, 2,444 square miles; pop. (1901) 786,406.

**Peshitto**, pē-shē'tō, the Syriac version of the Holy Scriptures. See BIBLE, VERSIONS OF.

**Peshwas**, the Brahman ministers of the great Mahratta dynasty in India, who in 1718 rose to such power that ruled the Mogul empire for a century. See INDIA, History.



## PESO — PETALESHARO

**Peso**, pā'sō, the name of the old Spanish silver dollar. In Mexico and South America the peso is still the monetary unit.

**Pes'simism**, the theory of philosophical speculation that the world in which we live, the personal environment of individuals and the general social conditions are the worst that could possibly exist and that unhappiness is the normal rule of human existence. This doctrine is a direct contravention of optimism (q.v.). Pessimism, which is as old as human philosophy, denies the goodness of God, even his existence, and of course makes the conception of a divine providence and a moral direction of the universe an impossibility. While the Greek philosophers never gave a clear and coherent statement to their conception of pessimism, there is some trace in their teachings of a suspicion that things were not as they might be under a clearly revealed deity with benignant and omnipotent control of man's origin, career and destiny. The malignity of fate, and the Nemesis or avenging jealousy of an overruling power, are frequently suggested by the earliest poets and philosophers under such figurative impersonations as Fortune, Destiny and the Furies. The optimism of the Jew on the other hand was altogether dependent on his conception of Jehovah as the King and Father of a chosen people. From the foundation of the Ionian philosophy in Greece in the 7th century before Christ the clouds of pessimism gathered in the sky and later on the shadows deepened in the minds of Cynics, Stoics, and even Epicureans like Lucretius of Rome. That Christianity was hailed with such welcome was largely owing to the fact that it boldly lifted the banner of hope and taught that temporal suffering, disappointment and self-denial were not the worst things that human nature was capable of enduring, and established a new morality with an ideal aim which shifted the axis of practical life and made happiness possible even under the most acute earthly calamities and sorrows.

It has remained for modern thinkers to revive the theory that unhappiness is the predominating element in mortal life and that it is better never to have lived than to live, and that the end of life is the only refuge against misery. This doctrine has been taken up by a brilliant German philosopher, Arthur Schopenhauer (q.v.), 1788-1866, who has tried to place pessimism on a scientific foundation. He must be looked upon as the founder of modern pessimism, and his influence is reflected over a wide area of German, French and English literature. The world according to him is the worst that could possibly exist. According to his metaphysical statement all phenomena combined present a mere illusion, produced by the human intellect, behind which lies will, the universal substance, the ultimate principle of all things. This will is in itself a blind unconscious striving, coming to consciousness in animated beings. Discontent is its essence. The radical evil is the will to live. It will be here perceived that this exposition finds its source in Oriental speculation, and may be traced to Buddhism, which advocates the annihilation of egotist craving, the extinction of natural passion, the aspiration after Nirvana as the end of human desire, whether conscious or not. The pessimist asserts that consciousness is a source of misery and wretchedness, and that

the evils we see and feel can never end unless they end in us by the abolition of that sense of individuality which convinces us that we are surrounded by a condition of things whose painfulness we can neither cure nor surmount. Consult: Gass, 'Optimismus and Pessimismus'; Huber, 'Pessimismus'; Sully, 'Pessimismus'; Leibnitz, 'Théodicée.'

**Pestalozzi**, pēs-tä-löt'sē, **Johann Heinrich**, Swiss educational reformer: b. Zürich 12 Jan. 1746; d. Brugg, Aargau, 17 Feb. 1827. He was educated at the University of Zürich, and became a follower of Lavater (q.v.), to whose 'Memorial' he contributed. The perusal of Rousseau's 'Emile' filling him with dislike for the habits of a learned life, and for the general system of education in Europe, he turned his attention to farming. He studied agriculture, and then in 1767 bought a piece of land near Birr, in Aargau, built a house, which he called Neu Hof. He became acquainted with the moral wretchedness of the lowest classes, and in 1775 began his career of instruction by the admission of the children of paupers into his house, turning his farm into a kind of asylum or industrial home. But his philanthropic and noble self-denial was derided, his confidence was abused, his own affairs declined, he was generally considered as a well-meaning enthusiast and his enterprise failed in 1780. Nevertheless, amid straitened circumstances he collected that knowledge of the state of the lower classes so admirably set forth in his novel 'Lienhard und Gertrud' (1781-85), a work which exerted a remarkable influence. Other writings of his are alike numerous and important, and contain further elucidations of his principles. In 1798 he established a school at Stanz, but circumstances obliged him to abandon it, and he then took charge of a school at Burgdorf, where he also received pupils who paid for their instruction, so that he was enabled to employ able assistants. This institution flourished, and in 1805 he removed it to Yverdon, in the Pays de Vaud, where he occupied the castle given to him by government. The grand principle of Pestalozzi's method was that of communicating all instruction by direct appeal to the senses and the understanding, and forming the child by constantly calling all his powers into exercise, instead of making him a mere passive recipient, selecting the subjects of study in such a way that each step should best aid the further progress of the pupil. The principles of his method are clearly developed in his 'Wochenschrift für Menschenbildung.' The value of these principles, as well as the esteem in which they are now held, may be gathered from the fact that they are substantially at the basis of the normal school system of Europe. Pestalozzi was a poor organizer, manager, and teacher; but he originated and gave the impetus to the ideas of social reform by education so prominent in the 19th century. Consult: 'Life and Works' by De Guimps (1889); and 'Life' by Pinloche (1901).

**Pesth.** See BUDAPEST.

**Petal**, one of the leaf-like parts of the corolla of a flower. See COROLLA; FLOWER.

**Pet'alesha'ro**, Pawnee chief of the Skidi band. He made himself famous by rescuing from sacrifice a young girl captive from the Sioux tribe with which the Pawnees were at



war. As she was being led to the place of sacrifice Petalesharo seized her, flung her upon a horse and springing upon another eluded pursuit and carried her near enough to her own people for her to be safe from pursuit. He then daringly returned to his tribe and faced their anger with such intrepidity that his conduct went unpunished. Later he succeeded in abolishing the practice of human sacrifice and upon his visit to Washington in 1821, acting as a delegate from the Pawnees, he was the recipient of much attention, and was presented with a medal in recognition of his service to humanity.

**Petard'**, in ancient warfare, a bell-shaped engine, made of gun-metal, loaded with from 9 to 20 pounds of powder, and then exploded. It was employed to break down gates, bridges, barriers, etc., to which it was hung by means of a wooden plank attached to it. It was also used in countermines to break through the enemy's galleries.

**Petavius**, pe-tā'vī-ūs, **Dionysus** or **Denys Pétau**, pā tō, French theologian: b. Orleans, France, 21 Aug. 1583; d. Paris, France, 11 Dec. 1652. He was educated at Orleans and at Paris pursuing with avidity the studies of mathematics and belles-lettres, and in Paris became an intimate friend of Isaac Casaubon (q.v.). In 1602 he was appointed to the chair of philosophy at the University of Bourges, which he resigned in 1605 to enter the order of the Jesuits. Subsequently he studied theology at the College of Pont-à-Mousson, and in 1621 accepted the position of professor of theology at the University of Paris, which he occupied 22 years. After 1646 he devoted himself entirely to literature, completing 49 books dealing with philology, history and theology, which give him rank as one of the greatest scholars of the Jesuit order. His chief work, 'Opus de Theologicis Dogmatibus' (5 vols., 1644-50), was uncompleted at his death. He published annotated editions of 'Synesius' (1611); 'Themisticus' (1613); 'Nicephorus' (1616); 'Epiphanius' (1622); etc., besides his historical and theological works, among which are: 'Opus de Doctrina Temporum' (1627); 'Uranologion' (1630); 'Rationarium' (1632).

**Petchora**, pech-ō'rä, a river of Russia, which rises in the north of the government of Perm, on the western slope of the Ural Mountains; flows almost due west, then turns north across the eastern part of the government of Vologda, enters the government of Archangel, and on reaching lat. 66° N. makes a long curve southwest to lon. 52° E., when it suddenly turns due north and falls into a bay of the Arctic Ocean by a great number of mouths; total course, about 1,200 miles, two thirds of which are navigable. Its principal affluents are the Ijma and Ussa.

**Petechiæ**, pē-těk'ī-ē, purple or crimson spots which appear on the skin in certain diseases, and are caused by hemorrhage into the subcutaneous tissues. These spots are well defined and of variable size. They are not raised above the surface of the skin, and do not fade on pressing. They may be symptoms of purpura or scurvy, and are sometimes seen in scarlet fever, measles, and smallpox. When large, these spots are sometimes called ecchymoses.

**Peter, Saint.** See SAINT PETER.

**Peter I. (the Great), Alexeievitch**, emperor of Russia: b. near Moscow 9 June 1672; d. St. Petersburg 8 Feb. 1724. He was the son of the Czar Alexei or Alexis Mikhailovitch. His elder brothers, Fedor and Ivan, were feeble in constitution. Fedor succeeded to the throne as Fedor III. in 1676, and died in 1682. An attempt was then made to have Peter assume the imperial dignity with his mother, the Czarina Natalia Kirillovna, as regent. This arrangement did not please Sophia, the third daughter of Alexis, who had hoped to reign in the name of her feeble brother. She roused the Strelitz, or bodyguard, and had Ivan proclaimed czar jointly with Peter, and herself regent. Peter gave early proof of capacity, and under the guidance of the Genevese Lefort took enthusiastically to the study of military science. In 1689 he married Eudoxia Fedorovna, who belonged to a powerful family, the Lapuchin. This alliance enabled him openly to oppose his sister, and in the course of this year he succeeded after a brief struggle in wresting the power from her. She was confined in a convent, where she died in 1704. Peter was now virtually sole emperor, though, till the death of his brother in 1696, he associated the latter's name with his own in the ukases of the empire. With the assistance of Lefort and Patrick Gordon he began to organize his army; but his great ambition was to form a navy. He went himself to Archangel, and cruised on board Dutch and English ships. He brought Dutch and Venetian ship-builders to Russia, and sent Russians to Venice, Holland, and Leghorn to learn ship-building. At length a fleet, which he had constructed, enabled him to conquer Azof from the Turks. His reforms excited great opposition among the old Russian party of the nobility. A few years after his marriage he repudiated his wife for the encouragement she gave the reactionary party. In 1697 he suppressed with great barbarity a revolt of the Strelitz. Leaving his capital under the military command of Gordon, he then proceeded on that remarkable tour through Europe, in which his vast designs for the improvement of his people first began to appear. He formed an extraordinary embassy to Holland, which he accompanied incognito. He took up his residence in August at Saardam, a famous ship-building port, and for several months worked for wages as a ship-carpenter. In 1698 he spent about three months in a similar manner in England, where also, as in Holland, he procured a great number of sailors and artificers, as well as engineers, for a great canal which he projected between the Don and the Volga. He afterward visited Vienna, where he particularly acquainted himself with the organization of the army. He was about to proceed into Italy, when he received intelligence of another revolt of the Strelitz. Gordon repressed the revolt, and a savage vengeance was taken on the insurgents. Peter organized his army on the German model; served himself in it as a private soldier, and worked his way up through all the subordinate grades before he received a commission, an example which he compelled the young nobles to imitate. He obliged his subjects to adopt European costume by taxing their long Tartar robes; emancipated the women



## PETER

from Asiatic seclusion; reformed the calendar; committed the charge of the public revenue to a regular administration; and made himself virtually the head of the Church. He founded schools of navigation and mathematics, brought cattle and herds from Silesia, called into his dominions foreign artisans of all kinds, established manufactories of arms, tools, and fabrics, and distributed metallurgists through the mining districts of Russia. Such were the peaceful occupations of his whole reign; but he was not satisfied till he had given Russia a sea-board, and this could only be done at the expense of Sweden. Accordingly in 1700, when he thought his army was ready, he joined Denmark and Poland in a league against Charles XII. (q.v.). His defeat at Narva, 30 Nov. 1700, and other early reverses, did not discourage him. In two following campaigns he gained some advantages over the Swedish generals, and 27 May 1703 his conquests enabled him to accomplish his great object by laying the foundation of St. Petersburg on the Neva. The decisive victory of Poltava, 8 July 1709, confirmed and extended his conquests; but the war dragged on for several years, and Turkey becoming involved in it he nearly threw away all his successes by allowing himself to be hemmed in by the Turkish army on the Pruth. The empress (see CATHARINE I.) opened negotiations with the grand-vizier, and procured a peace, with the relief of the Russian army, for the surrender of Azof and some small forts on the Black Sea. In 1713 Peter transferred the senate from Moscow to St. Petersburg. His eldest son, Alexis, was in open sympathy with the reactionary party. Peter had him tried for conspiracy and condemned to death, 5 July 1718. He died in prison 7 July. The Peace of Nystadt with Sweden was signed in 1721. By its terms the czar retained nearly all his conquests, including Livonia and Esthonia. He relinquished Finland, and paid to Sweden about \$2,000,000. The senate after this peace conferred on him the title of Emperor of all the Russias, to which were added the epithets of the Great and Father of His Country. In 1724 Peter founded at Saint Petersburg the Academy of Sciences, which was not, however, opened until 1726. The empress was declared his successor. The so-called Testament of Peter the Great, defining his political policy, was probably written at the order of Napoleon I. Consult: J. L. Motley, 'Peter the Great' in 'North American Review' for October 1845; Brückner, 'Peter der Grosse' (1880); Minzloff, 'Pierre le Grand dans la Littérature Etrangère' (1897); Browning, 'Peter the Great' (1898).

**Peter II., Alexeievitch**, Russian emperor, grandson of Peter the Great: b. St. Petersburg, Russia, 22 Oct. 1715; d. there 9 Feb. 1730. He succeeded to the throne in 1727 by the will of Catharine I., and during his brief reign was controlled by Mentchikof, who endeavored to marry the 13-year-old emperor to one of his daughters. Mentchikof was succeeded by Dolgoruki, who also wished to ally his family with the imperial one, but their intrigues were frustrated by the death of the emperor from smallpox in 1730. Anna Ivanova succeeded to the throne.

**Peter III., Feodorovitch**, emperor of Russia, grandson of Peter the Great, son of Anna Petrovna and Duke Karl Friedrich: b. Kiel 21 Feb. 1728; d. Ropscha 17 July 1762. Succeeding his father as duke of Holstein, he bore the name Karl Peter Ulrich. In 1742 he was appointed grand-duke and heir-apparent by his aunt, the Empress Elizabeth, the direct male line having failed with Peter II. Three years afterward he married Sophia Augusta, Princess of Anhalt-Zerbst, later the Empress Catharine II. (q.v.). He succeeded Elizabeth 5 Jan. 1762; immediately concluded a peace with Frederick II. of Prussia, restoring the parts of Prussia conquered by Russia and sending 15,000 Russian troops to join Frederick's army; and in general showed himself so devoted to German ways of living, and so enamored of Frederick of Prussia, that the nobles soon rose against him. His wife, Catharine, already accused of adultery, joined the conspiracy, in which her lover Orloff and his brother (see ORLOFF) also took part, and 8 July 1762 was proclaimed empress. Peter offered to retire to Holstein, but he was forced to abdicate and then was killed by the conspirators. Consult: Bain, 'Peter III., Emperor of Russia' (1902).

**Peter I.**, called KARAGEORGEVITCH as grandson of Karageorge or Czerny George, present king of Servia: b. Belgrade 1846. His father, Alexander, ousted Michael Obrenovitch in 1842, but in 1858 was exiled by the returning Obrenovitch dynasty. Peter was educated in Russian military schools and at St. Cyr; fought in the Franco-Prussian war, being thrice captured; furthered the Herzegovinan rising in 1875; married Zorka, princess of Montenegro, in 1883, and lived at Cetinje until her death in 1890. He then resided quietly in Geneva until June 1903, when he was proclaimed king of Servia by the army officers who had killed Alexander Obrenovitch and Queen Draga. A Pan-Slavist apparently, he is a Liberal with leanings toward Russia, but is commonly reckoned the mere tool of the army.

**Peter Cla'ver, Saint**, Spanish Jesuit missionary: b. Catalonia 1580; d. Cartagena, New Granada, South America, 8 Sept. 1654. He entered upon his novitiate in the Society of Jesus in 1602, and upon the establishment of a province of his order in New Granada was sent thither as missionary to the negroes in 1610. After two years of further study in the College of Santa Fé de Bogota, he was ordained priest; and from that time labored heroically in behalf of the blacks. He at once visited the slavers upon their arrival at Cartagena harbor, and when the negroes had been landed, instructed them, organizing a band of catechists for the purpose; directed their care in the hospitals; obtained for them humane treatment by their owners; regularly conducted for such as remained in Cartagena services in the Jesuit church; and extended his labors widely among the mines and plantations of the province. He was beatified by Pius IX. 16 July 1850, canonized by Leo XIII. 15 Jan. 1888. Consult the lives by Schelkle (1833; a translation into German of the work by the Jesuit Fleurian); and Höver (1888).

**Peter, Epistles of**, two books of the sacred canon ascribed to the Apostle Peter. Saint



## PETER THE CRUEL—PETER PENNY

Peter is not mentioned in the Acts of the Apostles after the Council at Jerusalem (50 A.D.), but in Galatians ii. 11 a subsequent visit of his to Antioch is referred to. It is believed that he spent the last years of his life at Rome, and there suffered martyrdom. In 1 Pet. v. 13 he speaks of Babylon, which has given rise to a dispute as to whether the Apostle meant Babylon, the capital of southern Mesopotamia, or Rome in a figurative sense. The date of this epistle is 63 or 64, just after the release of Saint Paul from his first imprisonment. It was addressed to Christians in Asia Minor and probably to believers of Jewish antecedents. The coming of some great calamity seems to overcloud the writer's mind, but he is cheered by a believer's hope, which indeed is the keynote of the epistle. The style is eminently characteristic, and quite in accordance with the language and idiom of the Apostle's speeches, reported in the Acts of the Apostles. The writer addresses and greets those to whom he is writing, thanks God for the living hope of the resurrection; exhorts them to holiness of living; in view of their redemption and regeneration. Patience and resignation enjoined and enforced by the example of Christ. Duty of wives and husbands dwelt upon. Sin must be forsaken and holy lives be led to the glory of God; fiery trials are for the believer's benefit. The elders are exhorted, the younger enjoined to submit to their elders. All are warned to be sober and watchful. Silvanus, bearer of the letter, is referred to; salutations and a brief benediction conclude the epistle.

The Second Epistle of Saint Peter is not so strongly supported by evidence of genuineness from early Christian writers as most New Testament books. The internal evidence for its authenticity is, however, incontrovertible. Some critics have claimed for it an authorship later than the apostolic age from the resemblance of some passages to the epistle of Jude, and also the reference made in it to the epistles of Saint Paul. But this resemblance and this reference do not disprove the Petrine authorship of the letter which was probably written about the same time as 2 Timothy, about 67 A.D. It was intended to warn those whom the writer had addressed in his first epistle against false teachers, and urge them to advance in knowledge, as well as in holiness. The false teachers he characterizes are not those of the 2d century, but undoubtedly belonged to the apostolic age. He opens with an exhortation to advancement in godliness; he refers to his own approaching end; and refers to the transfiguration of which he was an eyewitness. He warns against false teachers whose destruction he foretells. The epistle ends in a brief doxology.

**Peter the Cruel**, king of Castile and Leon. See PEDRO THE CRUEL.

**Peter the Hermit**, preacher of the first crusade: b. diocese of Amiens about 1050; d. Neufmoustier, near Huy, 8 July 1115. Many fictitious stories have been given of his early life. It is supposed that he made a pilgrimage to Palestine, but did not actually reach the Holy City. After the Council of Clermont (see CRUSADES), he preached the crusade in central and northern France, everywhere arousing unprecedented enthusiasm. He journeyed about on mule-back, clad in a hermit's robe, and bearing

in his hand a crucifix. Wherever opportunity offered he urged the cause. The success of his enthusiastic harangues was proportionate to the boldness of his scheme and the ignorance of his auditors. Peter himself led the way through Hungary at the head of an undisciplined multitude of more than 30,000 men, a comparatively small number of whom survived to reach the city. He preached on the Mount of Olives 8 July 1099, took part in the capture of Jerusalem (15 July); and, having witnessed the accomplishment of his undertaking, returned to his native country, where he entered the abbey of Neufmoustier and died its prior.

**Peter Martyr**, Protestant divine: b. Florence 1500; d. Zürich 1562. He entered at 16 the order of the regular canons of Saint Augustine, at the monastery of Fiesole. In 1519 he removed to Padua, where he studied Greek and philosophy. In 1526 he commenced to preach, and attracted great applause in several cities of Italy. After receiving numerous important offices in his order his religious opinions were considered as savoring too much of the doctrine of the reformers, and it became necessary for him to quit Italy, and at Zürich, in Switzerland, he was received in a friendly manner by the Protestant clergy (1542). Soon after he became professor of divinity at Strasburg, and in 1547 accompanied Bucer, Fagius, and other learned reformers, on the invitation of Archbishop Cranmer, to England. Martyr had followed the example of Luther in marrying a nun who had renounced her vows. He was appointed to the theological chair at Oxford in 1549, and became a very efficient assistant to the English reformed clergy in carrying on their plans of innovation in the church. On the accession of Queen Mary, being commanded to quit the country, he returned to Strasburg and resumed his former situation. In 1556 he removed to Zürich to occupy the office of theological professor. In 1561 he assisted at the famous conference between the Catholics and Protestants held at Poissy, in France.

**Peter, Order of.** See ORDERS, ROYAL.

**Peter Parley.** See GOODRICH, SAMUEL GRISWOLD.

**Peter Penny**, or **Peter's Pence**, a tribute paid by England to the pope, so called because it was paid on the festival of Saint Peter ad Vincula, 1 August. It was originated in 721, by Ina of Wessex, for the purpose of supporting at Rome a hospice for British pilgrims with a college, "the school of the Saxons," and church attached. The grant was confirmed by Offa of Mercia in 790. The tax consisted of a silver penny denarius for each household. In the laws of Edward the Confessor and William the Conqueror it was only exacted of those who had 30 pence of current money in their houses (*qui haberent 30 denariatas vivæ pecuniæ in domo sua*). It was prohibited by Edward I. and Edward III., abolished by Henry VIII., revived by Mary, and finally abolished by Elizabeth. Peter's Pence was collected in Denmark and Poland since the 11th century; in Sweden, Norway and Iceland since the 12th century. It was also contributed by Prussia and France. A voluntary contribution to the support of papal power and dignity is still made. See PETER'S PENCE.



## PETERBOROUGH — PETERLOO

Pius IX. 16,500,000 francs were contributed; and in 1880 Leo XIII. received 25,000,000 francs.

**Peterborough**, pē'tēr-bŭr-ō, **Charles Mordaunt**, 3D EARL OF, English soldier: b. about 1658; d. Lisbon, Portugal, 25 Sept. 1735. He succeeded to his title and estate in 1675, went to Holland in the reign of James II., and, entering into the scheme of his dethronement, returned to England with William III., by whom he was created Earl of Monmouth. He succeeded to the earldom of Peterborough in 1697, and in 1705 was employed as joint-commander with Sir Cloudesley Shovel of the English army in Spain, in the war of the Spanish Succession. In 1710-11 he was appointed ambassador to Turin and other Italian courts, and in 1712 Governor of Minorca. In 1722 he was made general of the marine forces of Great Britain. Lord Peterborough was intimate with his literary contemporaries, and was himself a writer of verse. Consult: Warburton, 'Memoirs of Charles Mordaunt' (1853); Russell, 'Memoir of Charles Mordaunt' (1887); Stebbing, 'Peterborough' (1890).

**Peterborough**, Canada, a port of entry and county seat of Peterborough County, Ontario; on the Outonabee River and Trent Valley Canal, and on the Grand Trunk and Canadian Pacific railways; 75 miles northeast of Toronto. The town is well laid out, with wide and regular streets, and has a town hall, post-office, customs and inland revenue buildings, mechanics' institute, collegiate institute, 9 other schools, 13 churches, a Young Men's Christian Association building, a Public Library, hospitals, banks, and daily and weekly newspapers. A United States consular agent is resident there. Peterborough is the centre of a rich agricultural region. It exports lumber, peas, oats, barley, wheat, flour, cheese, wool, and pork. The manufactures include steam-engines, agricultural implements, mill machinery, foundry products, furniture, pianos, locks, iron bridge works, flour, saw, and planing mills, and electrical and carbon works. A hydraulic lift-lock, the largest of its kind in the world, designed to lift vessels 140 feet long, 65 feet up in one movement, was completed at Peterborough in 1904. (See CANADIAN CANALS.) There are now 23 miles of water mains, 15 miles of concrete sidewalks, and 12½ miles of sewers in the town. The waterworks system, costing \$250,000, is owned and controlled by the town. Pop. (1907) 15,000.

**Peterborough**, England, an episcopal city, in the county and 43 miles north by east of the town of Northampton, mainly on the left bank of the Nen. It is the railway centre of a large agricultural district; its corn and stock markets are of great importance. The principal building is its cathedral, founded by Penda, son of Penda, fourth king of Mercia, in 655, and destroyed by the Danes in 870. Rebuilt in 966, in 1116 a great part of the edifice was destroyed by fire; in the following year its restoration was commenced; but not till the opening of the 16th century did the structure assume its present aspect. The prevailing character of the building is Norman, but it exhibits examples of transition, early English, decorated English, and perpendicular styles. The most commanding feature is the west front, consisting of three magnificent pointed arches 80 feet high, surmounted by pediments and pinnacles, and flanked by tur-

rets with spires and pinnacles. The whole front forms a square of 150 feet in height and breadth. Catharine of Aragon, wife of Henry VIII., was interred in this cathedral. The building has recently undergone extensive repairs and restorations. The minster precincts show the remains of a cloister, a fine perpendicular gateway leading to the deanery, a massive tower and gateway conducting to the bishop's palace, and an old chapel, now used as a museum. Other public buildings are seven churches, a number of Non-conformist chapels, the town-hall, corn exchange, county court offices, several banks, and a post-office. There is a training college for Church of England schoolmasters, grammar-school, middle-class school, etc. There are also an infirmary and dispensary, and monastic alms-house. Peterborough received a municipal charter in 1874. Pop. (1900) 30,870.

**Peterhead**, pē-tēr-hēd', Scotland, a seaport town in the county and 26 miles north-northeast of Aberdeen, on a peninsula, the most easterly point of Scotland, with a harbor on either side of it, communicating by a cut across the isthmus. A great harbor of refuge is being constructed by convict labor. The town has several churches, a town-hall with a spire 110 feet high, free library and museum, a market-cross, a custom-house, excellent schools, a convict prison, public baths, municipal lodging-house, etc. There are a woolen factory and granite-polishing works. The town has a considerable trade. The Greenland whale and seal fisheries, once of importance, have all but ceased; but the town is still an important centre of the herring-fishery. Some miles from the town are the ruins of the castles of Ravenscraig and Inverugie, the latter once the seat of the Keiths, earls-marischal of Scotland. There is at Peterhead a statue (presented to the town by William I., emperor of Germany) of James Keith, field-marshal in the Prussian service, who was killed at the battle of Hochkirch in 1758. Pop. (1901) 11,763.

**Peterhof**, pā'tēr-hōf, Russia, a town on the Gulf of Finland, 18 miles west of Saint Petersburg, noted for an imperial summer palace built by Peter the Great in 1711. It contains a fine collection of paintings, and is surrounded by beautiful parks and gardens laid out on the model of those at Versailles, with cascades, terraces, and summer houses. Pop. 12,000.

**Pe'terkin, George William**, Protestant Episcopal bishop: b. Washington County, Va., 21 March 1841. He was graduated from the University of Virginia in 1859 and from the Theological Seminary of Virginia in 1868, serving in the Confederate army during the Civil War. He entered the Episcopal ministry in 1868, was rector of St. Stephen's Church, Culpeper, Va., 1869-73, and of the Memorial Church, Baltimore, 1873-8. In May 1878 he was consecrated first bishop of the diocese of West Virginia.

**Pe'terlool, Massacre**, in English history, the name popularly given to the dispersal of an open-air meeting in favor of Parliamentary Reform, held 16 July 1819 in St. Peter's Field, Manchester. The meeting was dispersed by yeomanry cavalry, under orders of the magistrates. A number of persons were injured, and some killed. The word Peterloo is a burlesque of Waterloo. The number of persons assembled is



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said to have been 60,000, and the number of killed is stated at 8.

**Petermann**, pā'tēr-män, **August**, German geographer: b. Bleicherode, Prussian Saxony, 18 April 1822; d. Gotha 25 Sept. 1878. His first important work in cartography was a map for Humboldt's 'Central Asia.' He afterward went to Edinburgh and assisted Keith Johnston in the preparation of his 'Physical Atlas,' and in 1847 went to London, where he became a member of the Royal Geographical Society, and contributed to the 'Encyclopædia Britannica,' etc. In 1854 he became professor of geography at Gotha, and superintendent of Justus Perthes' geographical establishment, editing the 'Mitteilungen,' which he founded in 1855, the foremost among geographical magazines.

**Peters**, pē'tērz, or **Peter**, **Hugh**, English Puritan clergyman: b. Fowey, Cornwall, June 1598; d. London 16 Oct. 1600. He was educated at Cambridge, took orders, and preached with great success at St. Sepulchre, London, for a time but was presently imprisoned for non-conformity by Archbishop Laud. On being released he went to Rotterdam, and from about 1632 was minister of an independent congregation there. In 1635 he came to New England and in December 1630 was ordained pastor of the First Church in Salem, Mass., in succession to Roger Williams, whose followers he excommunicated. In 1637 he was made an overseer of the newly established Harvard College. He was active in civil and commercial affairs and in March 1638 was appointed to assist in collecting and revising the laws of the Massachusetts Bay Colony. He was sent to England in August 1641, with two others, to obtain revision of the laws of trade and excise, in which mission they were successful. Peters then joined the Parliamentarians, became a chaplain in the army and is said to have held a colonel's commission. He had intended to return to America, but various matters prevented and during the Protectorate he was a zealous supporter of Cromwell, on whose death he preached a sermon from the text "My Moses is dead." At the Restoration he was exempted from the Act of Indemnity, sent to the Tower, and indicted for high treason as having been concerned in the death of Charles I. He was able to prove false the rumor of his having been present on the scaffold at the king's execution, but was found guilty of treason and was beheaded at Charing Cross. His private character has been the subject of much discussion and the grossest immorality has been charged against him, but the modern view of him is much more lenient. He appears to have been honest and high-minded, but given to violent denunciations of his opponents and wanting in judgment. His writings are mainly political pamphlets and sermons. Consult: Samuel Peters, 'History of Hugh Peters' (1807); Felt, 'Memoir and Defence of Hugh Peters' (1851); and 'Dictionary of National Biography,' Vol. XLV.

**Peters**, **John Punnett**, American Episcopal clergyman and archæologist: b. New York 16 Dec. 1852. He was graduated from Yale in 1873, studied in Berlin and Leipsic 1879-83, entered the ministry, was professor of Old Testament languages and literature in the Episcopal Divinity School, Philadelphia, in 1884; of He-

brew at the University of Pennsylvania in 1885, and was in charge of the expedition of that university which conducted excavations at Nippur, 1888-91. Since 1893 he has been rector of St. Michael's Church, New York. He has published: 'Scriptures, Hebrew and Christian' (1886-9); 'The Bible as Literature' (1896); 'In Laude Zion' (1896); 'Nippur' (1897); 'The Old Testament and the New Scholarship' (1901); 'The Religion of Israel.'

**Peters**, pā'tērs, **Karl**, German explorer: b. Neuhaus, Hanover, Germany, 27 Sept. 1856. He was educated in Göttingen, Tübingen, and Berlin, founded the German Colonization Society in 1884, and led an expedition to Central Africa, where he raised the German flag in Usagara, Ukami, Nguru, and Useguha. He was granted the first Imperial Charter in German history, founded German East Africa in 1885; and continued his management of the colonial possessions until 1888, meanwhile annexing more territory in East Africa. In 1889-90 he led the German relief expedition in search of Emin Pasha and in 1890 reached Victoria Nyanza, after crossing which he met Emin Pasha with Stanley. In 1891-3 he was imperial high commissioner for East Africa and succeeded in establishing the boundary line between English and German possessions. He was attached to the colonial office of Berlin in 1893-5 and in 1896 was accused of cruelty in his treatment of the natives of Africa and recalled. The subsequent investigations resulted in his dismissal. He went to London, founded an exploration company, and in 1899-1901 explored the region between Zambesi and Sabi, where he made important discoveries of ruins which throw much light on ancient African history, and also found gold and copper mines. He has written extensively concerning his travels, his 'New Light on Dark Africa' has been published in nine languages and among his other publications are: 'Willenswelt und Weltwille' (1883); 'Die deutsche Emin Pascha-Expedition' (1891); 'Æquatorial und Südafrika nach einer Darstellung von 1719' (1895).

**Peters**, pē'tērz, **Madison Clinton**, American Baptist clergyman: b. Lehigh County, Pa., 6 Nov. 1859. He was educated at Franklin and Marshall College, Lancaster, Pa., and Heidelberg Theological Seminary, Tiffin, Ohio; entered the Reformed (German) ministry in 1880, and was pastor of the Bloomingdale Church, Broadway, New York, for 11 years. He then adopted the Baptist faith and is now (1904) in charge of the Sumner Avenue Baptist Church, Brooklyn. He has published: 'Justice to the Jew' (1899); 'Wit and Wisdom of the Talmud' (1900); 'Sanctified Spice' (1895); 'Why I Became a Baptist' (1901); etc.

**Peters**, **Richard**, American jurist: b. near Philadelphia 22 Aug. 1744; d. there 21 Aug. 1828. He was educated in Philadelphia, studied law, at the breaking out of the Revolution became captain of a company of volunteers, and in June 1776 was appointed by Congress secretary of the board of war. On resigning this post in 1781 he was elected a Member of Congress, and after the organization of the government he accepted the office of judge of the United States district court for Pennsylvania, a position which he retained for the rest of his life. The ad-



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miralty law of the United States may be said to owe to him its foundation. He was also eminent as an agriculturist, being president of the Philadelphia Agricultural Society.

**Peter's Pence** (Romescot, Rom-gesceot, Rom-feoh, Denarius S. Petri, The King's Alms, Hearth-money). Anciently, an annual tax of one penny for every house, collected in England and other countries of Christendom, and paid to the Holy See; in modern times, a yearly voluntary contribution made by Catholics, through their bishops, for the maintenance of the Sovereign Pontiff. Several theories are advanced as to its origin. It appears, however, to be beyond reasonable doubt that the tax was inaugurated by Ine, King of Wessex, about the year 727. Writes Roger of Wendover (+1237): "In the year of grace 727, the fortunate and powerful King Ine left his kingdom to his kinsman, Athelhard, and went to Rome that he might exchange a temporal for an eternal kingdom. On his arrival, with the consent and approbation of Pope Gregory, he built a house in the city which he called the English School to the end that when the kings of England, and the royal family and the bishops, presbyters, and clergy came hither to be instructed in the Catholic faith and doctrine, nothing heterodox or contrary to Catholic doctrine might be taught in the English church, and that they might return home confirmed in the faith. . . . He built moreover, nigh to the aforesaid house, a church in honor of the Blessed Virgin Mary, wherein the divine mysteries might be celebrated for the English who came to Rome, and in which they might be buried if any of them chanced to die in Rome. And to give strength and perpetuity to all this, it was ordered by a general decree, throughout the entire kingdom of the West Saxons, in which the aforesaid Ine reigned, that, every year, one penny, which in English is called Romescot, should be sent by every family for the blessed Peter and the Roman Church, that the English who sojourned there might be furnished with the necessary subsistence." ('Flowers of Hist.,' tr. Giles, 1849, vol. I, p. 137. Comp. 'Cronica Ranulphi Cestrensis Monachi, lib. v., c. 24, Caxton, 1482). Offa, king of Mercia, according to the same chronicler, augmented this revenue (793) by granting "the blessed Peter's penny . . . which the English call Rome-scot," to be paid, each year, throughout the 23 shires subject to him, by each family that had possessions in lands to the value of 30 pence (ib. pp. 163, 164). In the 9th century, Ethelwulf "offered to God and to Saint Peter an annual tax of a penny to be paid by each house in England; this tax is now known under the name of Peter's Pence." (Will. of Malmesbury, *Gesta Regum*, ii., 2). At the request of Alfred the Great, son of the former, the Pope freed the English school from all tribute and tax, and the Romescot was contributed by both the king and the people for a new and two-fold object, part for the Pope's personal use, and part to keep up the light in the churches of St. Peter and St. Paul. ('Mon. Hist. Brit.' ed. Petrie and Sharpe,

p. 472. Comp. ib., p. 552, p. 517, C.). In 1031, King Knut wrote from Rome to the English clergy and laity, and, in his letter mentioned "the pennies which we owe at St. Peter's, Rome," as among the things "we owe to God, according to ancient law." ('Mon. Hist. Brit.' p. 597.) Considerable irregularity arose, from time to time, in the levying of the Peter's Pence. At times, it was interrupted through misunderstandings and quarrels with the Holy See; sometimes, portions of it were withheld or the sum total forwarded only after several years. Some English sovereigns, notably Edward III. in his speech to Parliament, 21 Jan. 1365, resisted the collection of the Romescot. King John, when he swore fealty to the Pope, expressly promised that in addition to the payment of the sum of one thousand marks a year the payment of the Peter's Pence should be continued. (Lingard, 'Hist. Eng.' vol. III., p. 41, note.) Suppressed by statute 25th Henry VIII., ch. 21, in 1534, it was revised by Mary, and finally abolished in England under Elizabeth.

The Peter's Pence tribute is said to have been introduced into Denmark and Norway by Knut, into Sweden by Olaf, into France by Charlemagne, and into Poland under Casimir I. It was extended to Ireland in 1154, through the much-discussed bull of Adrian IV. It was paid in Scotland, Bohemia and Spain. That toward the end of the 11th century the payment of this tribute implied, in Continental countries, the acknowledgment by the various sovereigns of a kind of suzerainty or temporal protectorate on the part of the Apostolic See, is certain. (Fabre, 'Etude sur le Liber Censuum de l'Eglise Romaine.') And there can be little doubt that after the original object of the Romescot—the support of the English school—had no longer to be met, the same condition obtained also in England. (Rivington, 'Rome and England,' p. 47.) When Henry VIII. broke with the Holy See, and the Peter's Pence was prohibited by act of Parliament, this latter took place "on the grounds," writes Gairdner, "that the realm was not subject to any power outside it." ('Hist. Eng. Ch.' p. 145.)

The Peter's Pence tribute was collected in midsummer on the days which intervene between the feast of Sts. Peter and Paul and the feast of St. Peter's Chains. The value of the penny varied considerably. In the time of Henry II. it amounted to one dollar or a little more than one dollar of our money. (Malone, 'Ch. Hist. of Ireland,' 1880, p. 26, note.) The annual sum forwarded in the time of King John was £199 8s., according to Lingard, who took the figures, with the amount for each of the 15 dioceses which paid it, from the 'Authentic Register of Innocent III.,' in the Vatican Library. ('Hist. Eng.' vol. III., p. 41, note.) Some of the coins are still in existence. The English penny was of fine silver, two hundred and forty to the pound weight. In the latter days of the tax, the tokens appear to have been manufactured in every cathedral town. On the one side they have the inscription *Sci. Petri M.* (*Sancti Petri Moneta*); on the other the name of the place of minting. The Poles, who kept up



the impost for about three centuries, paying within that period not far from half a million florins, used a coin for the purpose which was a base mixture of copper and silver. On one side was stamped the image of the Polish eagle; on the other, that of St. Peter with a key.

The modern Peter's Pence is used by the Pope for the current expenses of his administration. A voluntary offering, inaugurated through the efforts of M. de Coux and Louis Veuillot, editors-in-chief of the 'Univers,' in September, 1847, its purpose was to relieve a condition of embarrassment then prevailing in the papal finances, as well as, in a practical way, to demonstrate the devotion of Catholics to the Holy Father. One hundred francs for the Pope, deposited at the office of the paper by an anonymous benefactor, was made the occasion of a movement which almost immediately received the indorsement of Cardinal de Bonald, many bishops and the whole Catholic press. In a short time the subscription became general throughout France. (Eugene Veuillot, 'Louis Veuillot,' Paris, 1901, t. II., pp. 195-198.) From France it spread into other countries, especially on the seizure of the papal provinces; it is now observed by Catholics everywhere. In 1868 the second plenary council of Baltimore decreed that collections for the Pope be taken up annually in all churches of the United States on the Sunday within the octave of Sts. Peter and Paul, or at any other opportune time, that the total sum collected be sent, either directly by the bishops themselves or through the metropolitan of each province, to the Sovereign Pontiff. (Cl. P. B. II., n. 48.) The pastoral letter of the archbishops and bishops of the third plenary council in 1884 praises the liberality of the people in the collection for the Holy Father "which will continue to be made annually throughout all the dioceses of the country." (Cl. P. B. III., p. 77.)

*Bibliography.*—Fabre, 'Etude sur le Liber Censuum de l'Eglise Romaine' (Paris, 1892); Cancellieri, 'La visita de' sacri limini ed il danaro di S. Pietro' (Roma, 1821); Rivington, 'Rome and England' (London, 1896); Addis and Arnold, 'Catholic Dictionary' (1884); Eugene Veuillot, 'Louis Veuillot,' t. II. (Paris, 1901); 'Chamber's Journal,' vol. 36, pp. 298-301; Historical and Political Papers, vols. 45, 46. 'The Peter Pence of the 19th Century'; Wetzel and Welte, 'Dict. Encyc.'; Lingard 'Hist. Eng.' (1823).

REV. FRANCIS GILFILLAN, S. T. L.

**Petersburg, Va.,** city, port of entry, in Dinwiddie County; on the south bank of the Appomattox River, the upper Appomattox Canal, and on the Atlantic Coast Line, the Seaboard Air Line, and the Norfolk & W. R.R.'s; about 20 miles south of Richmond. It is in an agricultural region in which tobacco and peanuts are the chief products.

Where Petersburg now stands was once the site of an Indian village, which was destroyed by Nathaniel Bacon in 1676. Petersburg was founded in 1733, incorporated as a town in 1748, and in 1850 was chartered as a city. It was the scene of several engagements during the Revo-

lutionary War, and twice it was occupied by British troops under Gen. Philips. In the War of 1812, and in the War with Mexico, Petersburg sent her full quota to the front. During the Civil War, it was the scene of many of the engagements of the famous Virginia Campaign. East of the city, on Griffith's farm, is a small museum, containing many relics of the war, principally from the old crater which is on this farm. See PETERSBURG, MILITARY OPERATIONS AGAINST.

Petersburg has large manufacturing interests, owing to the good water-power, the transportation facilities, and the abundance of raw material near at hand. The chief manufacturing establishments are tobacco and peanut factories, cotton mills, knitting mills, silk factory, foundries, trunk factories, brick works, veneer and wheel factories, and lumber mills. It has a large trade in tobacco, fruits, and vegetables. The prominent public structures are two steel bridges, Y. M. C. A. building, Masonic Temple, Odd Fellows' and Red Men's buildings, electric light works and the municipal buildings. It has the State Central Hospital for the Colored Insane, with 1,000 patients (1904), two public parks, a Home for the Sick, and the Benevolent Mechanics' Association building. The educational institutions are the Virginia Normal and Collegiate Institute, for colored students; the University School for young men, the Southern Female College, public and parish schools, and the library and museum of the Mechanics' association. The government is administered under a charter of 1875 which provides for a mayor, who holds office four years, and a council. The city owns and operates the waterworks. Pop. (1900) 21,810; (1904) 24,271.

N. T. PATTESON,

*Secretary Petersburg Chamber of Commerce.*

**Petersburg, Military Operations Against.** When Gen. McClellan, in the summer of 1862, was forced to abandon his advance upon Richmond by way of the Peninsula and fall back to Harrison's Landing, he proposed to cross to the south side of James River and operate against Richmond by that side, seizing Petersburg and the railroads leading to that city and Richmond from the south, and for this purpose asked that his army be largely reinforced. Gen. Halleck, commander-in-chief of the army, disapproved the movement and withdrew the Army of the Potomac from the Peninsula. No further effort was made for a serious advance south of the James until early in May 1864, when, in co-operation with the campaign beginning in the Wilderness, Gen. Grant ordered Gen. Butler, commanding the Army of the James, to cross to the south side of the river and, moving close along its bank, press for Richmond. Butler was stopped at Drewry's Bluff (q.v.), and held to his intrenchment at Bermuda Hundred. On 9 June Butler ordered Gen. Gillmore and Gen. Kautz to capture Petersburg and destroy the railroad bridge across the Appomattox. On the morning of the 10th Gillmore, with 1,800 men arrived before the Confederate works on the City Point road, Gen. Hinks, with 1,200 men coming up a mile to his left. Both thought the works too strong to be carried, and withdrew. Kautz, with 1,500 cavalry, moved on the Jerusalem plank-road, four or five miles to Gillmore's left and, near noon, made three unsuc-



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cessful attacks, then turned the Confederates in his front, and advanced close to the city waterworks, on Reservoir Hill, where he found infantry and artillery intrenched, and, satisfied that he could not capture the city, withdrew, followed by Dearing's Confederate cavalry brigade. At this time Petersburg was held by about 2,400 infantry under Gen. Wise, Dearing's cavalry, and some local militia.

After the loss of 53,400 men in his campaign from the Wilderness to Cold Harbor, in an effort to reach Richmond from the north, Gen. Grant concluded to transfer his army south of James River and conduct operations against Petersburg and Richmond similar to those proposed by McClellan two years before. Gen. Halleck objected and proposed an investment of Richmond from the north, but Grant adhered to his own plan, sent Sheridan to destroy the railroad north and west (see TREVILIAN RAID AND BATTLE OF TREVILIAN STATION), and began preparations to withdraw from before Lee at Cold Harbor and cross to the south of the James. The general movement began on the 12th and was skilfully conducted; and crossing the Chickahominy and then the James, at and near Wilcox's Landing, the entire Army of the Potomac was south of the river, in rear of Bermuda Hundred, at midnight of the 16th.

*First Assault.*—Before all the Army of the Potomac had crossed the James, Grant ordered an advance on Petersburg for 15 June. The Petersburg intrenchments ran from the Appomattox River east a mile to the City Point Railroad; then south three miles to Norfolk Railroad; then west four miles to a point a mile west of the Weldon Railroad; then north two miles to the Appomattox. The length of the intrenchments from the Norfolk Railroad west to the Jerusalem plank-road was 1½ miles. These works 15 June were held by Gen. Wise's infantry brigade of 2,400 men, Gen. Dearing's cavalry brigade of 3,500, and a small body of local militia. Gen. W. F. Smith, who had rejoined the Army of the James at Bermuda Hundred, on the night of the 14th and next morning with his infantry division increased to 13,700 officers and men, and Kautz's division of 2,400 cavalry marched along the City Point Railroad and wagon-road, capturing one gun and, when he came under fire of artillery, reconnoitered and formed his troops for assault. His reconnoissance was deliberate and prolonged, and it was 5 P.M. when he concluded not to assault in column under a heavy artillery fire that had been opened upon him, but to use his own artillery against one of the Confederate redoubts and to attack the Confederate works with a strong skirmish-line. When he was ready for the movement it was found that all the artillery had gone to the rear to water the horses, and there was a delay of an hour or more. About 7 o'clock the guns opened, the skirmishers advanced, by 9 o'clock 1½ miles of the Confederate intrenchments had been taken, and with them 16 guns and nearly 400 prisoners. Gen. Hancock, commanding the Second corps, had been ordered to march on Petersburg on the morning of the 15th after rationing his men; but neither he nor Gen. Meade was informed of Smith's movement; there was delay in furnishing the rations; he started late in the morning without them; the position he was to occupy was incorrectly laid down on the maps; it was

dark when he came to Smith's position; and at Smith's request he relieved his troops. Had there been a proper understanding that day between Grant, Meade, Hancock, and Smith, Petersburg would have been taken before night, and a weary, wasting ten months' siege avoided. During the night Hoke's division was sent by Beauregard to form on Wise's left and extend to the Appomattox. B. R. Johnson's division was withdrawn from the Bermuda Hundred line and early on the 16th took position on Hoke's right. Wise's right was still half a mile from the Jerusalem plank-road. From Wise's right to Hoke's left, a distance of five miles, the Confederates had, on the 16th, besides artillery, about 14,000 men. On the morning of that day Egan's brigade of Hancock's corps attacked and carried a Confederate redoubt. Burnside's Ninth corps came up at 10 A.M. and formed on Hancock's left. The Union troops now fronting Beauregard's 14,000 numbered 53,000 men. At 6 P.M. Hancock assaulted with the Second corps, supported by two brigades of the Eighteenth on the right and two of the Ninth on the left. Three redoubts and their connecting works were carried. The Union loss was severe. B. R. Johnson's withdrawal from the front of Butler's right had been discovered during the night of the 15th, and early next morning Gen. Terry advanced, captured some pickets and, after sharp resistance, occupied the main line of Beauregard's intrenchments, taking many prisoners. At 6 P.M. Pickett's division, sent by Gen. Lee from Drewry's Bluff, drove in Terry's skirmishers, and Terry abandoned the captured works, which were reoccupied by Pickett, who, advancing from them, attacked Terry and was repulsed. On the morning of the 17th the Second and Ninth corps again assaulted the Confederate works, carrying portions of them and taking guns, colors, and prisoners. Meanwhile Warren's Fifth corps had come up and formed on the left of the Ninth. Another assault was made in the afternoon by the Second, Ninth, and Fifth corps, and continued until after dark, with heavy losses on both sides, but the advantage remained with the Union troops, who had gained several important positions. During the night Beauregard withdrew across a ravine, formed a new line from 500 to 1,000 yards in rear of the one he had been occupying, and immediately intrenched it. Gen. Meade ordered a general assault for the 18th, which was made by piecemeal and repulsed, but the ground gained, close up to the Confederate works, was intrenched, and on this part of the field the two opposing lines remained substantially the same in position to the close of the war. In these attempts to carry Petersburg by assault 10,000 men had been lost; it was now known that Lee's entire army was being thrown into the place; Meade said there was "nothing further to be gained by direct attacks"; and Grant ordered that no more assaults be made and determined to invest the place partially by extending his left across the Weldon railroad and to the South Side railroad.

*Petersburg.*—Gen. Grant ordered strong works to be thrown up close to those of the Confederates; close connection was made with the Army of the James on the right; and the first offensive movements were to destroy communication with Petersburg on the south. On 22 June Gen. Wilson, with 5,500 cavalry and 16



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guns, marched to destroy the Weldon railroad and the South Side railroad (see WELDON AND SOUTH SIDE RAILROAD, WILSON'S RAID ON), and on the same day the Second and Sixth corps made an effort to seize the Weldon railroad near Globe Tavern, but were checked by A. P. Hill's Confederate corps when about a mile from the road. (See JERUSALEM PLANK-ROAD, ENGAGEMENT NEAR.) Both armies remained comparatively quiet for more than a month, intrenching and throwing up redoubts, but there was incessant skirmishing all along the lines, with severe losses. On 25 July Grant ordered a movement north of the James to threaten Richmond and thus draw from Petersburg a part of Lee's army to give more likelihood of success in a proposed explosion of a mine in front of his army on the Petersburg line and a subsequent assault. This movement resulted in the battle of Deep Bottom (q.v.), and the transfer by Lee of five infantry and two cavalry divisions to the north side of the James, thus reducing the force south of it to three divisions of infantry and one of cavalry.

*Petersburg Mine.*—In the latter part of June Lieut.-Col. Pleasants, 48th Pennsylvania, suggested to Gen. Potter, his division commander, the mining of a Confederate redan in his front, and agreed to conduct the operation. Gen. Burnside authorized it to be done, and Gen. Meade, though not having much faith in it, assented. The redan was held by Elliott's brigade of B. R. Johnson's division, and was opposite the centre of the Ninth corps, where the opposing lines were not more than 120 yards apart. Pleasants had many difficulties to overcome, but the work was finished ready for charging by 23 July. The main gallery was 511 feet long, with two lateral galleries of 37 and 38 feet, in which were eight magazines, each charged with 1,000 pounds of powder. It was intended that, upon the explosion of the mine, the artillery on the right and left should open a furious fire, and that two brigades of Gen. Ferrero's colored division should lead in the assault upon the wrecked work; but as these troops had never been under close fire of the enemy, Gens. Meade and Grant objected, and Burnside substituted Gen. Ledlie's division. The whole army was held in readiness to advance and take any advantage gained by the confusion anticipated in the Confederate lines. The order for the attack was issued by Gen. Meade on the 29th, and was full and precise as to what was to be done by each commander. Burnside was to spring the mine at 3.30 in the morning of the 30th, his assaulting columns were to rush forward, seize a crest of ground 150 yards beyond the breach in the line caused by the explosion, re-form and push on, closely followed by Gen. Ord's corps on the right and by Gen. Warren's on the left. It was 4.40 when the explosion occurred, carrying men, guns, carriages, dirt, and timbers high into the air and leaving a crater 170 feet long, 60 feet wide and 25 to 30 deep. Burnside had failed to carry out the precise orders given him; there was delay and confusion in getting the charging columns over his own works; and Ledlie's division, without its commander, moved into the crater and halted, filling it with a confused mass. It did not go forward; was not promptly supported; other troops rushed into the crater and added to the confusion; the Confederates, re-

covering from their first surprise, reoccupied the intrenchments they had abandoned on the right and left; they swept the crater with canister; and shortly after noon the Union troops were ordered to fall back either during the day or under cover of night. Those in the crater were driven out or captured early in the afternoon, losing many in killed and wounded, though they had not much more than 100 yards to go to reach the intrenchments from which they had charged. Gen. Grant says: "The effort was a stupendous failure . . . due to inefficiency on the part of the corps commander and the incompetency of the division commander who was sent to lead the assault." The Union loss was 504 killed, 1,881 wounded, and 1,413 captured or missing; an aggregate of 3,798, of whom 3,475 were of the Ninth corps. The Confederate loss was not over one third of that sustained by the Union troops.

*Siege of Petersburg and Richmond.*—On 30 July 1864 the armies of the Potomac and the James, investing Petersburg and Richmond, numbered about 59,000 effective infantry and 12,000 cavalry. Gen. Lee had about 38,000 effective infantry and 8,300 cavalry. The Army of the Potomac undertook the investment of Petersburg, while the Army of the James held Bermuda Hundred and all the ground possessed north of James River. The Ninth corps was on the right of the Army of the Potomac at Petersburg, the Fifth in the centre, and the Second on the left. The Sixth corps had been sent to Washington to oppose Gen. Early. To prevent Gen. Lee from sending reinforcements to Early, Grant 12 August, ordered another movement north of the James to threaten Richmond, which resulted in the second battle of Deep Bottom (q.v.), in which the Union loss was over 2,700 men. Under cover of this movement Warren's Fifth corps, with a brigade of cavalry, moved to the left on the morning of the 18th, and, after some hard fighting for four days, with heavy losses on both sides, succeeded in gaining and holding the Weldon railroad at Globe Tavern, about four miles south of Petersburg. (See GLOBE TAVERN, BATTLE OF.) On the 22d Gen. Hancock, with about 8,500 infantry and cavalry, moved to destroy the railroad south of Globe Tavern. By the 25th he had destroyed it as far down as Ream's Station and three miles beyond, 12 miles south of Petersburg, when he was attacked by A. P. Hill and driven back with a loss of 2,700 men, 12 colors, and 9 guns. (See REAM'S STATION, BATTLE OF.) On 28 September, to retain Lee in his position, Grant ordered two corps of the Army of the James to move on Richmond from the north side of the river. This brought on the Battle of Fort Harrison (q.v.), the capture of some Confederate works, and the extension of the Union lines to the river. The two opposing lines north of the James maintained their relative positions to the close of the siege. In co-operation with this movement north of the James, Gens. Warren and Parke, with two divisions each of the Fifth and Ninth corps and Gregg's cavalry division, moved 30 September to extend the intrenched line beyond the Weldon railroad in the direction of the South Side railroad. There was sharp fighting on 1 and 2 October, but the movement was checked after reaching the Weldon railroad south of Globe Tavern, the Union loss being about 2,800, the Confederate loss about 1,000.



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(See POPLAR SPRING CHURCH, BATTLE OF.) On 7 October Kautz's cavalry division of 1,700 men, holding the right of the Union line north of the James, was attacked by the Confederate infantry divisions of Field and Hoke and Gary's cavalry brigade, and driven back under cover of the infantry, losing 274 men and eight guns. Field's division followed and attacked the right of the Tenth corps on the New Market road, and was repulsed. On the 13th Gen. Butler made a reconnoissance of the Confederate works on the Darbytown road, north of the James; one brigade made an assault upon them and was repulsed. On 27 October parts of the Ninth, Fifth, and Second corps, together with Gregg's cavalry division, in all about 38,000 men, moved to the left to seize the bridge over Hatcher's Run and capture the Confederate works, which at that point Grant thought were not strongly held, and seize the South Side railroad. The object of the movement failed, and the troops were withdrawn with a loss of over 1,700. (See HATCHER'S RUN (BOYDTON ROAD), BATTLE OF.) On the 27th and 28th Gen. Butler made another movement on Richmond north of the James, by the Williamsburg, Charles City, and Darby roads. A severe engagement took place on the old battlefield of Fair Oaks or Seven Pines, in which Butler's forces were repulsed by Longstreet, and fell back to their camps near Fort Harrison, with a loss of about 1,100 men. On 6 December Gen. Warren, with his own corps, Mott's division of the Second, and Gregg's cavalry, started on a raid against the Weldon railroad, which was destroyed as far as Hicksford, on the Meherrin River, about 40 miles south of Petersburg. A. P. Hill was sent to intercept him, but failed to do so; and having completed his work, Warren returned to his camps.

Winter had now set in, and was of unusual severity, entailing much suffering upon both armies, but especially upon the Confederates, who were poorly fed and clothed. Lee strengthened his works and extended them up the south side of Hatcher's Run and where the Boydton plank-road crosses the run. A. P. Hill held the right from Hatcher's Run to Fort Gregg; Gordon and R. H. Anderson held from Hill's left to the Appomattox, and Longstreet from the Appomattox to the Confederate left, north of the James, at White Oak swamp. The length of the line was about 37 miles, eight of which were north of the James. To cover those 37 miles Lee had, 30 December, about 59,000 officers and men. At the same date Grant had about 110,000 men. With these he held Lee tightly to his works while armies elsewhere were carrying out his own comprehensive plans. On 5 February 1865 Grant put the greater part of his army in motion to the left to destroy Lee's communications, resulting in the battle of Hatcher's Run, Dabney's Mill, and Armstrong's Mill, and the extension of his intrenched line to the Run. The loss was severe on both sides.

Gen. Lee had foreseen that the evacuation of Petersburg and Richmond would be forced upon him when Sherman approached from the south, and it was determined early in March that, as soon as the roads would admit of movement, the two places should be abandoned and his army moved to Danville to unite with Gen. J. E. Johnston and attack Sherman, and preparations

were made accordingly. Meanwhile Lee proposed to make a sortie in order to gain some of the works on the right of the line held by the Army of the Potomac, near the Appomattox, and the ridge in their rear, with the expectation that this would oblige Grant to concentrate there by drawing in his left, and thus postpone the necessity for abandoning Richmond and Petersburg until the weather was favorable for falling back to Danville. To this President Davis gave his assent. Gen. Gordon with about one half of the army, was given charge of the movement, which was directed against Fort Stedman, on the Ninth corps line, where the opposing lines were only 150 yards apart, the pickets 50 yards apart. The assault was made at half-past four in the morning of 25 March, and was at first successful, the Confederates carrying the fort and works on either side of it; but after a hard fight of four hours they were driven back, with an estimated loss of 4,000 men and many colors. The Union loss was about 2,200. (See FORT STEDMAN, ASSAULT ON.) Before this assault Grant had ordered a movement for the 29th to destroy the railroads leading into Petersburg from the south, force Lee to come out of his intrenchments and fight on open ground, or so far attenuate his line as to give chance for a successful assault. He had been joined by Sheridan and his cavalry from the Shenandoah Valley, and had under his command 101,000 infantry, 14,700 cavalry, and 9,000 field artillery, with 369 guns, an aggregate of 124,700 men. The Confederate army under Gen. Lee numbered about 46,000 infantry, 6,000 cavalry and 5,000 field artillery, with about 190 guns, an aggregate of 57,000 men, or less than half of Grant's force.

The movement, which was the beginning of the end, began on the day fixed by Grant. The greater part of the Army of the James was marched secretly on the night of the 27th from the right to the left of the Army of the Potomac, 36 miles, and on the morning of the 29th Sheridan's cavalry, with the Fifth and Second corps, moved to the left to turn Lee's right. The result was the battles of Dinwiddie Court-House and White Oak Road (q.v.), on the 30th and 31st, followed by the decisive battle of Five Forks (q.v.) on 1 April.

*Final Assault Upon Petersburg.*—Gen. Grant heard of the victory of Five Forks at 9 o'clock that night and ordered Gen. Humphreys, commanding the Second corps, on the left of the general intrenched line, to "feel for a vulnerable point in the enemy's intrenchments, and, if one was found, to assault immediately." Humphreys assaulted before midnight, carried the picket-line, but was repulsed when he approached the main line. A general bombardment of the Confederate lines was kept up throughout the night and, under Grant's orders, at 4 A.M. of 2 April Ord's, Humphrey's, Wright's and Parke's corps, about 63,000 men, assaulted the lines before which they had been held for ten months, and which were now defended by less than 20,000 men. On many parts of the line there was desperate resistance, but the exterior lines were finally captured, Lee notifying President Davis that he would hold on to his interior line until night, and then endeavor to reach Danville. At 3 P.M. Lee ordered a retreat, which began at 8 o'clock, the point of assemblage of his various columns being Amelia Court-House. Grant or-



dered a general assault for the morning of the 3d, but at 3 A.M. it was discovered that Lee had abandoned all his works. Petersburg was taken possession of by Willcox's division of the Ninth corps, and at 8.15 A.M. Richmond was formally surrendered to Gen. Weitzel, who had entered it from the north of the James.

The Union loss in the final assault on Petersburg, 2 April, was 625 killed, 3,189 wounded, and 326 missing. There is no record of Confederate losses. From 15 June 1864 to 9 April 1865 the campaign for Petersburg and Richmond cost the Union armies under Gen. Grant 6,883 killed, 35,414 wounded, and 20,859 captured or missing; an aggregate of 63,156 officers and men. The Confederate loss for the same period is not known. Consult: 'Official Records,' Vols. XXXVI., XL., XLIII., XLVI.; Humphrey's 'The Virginia Campaigns of 1864-5'; Walker, 'History of the Second Army Corps'; Powell, 'History of the Fifth Army Corps'; Grant, 'Personal Memoirs,' Vol. II.; Sheridan, 'Personal Memoirs,' Vol. II.; Pennypacker, 'Life of Gen. Meade'; Long, 'Life of Gen. Lee'; Fitzhugh Lee, 'Life of Gen. Lee'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

E. A. CARMAN.

**Petersen**, pā'těr-sën, **Niels Matthias**, Danish historian and theologian: b. Sanderup, island of Fünen, Denmark, 24 Oct. 1791; d. Copenhagen, Denmark, 11 May 1862. He studied philology and history, and in 1845 was appointed to the chair of Norse languages in the University of Copenhagen. He was an authority on mythology, geography, and history, his specialty being literary history, and though most of his works have been superseded his 'History of Danish Literature' (1853-64) is still a standard. Among his books are: 'Det Danske, Norske og Svenske Sprogs Historie' (1829); 'Danmarks Historie i Hedenold' (1834); 'Den Nordiske Mythologi' (1849); 'Bidrag til den old Nordiske Literaturs Historie' (1866); etc.

**Peterson**, pē'těr-sòn, **Frederick**, American neurologist: b. Faribault, Minn., 1 March 1859. He was graduated from the medical department of the University of Buffalo, studied abroad, and in 1882-8 was professor of general pathology and laboratory director in the University of Buffalo. In the latter year he removed to New York, where he practised as a nerve and brain specialist, and in 1893-4 was professor of neurology at the University of Vermont. He has been attending physician at various hospitals, was professor of neurology at the Woman's Medical College of the New York Infirmary, pathologist in the New York City Insane Asylum, president of the board of managers for the Craig Colony of Epileptics, chief of the clinic in the department of nervous diseases at Columbia, and in 1900 was made president of the New York State Commission in Lunacy. He has for several years been associate editor of the New York 'Medical Journal' and the 'Journal of Nervous and Mental Disease.' His publications include: 'Mental Disease' (1899); 'American Text-Book of Legal Medicine and Toxicology' (1903); etc.

**Peterwardein**, pā'těr-vär-dīn, Hungary, a town on the right bank of the Danube, 45 miles northwest of Belgrade. It stands partly on a steep rock and partly on a flat below, and is

the strongest fortress on the Danube. It communicates by a bridge of boats and a railway bridge with the town of Neusatz on the opposite bank. The fortifications are extensive, and contain barracks for a garrison of 10,000 men; but the town itself is small. It has, however, four churches, a military hospital, an arsenal, a high school; and a trade in wine and fruit. A great victory was gained here (5 Aug. 1716) over the Turks by Prince Eugene. Peterwardein was occupied by the Hungarians in the civil war of 1848-9. It surrendered to the Austrians 6 Sept. 1849. Pop. (1900) 5,019.

**Petigru**, pēt'ī-groo, **James Louis**, American lawyer: b. Abbeville district, S. C., 10 March 1789; d. Charleston, S. C., 3 March 1863. He was graduated at the South Carolina College in 1809, and in 1812 was admitted to the bar. Having attained professional eminence in the rural districts, he removed to Charleston, where he rapidly rose to distinction. In 1822 he became attorney-general of the State, which office he held for eight years. During the Nullification troubles of 1830-2 he opposed the doctrine of the State veto, and was one of the leaders of the "Union and State Rights" party. Upon the defeat of his party, he became in his political capacity an object of much popular dislike, but his talents and virtues nevertheless secured him the respect of the community in which he lived, and he continued to maintain his position as a leader at the bar with scarcely a rival. He subsequently served in the State legislature, and codified the laws and statutes of South Carolina. Although opposed to the secession movement of 1860-1, he followed the fortunes of his State. Consult: Grayson, 'James Louis Petigru' (1866).

**Petiole**, in botany, the stalk of a leaf. When the petiole is wanting, the leaf is said to be sessile. In general, however, it is distinctly marked, and is usually either round, or half-cylindrical and channeled on the upper side. In the poplar it is strongly flattened at right angles to the blade, and hence the remarkable movement observable on the least breadth of wind, especially in the aspen. Sometimes, as in the garden sweet-pea, the petiole is furnished with a kind of border or wing. In many umbelliferous plants its base is dilated into a broad membranous inflated sheath. In grasses and various other plants it consists of a sheath embracing the stem; in the pea tribe the apex of the petiole is often changed into a tendril. In one section of the genus *Astragalus* (tragacanth) it hardens into a spine after the leaflet drops. The petiole in some Australian species of acacia and eucalyptus is flattened into a leaf-like expansion, occupying the place of the true leaf; such petioles have received the name *phylloдия*. See LEAVES.

**Pétion**, pā-tē-ôn, **Alexander Sabes**, Haitian soldier and politician: b. Port-au-Prince, Haiti, 2 April 1770; d. there 29 March 1818. He was educated in Paris, entered the French army in Haiti, and in 1791 joined the forces of Toussaint l'Ouverture (q.v.), serving as commander of artillery. In 1799 he entered the service of Gen. Rigaud and upon the latter's defeat by l'Ouverture was obliged to leave the island. He went to France and returned in 1802 with the rank of colonel under Gen. Leclerc, who



## PETION DE VILLENEUVE — PETITION

was to subdue the island, but in the same year Pétion joined the revolt under Henry Christophe and later served under Dessalines. The latter was murdered in 1806 and Christophe assumed the presidency in 1807. The south and west provinces, however, declared for Pétion and chose him president of that portion of the island, which resulted in almost continual warfare. Pétion's administration was in marked contrast to that of Christophe. He opened his ports, granted protection to commerce, paid the debts of the country, and introduced measures which gave great commercial and agricultural prosperity to the country. In 1815 he was elected president for life with power to nominate his successor, but in the latter part of his administration the financial affairs of the government became depressed, and Pétion fell a victim to hypochondria in which state he starved himself to death. Consult St. John, 'Hayti; or, the Black Republic' (1884).

**Pétion de Villeneuve**, *dé vël-nèv, Jérôme*, French Revolutionist: b. Chartres, France, 1753; d. near Saint Emilion, France, 1794. He was an advocate in his native city when chosen a deputy to the States-General in 1789, became a member of the Jacobin Club and a supporter of Robespierre. He acted with unnecessary cruelty in the performance of the duty assigned him of forcing the return of the royal family from Varennes; was elected mayor of Paris in 1791, and president of the Convention in 1792 and voted for the execution of the king. He was nevertheless suspected of being a royalist, and the jealousy of Robespierre being aroused he was arrested with the Girondists in 1793. He escaped, but perished in a field near Saint Emilion, either by suicide or starvation. His works were published in four volumes in 1793. Consult Dauban, 'Mémoires inédites' (1866).

**Petit de Julleville**, *pè-tê dè zhül-vël, Louis*, French historian of literature: b. Paris 18 July 1841. He was graduated from the Ecole Normale, and after teaching in the Collège Stanislas of Paris and the faculty of letters at Dijon, became professor of French literature in the Paris faculty of letters in 1886. His principal work is 'History of the Theatre in France' (1880-6); very complete with regard to the old French theatre. He gives in 'The Theatre in France' (1889) an account of the evolution of the French drama down to the present time. In 1896 he commenced the publication of a 'History of the French Language and Literature.'

**Petition, Right of**, in public law, the right of the citizen to present a formal supplication to the government for the granting of some favor, usually the redress of a grievance. The better opinion is that it also includes the right of the petitioner to have his petition heard, otherwise the right of petition is worthless. Like many of the great constitutional safeguards it is the result of a long struggle against tyranny. It was implied in the guarantees of Magna Charta and was so frequently exercised in the time of Edward II. that it became necessary to formulate rules by which the task of hearing petitions could be facilitated. During this period petitions were usually made to the king, but later when Parliament had succeeded in establishing its supremacy over the royal power petitions came to be preferred to that body in-

stead. The Stuarts looked with disfavor upon the growing practice of presenting petitions, and during the reign of Charles II. Parliament passed an act forbidding the presentation of petitions signed by more than 10 persons and placing other restrictions upon the right of petition. The refusal of James II. to hear the petition of the seven bishops, who refused to publish his declaration of independence, created a great sensation throughout England, and in the Declaration of Right drawn up by Parliament after the Revolution of 1688 it was declared to be the right of English subjects to petition the king, and all commitments and prosecutions for such petitioning were declared to be illegal. This right was confirmed by the Act of Settlement of 1700. Petitions to Parliament now became very numerous and the exercise of the right may be said to have culminated in the Chartist movement of 1848, when a petition bearing its signatures of more than 1,000,000 persons was presented to Parliament praying for annual parliaments, universal suffrage, and other reforms. In early times it became the custom of Parliament at the opening session to appoint "receivers" and "triers" of petitions, who examined them and referred them to the courts or to Parliament for consideration. In order to receive attention from Parliament petitions must be in a prescribed form, respectful in language, and ordinarily must be presented by a member.

The first amendment of the Constitution of the United States prohibits Congress from making any law to abridge "the right of the people to peaceably assemble and to petition the government for a redress of grievances." It will be seen from the language of this provision that its purpose is not to create the right of petition, its existence being assumed, but to secure it. In spite of this provision the National House of Representatives in the course of the controversy over slavery encroached seriously upon this right. Beginning as early as 1790 petitions for the abolition of the slave trade and the prohibition of slavery in the District of Columbia were presented to Congress. The latter were referred to the Committee on the District of Columbia and reported unfavorably. As the petitions increased the committee ceased to make reports. In 1836 the House adopted a rule providing that all petitions relating to slavery should be laid on the table without action and without being printed or referred to a committee. This was the first of the so-called "gag" rules and was stoutly opposed by John Quincy Adams, who had presented most of the petitions relating to slavery. Finally in January 1840 the House adopted a rule declaring that no petition praying for the abolition of slavery or of the interstate slave trade should be received or entertained in any manner whatever. For the repeal of this illiberal rule Adams labored incessantly until his efforts were crowned with success in 1844. After this the right of petition was never again abridged by Congress.

By the present rule petitions are delivered to the clerk, endorsed with the name of the member presenting them and of the committee to which they are referred, and by him they are transferred to the appropriate committee. All of the States with one or two exceptions have



## PETITION OF RIGHTS — PETRARCH

constitutional provisions guaranteeing the right of petition.

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**Petition of Rights**, in English politics, a celebrated statute of Parliament passed in 1628 declaratory of certain of the ancient rights and privileges of Englishmen. It had its origin in the controversy between Charles I. and the Parliament concerning the prerogatives of the king and the privileges of the Commons. Charles had violated the privileges of Commons and the rights of the people by evasions of the constitution. Accordingly it was resolved to demand from him a formal concession of those rights and privileges, in particular, which he had violated and to refuse a grant of supplies until his consent had been given. These rights were embodied in a statute, but the document is popularly known as the Petition of Rights from the fact that the grievances of the Commons were presented in the form of a petition. When the petition was presented to the king for his approval he quibbled and hesitated and finally answered in a general way "that right should be done according to the laws and customs of the realm and that the statutes should be executed that his subjects may have no cause to complain of any wrong or opposition to their rights and liberties." But the Commons refused to be satisfied with an answer so vague and indeterminate and prepared a remonstrance. Finally the king yielded and gave his assent in a manner acceptable to the Commons on 7 June 1628. The petition after reciting various statutes recognizing the rights contended for, declared that forced loans, benevolences, gifts, etc., should no longer be demanded by the king without the consent of Parliament; that soldiers should not be billeted upon the citizens without payment; that no freeman should be imprisoned except by the law of the land; and that martial law should not be proclaimed in time of peace.

**Petöfi**, pětè-fĩ, **Sandor (Alexander)**, Hungarian poet: b. Kis-Körös, comitat of Pest; d. near Schässburg 31 July 1849. He was a common soldier for some two years and for a time a subordinate member of a troop of strolling players. His first published collection of verse (1844) established his national fame as a poet. He was less fortunate as a novelist. In March 1848 he came forward at the head of the youth of Pest with the celebrated 12 national requisitions, and made the revolutionary cause triumphant for the time. His spirited lyric 'Talpra, Magyar' ('Up, Magyar') was everywhere sung, and was the first of a series of patriotic verses. In 1848 he joined the Honved, and served with distinction under Bem. He perished in the battle of Schässburg, though doubts were long entertained as to his being really dead. He banished false rhetoric from Hungarian poetry, and much of his own work attained a true folk-character. There are renderings into English by Sir John Bowring (1866); Loew in 'Gems from Petöfi and other Hungarian Poets' (1881); and Phillips (1885). A critical edition of his works was published in 1894. Consult biographies in Magyar by Zilahy (1864), and Vutkovics (1883); Bubenik, 'A Petöfi, eine Skizze seines Lebens und Dichtens' (1882); Fischer, 'Petöfis Leben und Werke' (1889).

**Petong'**. See PACKFONG.

**Petoskey**, pētōs'kĩ, Mich., city in Emmet County; on the south shore of Little Traverse Bay, an inlet of Lake Michigan, and on the Pere Marquette and the Grand Rapids & I. R.R.'s; about 200 miles south of Grand Rapids and 35 miles south of Mackinac. It has steamer connections with the lake ports. It was settled in 1874 by white traders and missionaries; incorporated in 1879, and chartered as a city in 1895. It is in a lumber region, but the surrounding cleared land has been converted into productive farms. The chief manufacturing establishments are lumber works, leather works, which employ about 150 persons; fibre and paper mills, 125 persons; wooden-ware works, 75; lime works, 110; other industries about 200 more. The delightful summer climate attracts thousands of visitors which necessitates extensive hotel accommodations and the employment of many persons during the season. It has the Lockwood Hospital, nine churches, public and parish schools, and a public library. The two banks have a combined capital of \$160,000; and the annual amount of business is over \$1,000,000. The government is vested in a mayor and a board of public works, a council of eight members, who hold office two years. The population is composed of a majority American born, a number of Germans, a few Armenians, Indians, Hungarians, and Poles. Pop. (1890) 2,872; (1900) 5,285.

E. R. GOLDSMITH,  
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**Petra**, pē'tra, in Aramaic, called Reqem, and in Hebrew Sela, a ruined Nabataean city of northern Arabia, in the heart of Arabia Petræa, to which it gave that name. Its great importance was as trading place and station on the caravan route between Syria and Arabia up to the 4th century A.D. Soon after it declined and the site was unknown until 1812 when Burckhardt discovered it in the Wadi Musa. Since that time rock-tombs, a great "treasure house," an amphitheatre, convent, citadel, and palace have been found, mostly of late Greek architecture, but with evidence of Egyptian and Oriental influences as well. The city was captured by Amaziah of Judah in the 9th century B.C.; became the property of the Nabataeans in the 3d (or 2d) century B.C., was made tributary to Rome in the 1st century B.C., and in the 2d century A.D. became capital of a Roman province, Arabia Petræa. It was a Christian bishopric during its last years. Consult: Palmer, 'The Desert of the Exodus' (1871); Duc de Luynes, 'Voyage d'Exploration à la Mer Morte, à Pétrée, etc.' (1875); and Buhl, 'Geschichte der Edomiter' (1893).

**Petrarch**, pē'trärk (Italian, PETRARCA, pät-rär'kä), **Francesco**, Italian lyric poet and scholar; b. Arezzo 20 July 1304; d. Arquà, near Padua, 18 July 1374. He studied law at Montpellier 1319-23, and at Bologna 1323-5. His own inclinations, however, led him to study the Latin and Provençal poets in preference to law and scholastic divinity. He returned to Avignon, where his talent for Latin poetry commended him to the court of Pope John XXII., and took minor orders in the Church. It was at this time that he first saw in the church of St. Claire (1327) the Laura



## PETREL

who exercised so great an influence on his future life, and dictated to him his most famous works. The identity of this personage, and whether she was a real or ideal one, has been much disputed. Pope Benedict XII. conferred on Petrarch a canonry at Lombez (1335). In 1336 he embarked at Marseilles for Rome, the antiquities of which he visited with an enthusiasm which he has recorded in his poems. In 1337 he returned to Avignon, and bought a small estate at Vaucluse. He remained here for three years, and wrote numerous sonnets which acquired popularity even before the earlier and longer work of Dante (still in manuscript), and served to fix the Italian language. These were, however, only his recreation. He rested his hopes of fame on his Latin scholarship. Virgil, Cicero, and Livy were his favorite authors, but he was a diligent explorer of the monasteries for old manuscripts of all the Latin classics (he did not learn Greek till comparatively late in life), which he transcribed with his own hand, and diffused as much as possible, while he formed a precious collection of his own. In his travels he made valuable discoveries, which have placed his name high among the restorers of letters. He had advanced views for his age of history and science, despising legends and astrology, and recommending true research. In politics his views were equally advanced. In religious matters he had no sympathy with the skepticism common among the scholars of his day. His Latin works, both in prose and verse, were highly esteemed, and in 1341 he was called to Rome to receive on Easter-day (8 April), the crown of laureate of the civilized world, awarded him for his Latin epic, 'Africa,' a work of real eloquence. He was subsequently charged with various diplomatic missions, and in 1342 appointed joint ambassador with Rienzi to Clement VI. to solicit his return to Rome. He praised the enterprise of Rienzi (1347) in a Latin epistle, and went to Rome, though too late, to support him. At one time he thought of shutting himself up in a monastery, and determined to live more in accordance with his ecclesiastical profession. His great popularity, however, caused him to be employed in many important diplomatic negotiations. He was consulted by the pope and the emperor. In 1354 he negotiated a peace between the republics of Genoa and Venice in the name of Giovanni Visconti of Milan. From this time, with the exception of embassies to France and Germany, he lived entirely in Italy, and until 1376 chiefly at Milan, Padua, and Venice, to the last of which he presented his library. In 1370 he took up his residence at Arquà, near Padua, where he passed his remaining years in religious exercises. He had two natural children by an Avignon lady—a son who died before his father, and a daughter who married Francesco de Brossano, a Milanese gentleman who became his executor. Petrarca left no works in Italian prose. Among his Latin works are three books of 'Epistles' ('Epistolæ Familiares') and 12 'Eclogues,' his poem 'Africa,' various philosophical, religious, political, and historical treatises, as 'De Officio et Virtutibus Imperatoris'; 'De Vera Sapientia'; 'De Contemptu Mundi'; 'Itinerarium Syriacum' (a geographical work); and 'Epitome Vitarum Virorum Illustrium.' His Italian poems consist of 'Sonetti' and 'Can-

zoni in Vita e in Morte di Laura,' and of 'Trionfi.' The first edition is dated Venice, 1470. The subsequent editions are innumerable. They may be found translated into English by various hands. The 'Trionfi' are in *terza rima*. Despite their refinement and delicacy of sentiment and purity of language, the sonnets of Petrarch are somewhat dull and monotonous. They are also filled, according to the taste of the age, with conceits, artificial refinements of sentiment, and plays upon words. Petrarch's learning was very great, and, for his time, critical. He despised the vulgar tongue of Italy, but as the champion of national unity wrote in that tongue such celebrated patriotic poems as the canzone 'Spirito Gentil.' As a writer of Latin he ranks among the best of modern times. He is placed by suffrage of the Italians as among their poets second to Dante only. Consult: Lord Woodhouselee, 'An Historical and Critical Essay on the Life of Petrarch' (1810); Campbell, 'Life and Times of Petrarch' (1841); Mézières, 'Pétrarque' (1867; new ed. 1896); Koerting, 'Petrarcas Leben und Werke' (1878); Symonds, 'The Renaissance in Italy' (1877-81); Robinson and Rolfe, 'Petrarch, the First Modern Scholar' (1898).

**Petrel**, any of the smaller species of a group of oceanic birds allied to the albatrosses, characterized by webbed feet and tubular nostrils. In the albatrosses the tubular nostrils of the two sides are quite distinct, while the fulmers, shearwaters, and petrels proper have them united to each other and to the base of the bill, and are therefore placed in a distinct family, the *Procellariidæ*. Most of them also have the hallux much better developed than have the albatrosses. The wings are long and pointed, the tail short but of various shapes, and usually with 14 or 16 quill-feathers. Owing to its compactness and oiliness the plumage is extremely resistant to water. The feet are small and completely webbed in front. The fulmers and shearwaters are relatively large birds, the petrels proper of small size and distinguished by the prominence of the nasal tube and the more or less hooked beak. Except during the breeding season the petrels never voluntarily come on land, and seldom even approach the shores, but remain out at sea even during the most severe storms. Sailors call the smaller ones Mother Carey's chickens. Probably 75 species are known, many of which have a wide range. They feed on small marine animals and on almost any kind of food-refuse cast overboard from ships, and appear exceedingly fond of fat or grease, for which, and for other edibles, they will follow in the wake of vessels for great distances, and often collect in great numbers where food is plentiful. When irritated they vomit an oily fluid.

These birds breed in large communities in localities adjoining the sea, forming their nests in burrows or cavities; the female lays one egg. They are not often seen near shore in the daytime, remaining hidden in the nest and going abroad for food at night. They fly rapidly, and generally close to the water; and when in pursuit of food they suspend themselves by extending their wings, and appear to run on the surface of the water. It is from this circumstance that they are called petrels, after the



apostle Peter, who walked on the water. The appearance of these birds is considered by seamen to presage a storm—hence the common name of a familiar species known as the “stormy petrel”—and it is thought peculiarly unlucky to kill one of them. Owing to their wandering habits most of the species are likely to occur occasionally in North American waters, where fully 15 species of true petrels, besides as many more shearwaters and fulmers, have been actually recorded. The best-known on the North Atlantic coast is Leach’s petrel (*Cymochorea leucorrhoa*), a pretty little bird in black with a white rump, which skims the waves with the most marvelous skill and seems never to tire. It is barely six inches long and one of the smallest of water birds. Wilson’s stormy petrel (*Oceanites oceanicus*) is one of several petrels characterized by their long plover-like legs. It is one of the most widely dispersed and commonest species on the high seas. Consult: Baird, Brewer, and Ridgway, ‘North American Water Birds’ (Boston 1884); and Salvin, ‘Challenger Reports,’ Vol. II. (London 1881).

**Petrie, pē'tre, William Matthew Flinders,** English Egyptologist, grandson of Matthew Flinders (q.v.), the Australian explorer: b. Charlton 3 June 1853. He received a private education, and in 1875–80 devoted his attention to British archæology, the results appearing in the works, ‘Inductive Metrology, or the Recovery of Ancient Measures from the Monuments’ (1877); and ‘Stonehenge: Plans, Description, and Theories’ (1880). He then went to Egypt, making a careful survey of the Pyramids of Gizeh, of which he published an account in ‘The Pyramids and Temples of Gizeh’ (1883). He continued his work in Egypt under the auspices of the Egypt Exploration Fund Committee (1884–6); excavated the site of Tanis, and discovered and excavated Naukratis, Am. and Daphnæ, his results being published in ‘Tanis’ (1885–7), ‘Naukratis’ (1886). He has continued his explorations of ancient sites, his excavations forming the theme of the works, ‘Hawara’ (1889); ‘Tell el-Amarna’ (1895); ‘Koptos’ (1896); ‘Denderah’ (1900); ‘Diospolis’ (1901); and ‘Royal Tombs of the Earliest Dynasties’ (1901); etc. Among other publications are: ‘A Season in Egypt’ (1888); ‘Racial Portraits’ (1888); ‘Historical Scarabs’ (1889); ‘Ten Years’ Digging in Egypt’ (1893); ‘A History of Ancient Egypt’ (1894); ‘Egyptian Tales’ (1895); ‘Egyptian Decorative Art’ (1895); ‘Religion and Conscience in Ancient Egypt’ (1898); ‘Syria and Egypt’ (1898). Since 1892 he has been professor of Egyptology in University College, London.

**Petrobru'sian,** a follower of Pierre de Bruys, who in Languedoc, during the 12th century, founded a sect of religious extremists. His tenets included the advocacy of adult baptism, the abolition of church buildings; the disuse of crosses as objects to be set up and venerated; and a denial of the Real Presence in the Eucharist, whose elements were, he said, mere symbols. For 20 years his doctrines were propagated with fiery zeal, and the number of his followers in southern France rapidly increased. Peter, abbot of Cluny, wrote a treatise to refute him, and he incurred the anger of the people by the demolition of altars and churches,

and in 1126 was burnt to death by the mob at Saint Giles, near Nîmes.

**Petrography,** the science which deals with the description of rocks. In modern methods the microscope and chemical analyses play a conspicuous part. Strictly considered, petrography confines itself to the study of the rock specimen *per se*, while the study of the field relations, and of the origin of the rock, falls more properly under the science of petrology. The two are, however, often used synonymously. Another more obsolete term is lithology.

**Petro'leum,** the general name given to an oily liquid found in different parts of the earth, a mixture of hydrocarbons, chiefly belonging to the marsh-gas ( $\text{CH}_4$ ) series. (See BITUMEN.) Petroleum is found in almost all localities where bitumen exists in quantity in the rocks. Attention appears to have been first directed to it by the successful manufacture and sale of paraffin and paraffin oil in Great Britain derived from shale. (See PARAFFIN.) In the United States petroleum is produced chiefly by Pennsylvania, New York, Ohio, West Virginia, Colorado, California, and Indiana. See PETROLEUM INDUSTRY, THE.

**Petroleum.** Petroleum, in some of its forms, has been known and used by mankind in various parts of the world from time immemorial, but its history as an important commercial product extends over a period of less than 50 years. The word is derived from the Latin “petro,” a rock, and “oleum,” oil, and literally means “rock oil.” It is also known in some parts of the world in its crude state as naphtha, which comes from the Persian “nafata.” As used in the United States and England, the term naphtha is applied only to one of the lighter products, which are given off in the process of distillation. In Germany petroleum is known as “erdoel,” or earth oil, and “steinoel,” stone oil; the French and Italian equivalent is “petrole.” All these terms are embodied under the general one, “mineral oil,” which clearly distinguishes it from other oils of an animal and vegetable nature. There are semi-liquid and solid varieties of petroleum, known as asphalt, bitumen, and maltha. These vary in weight in the natural state from 50° Baume, or .7841 specific gravity, to 10° Baume, or water equal to 1.0, and in some instances are heavier than water. Petroleum ranges in color from a water white transparency to jet black, but the most common variety is dark green, which by reflected light is shown to have a brownish yellow tinge. It is a highly inflammable substance and its chief constituents are carbon and hydrogen with varying quantities of oxygen and nitrogen. Some varieties are also impregnated with or combined with sulphur. This is more especially true of petroleum that has an asphalt base.

*Origin of Petroleum.*—Numerous theories have been advanced to account for the existence of petroleum, but no complete and entirely satisfactory solution of the problem has yet been presented. For many years it has been claimed by the geologists that petroleum was formed in the rocks by the decomposition of animal and vegetable matters. Of late, many scientists have supported the idea that the formation of petroleum was due to the natural distillation of shales and hydrocarbons, found in the earth’s



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crust, by internal heat. Its chemical origin from inorganic matter appears the more probable, since it has been discovered in some of the lower geological formations, of an age when animal and vegetable life was not superabundant. It has been manufactured for years from the artificial distillation of shales in various parts of the world and scientists have been able to produce a substance closely resembling it in every way by purely chemical means. It has also been made artificially by the destructive distillation of animal and vegetable matter.

*Early Uses of Petroleum.*—The use of petroleum, in its semi-liquid and solid forms, was common among the ancient nations of the east. The "slime" noted in the Old Testament, as employed in the construction of the Tower of Babel, was, without doubt, partially evaporated petroleum. The ruins of Nineveh and Babylon reveal its use as a bond in cementing structures of brick at least 2000 B.C. Herodotus, the Greek historian, mentions the oil springs on the island of Zante and the asphaltic deposits, which were carried down by the river Is and collected by the ancient Babylonians. Bitumen was an article of commerce in the region of the Dead Sea and was transported into Egypt and sold for embalming purposes centuries before the time of Christ. "Sicilian Oil," obtained from natural springs near Agrigentum, on the island of Sicily, was burned in the lamps of the Temple of Jupiter about the beginning of the Christian Era. This is the earliest record of petroleum being used for illuminating purposes. A Roman general built a bridge across the Danube about the year 100 A.D., near the city of Severance. The piers were of brick, cemented with bitumen. Two of these ancient piers remain to this day on the banks of the Danube, in which the outer layers of brick have crumbled away, leaving the black pitchy matter protruding. Historical references to the early knowledge and use of petroleum in Galicia, Persia, India, China, and Japan are very numerous. The "holy fire" from the naptha and natural gas springs of the Apsheron peninsula, on the borders of the Caspian Sea, has been known and worshipped by certain sects among the Persians for from 2,500 to 3,000 years.

On the western continent, this important mineral product was known to the aborigines centuries before the discovery by Columbus. The presence of pits, excavated for the purpose of collecting oil, along the waters of Oil Creek and French Creek, bear witness to this fact. Many of these were from six to eight feet square and varied in depth from four to twelve feet.

They were lined with heavy timbers and were always to be found in the valleys and along streams where natural seeps of petroleum existed. They were not constructed by the Senecas or other Indian tribes that occupied the territory, when the first white men appeared in America. They were, doubtless, the work of the same race of people who developed the copper deposits of Lake Superior, the lead ores of Lexington, Ky., and built the great mounds in Ohio and other of our Western States.

The earliest mention of petroleum in the United States was in 1627 by a French missionary, who described the famous petroleum spring near Cuba, in western New York State. The

first mention of petroleum in Pennsylvania was by a Moravian missionary, who visited the region in 1767 and described the petroleum bubbling up in springs and from the beds of creeks, accompanied by natural gas. Many subsequent travelers, who penetrated the almost unbroken wilderness in after years in southwestern New York, northwestern Pennsylvania, and southeastern Ohio, mention the existence of petroleum and natural gas. These explorers were guided to these localities by the Indians, who usually collected sufficient petroleum from the surface of the streams for a fire. This phenomena was regarded by them with religious awe and superstition.

The artesian well driller, in search of salt brine in subsequent years, demonstrated the existence of petroleum in greater or less quantities, accompanied by natural gas, both of which were considered a source of annoyance and danger, over a large area in the Ohio Valley, reaching from Freeport, on the Allegheny River in Pennsylvania, to Burkesville, in southeastern Kentucky, and from the waters of Duck Creek, in Washington County, Ohio, to a few miles above Charleston, on the Big Kanawha, in West Virginia. The last named locality has the distinction of containing the pioneer salt brine well of the United States, which was drilled by the Ruffner Brothers in 1808. They employed the most primitive appliances, but successfully cased off the weaker salt brine, adopting methods that are now employed in sinking deep artesian wells of every kind. About the year 1810 the first salt wells were drilled at Tarentum, Pa., followed by those on the Big Sandy, on the borders of Kentucky, which also produced considerable petroleum and natural gas associated with the salt brine.

About the year 1829 a well was drilled for salt near Burkesville, in Cumberland County, Kentucky, which struck a great reservoir of petroleum; the oil flowed into the Cumberland River nearby, caught fire and produced a conflagration on the surface of the river for nearly fifty miles. For a number of years after, this well continued to flow, and a portion of the product was bottled up and marketed under the title of American Medical Oil, Burkesville, Ky.

From the year 1848 to 1856 Mr. Samuel Kier, of Pittsburg, Pa., bottled the petroleum produced from the salt wells at Tarentum and sold quantities of it for medicine under the name of Seneca Oil, which name has been given it from the oil produced by the celebrated spring near Cuba, N. Y., whose product was also sold for medicinal purposes.

A portion of the petroleum from these wells was used in its crude state for illumination, but, because of the smoke and offensive odor, it was unfit for burning indoors. Mr. Kier, of Pittsburg, Pa., also made a number of experiments and succeeded in manufacturing an illuminating oil, but, owing to the crude and imperfect methods employed and the faulty character of the lamps, it did not become popular as a source of artificial light. In the meanwhile other minds were at work on the problem of supplying the world with a cheap, safe, and efficient illuminant, to take the place of the beeswax and tallow candle and the greasy whale oil lamp, which were then the common sources of artificial light in general use. The decline in the whale



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oil industry, owing to the growing scarcity of the animals in the high seas, threatened the total extinction of the supply of sperm or whale oil.

*The Shale Oil Industry.*—To meet the emergency, manufacturers turned their attention to the shale oil industry, which had already made considerable progress in Scotland and some other parts of Europe. By distillation, it was found possible to extract a rich paraffin oil from the bituminous coal shales and out of this was manufactured a very fair grade of illuminating oil. The first patent for refining coal oil (as it was called) was granted to James Young, of Manchester, England, in 1850.

The same process was patented in the United States in 1852. Dr. Abraham Gessner patented his illuminating oil, which he called "kerosene," and was obtained from the same sources in 1854. By 1859, the shale oil industry had made considerable progress and there were nearly 60 establishments engaged in its manufacture. It was the progress made by this industry that paved the way for the almost instant success of refining crude petroleum. But the discovery of the latter in commercial quantities at Col. Drake's experimental well in 1859 rendered the laborious process of obtaining a crude distillate from the shale rocks no longer necessary and speedily brought about the abandonment of the shale refineries. A number of them immediately took up the new discovery and adapted their works to the manufacture of illuminating oil from the crude product that they secured from the Pennsylvania oil regions. Between 1853 and 1860 four large distilling plants for the manufacture of shale oil were erected on the Allegheny River, near Freeport, Pa., eight miles above Tarentum. A number of factories were established along the New England coast, which used the boghead coal, obtained in Scotland, for distilling purposes. Albertite, from Nova Scotia, was employed in some Maine establishments, and several manufactories were erected in the interior for distilling oil from the Breckenridge cannel coal, obtained in Kentucky and the Grahamite deposit of West Virginia. The principal points of manufacture were at Canfield, Ohio; Ritchie Mines and Peytonia, W. Va., and Cloversport and Maysville in Kentucky.

*Distribution of Petroleum.*—The United States leads the world in the production of petroleum as well as in the manufacture of refined oil. For several years it was surpassed in the production of an inferior crude oil by Russia, but recent discoveries of enormous supplies in southeastern Texas and Kansas, together with the rapid development of the California oil fields, have placed the United States once more in the first rank of oil-producing countries. Besides the United States and Russia, petroleum is obtained in commercial quantities in Rumania, Galicia, Germany, and Italy in Europe, Borneo, Java, and Sumatra in the Dutch East Indies, India and Japan in Asia, Argentina and Peru in South America. Its presence is known in several other parts of the world, but in most instances it has not yet been produced in large quantities and if it has any market at all, it is solely a local one.

*Petroleum in the United States.*—For years the world was almost entirely dependent upon the oil fields of Pennsylvania for its supply of

illuminating oil and the American product dominated the markets of the world. The developments gradually extended to the northeast and southwest, taking in several counties in the lower part of New York and covering large areas of territory in West Virginia and southeastern Ohio. Then followed the discovery of oil in the Trenton limestone formations of northwestern Ohio and Indiana. Up to the year 1901 almost the entire production of the United States came from five States east of the Mississippi, namely, New York, Pennsylvania, West Virginia, Ohio, and Indiana. In 1901 the wonderful asphalt petroleum fields in Texas were opened up, and California and Kansas came into prominence as producing sections. At the present time, the production of the Western States surpasses that of the Eastern, and while the territory producing Pennsylvania oil appears to be on the decline, there are immense fields west of the Mississippi yet to be defined. During the past two years Louisiana has come to the front as an oil-producing State, while Kentucky, Tennessee, Colorado and Wyoming, for many years, have been noted for their deposits of crude petroleum. Its existence has also been demonstrated in Michigan, Illinois, Utah, Missouri, and Alaska, although actual developments thus far have not proved entirely satisfactory.

*The Drake Discovery.*—Previous to 1858, nothing had been accomplished towards establishing the fact that petroleum existed in almost inexhaustible quantities and that large supplies could be obtained by simply drilling wells into the rocky structure of the earth. The natural petroleum had been analyzed by eminent chemists, its properties as an illuminant had been pretty well established and in a small way it had become an article of commercial exchange. Its production, however, was confined to collecting it by various crude and imperfect methods from the oil springs and streams that bore petroleum on their waters, in various parts of the country. It was obtained in considerable quantities from the salt wells of Tarentum, Pa., and the lower Allegheny valley and it was gradually finding a market in Pittsburg and New York for various purposes. On March 4, 1858, nine barrels of oil from Tarentum were shipped to the Kerosene Oil Company at New York city and sold for \$275.19. From such small beginnings rose an industry that was to revolutionize the methods of artificial lighting then in general use and add millions of dollars to the general wealth of this country.

The Pennsylvania Rock Oil Company, the first of its kind, was organized in New York in December 1854 by George H. Bissell and Jonathan D. Eveleth. They were prosperous New York attorneys, who had become interested in petroleum, and had secured some land on Oil Creek from Brewer, Watson & Co., a firm of lumbermen operating a lumber mill below Titusville, Pa. Their first idea was to collect the oil from the surface springs and they hoped by systematic work to secure it in sufficient quantities to market it in the East. Prof. Benjamin Silliman, Jr., of New Haven, Conn., had made an exhaustive analysis of the samples of oil submitted to him by Messrs. Eveleth and Bissell, and his report confirmed their highest expectations as to the value of the product. The



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efforts of the company to obtain petroleum by such primitive methods proved far from successful and another company was formed in Connecticut for the same purposes. It took over the property of the New York concern, and later on was succeeded by the Seneca Oil Company, in which Col. E. L. Drake of New Haven became interested. Drake was sent to Titusville, Pa., in 1858, and shortly after commenced preparation for drilling an artesian well in order to tap the hidden sources of the oil supply in the underlying rocks. He encountered many trials and difficulties, his partners lost faith in the enterprise and he was compelled to strain his own resources to the utmost in order to continue the project. His persistency was rewarded and on 28 Aug. 1859, the first oil well in the United States began producing at a depth of 69½ feet. The oil rose to within 10 feet of the surface and when the well was equipped for pumping, it produced for a short time about 40 barrels a day. The product sold readily at 50 cents a gallon or about \$20 a barrel. The news of the wonderful discovery spread over the country and created the greatest excitement. The production of the Drake well during the last four months of 1859 and the first four months of its existence is estimated at 2,000 barrels. Another well was completed near Rouseville, farther down Oil Creek, in December 1859, which pumped about eight barrels a day.

Hundreds of wells were then started in the Oil Creek valley and up and down the Allegheny River and the rush to engage in the new industry resembled greatly the excitement that followed the discovery of gold in California in 1849. Oil was found the following year at Tidionte, Henry's Bend, Franklin, and Smith's Ferry, Pa., and the production for the year 1860 amounted to over 500,000 barrels. Most of these wells were drilled only to the first sand, as the upper producing formation of the Venango group, as it is commonly termed, and dry holes were numerous in territory that in after years proved highly productive from the deeper sands.

In 1861 the first flowing well was struck on the Funk farm, near Rouseville, Pa. It was 400 feet in depth and the oil was obtained in the third sand. This well was followed by others that spouted from 2,000 to 3,000 barrels a day. The market was overstocked and prices went down to the lowest point known in the history of the oil industry. The estimated production for 1861 was 2,113,609 barrels, but thousands of barrels flowed upon the ground and were carried away by the waters of Oil Creek and the Allegheny River.

The oil developments, which were at first confined to the lowlands along the valleys of Oil Creek, French Creek, and the Allegheny River, were rapidly extended in all directions, and test wells in search of the hitherto little known product were drilled miles away from the original strike. An era of oil stock companies ensued, which came to an end in 1866-7 after causing heavy losses to the people of this country, amounting to many millions of dollars. The rise and fall of Pithole occurred during this period, which was almost duplicated a few years later in the history of Petroleum Centre. Both were flourishing towns in Venango County, Pa., but the exhaustion of their big wells and the re-

moval of their population to fresh centres of oil development caused their whole or partial abandonment. At present Pithole is nothing but a memory, while the name of Petroleum Centre is still preserved by a flag station on the Pennsylvania Railroad, between Oil City and Titusville, Pa.

From Venango County the oil developments were extended southward into Clarion, Butler, and Armstrong counties, and within 15 years after the Drake strike, production had risen to nearly 30,000 barrels a day. In December 1874, the initial well of the great Bradford oil field in Pennsylvania was opened up, but it was not until 1878 that the exodus of lower country operators to the prolific districts of the Northeast began in real earnest. For three years this new district, which covered over 100,000 acres, extending from Cattaraugus County, in New York State, through the central portion of McKean County, Pa., was the centre of an unparalleled activity. New wells were drilled and production increased at a rapid rate, beyond the ability of the pipe line companies to take care of the oil. In July 1880 the production of the Bradford field reached 100,000 barrels a day, but not more than 80,000 barrels were run into the storage tanks of the transportation companies. The remainder ran to waste. The same year the developments in Allegany County, in New York State, began to attract attention, and it likewise proved a very rich and prolific source of oil production. Stocks were steadily increasing during this time and prices going down, but there was no cessation of drilling operations. Bradford and Allegany were followed by the discovery of the Cherry Grove district in Warren County, Pa., which came into prominence during the summer of 1882. It furnished a number of spouting wells, such as the oil country had not known since the development of the fourth sand belt in Butler County, about 10 years previous. The pool, however, was quickly drilled over and the "gushers" declined to pumping wells of small calibre. Cherry Grove was followed by Cooper and Balltown, both of which produced a large amount of petroleum and helped swell the constantly increasing stocks in the custody of the pipe lines. These three last named pools obtained their oil from white sand formations, similar to those of Venango and Butler counties, but they were found at a greater depth and of a different geological horizon. The Bradford and Allegany oil is found in a dark, chocolate-colored formation commonly known as the "black sand," to distinguish it from the white. These sands are all found below the regular Venango group, which was the first and only oil formation known to the early drillers and operators. With the advent of the Cherry Grove field in 1882, oil declined to less than 50 cents a barrel, and the steady accumulation of the stocks made the outlook very discouraging for the oil producers. By August 1884 the gross stocks had reached over 40,000,000 barrels, and its depressing influence upon prices of crude petroleum was freely admitted by every one. In 1884 another big white sand development was opened up in Washington County, Pa., and the attention of oil men was again attracted toward the Southwest. These developments were extended into West Virginia and southeastern Ohio, and for the past 15 years have proved the sources of the



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greater supply of high grade petroleum. In 1891 the phenomenal oil field at McDonald, in Allegheny and Washington counties, Pa., was opened up, and ran the production for that year up to the largest amount that had ever been recorded. Mannington and Sistersville, in West Virginia, were the next pools of importance, and they were followed by others in succession, all of which helped to maintain the supply.

For years the production of Pennsylvania oil had steadily exceeded the demand, stocks continued to accumulate, and prices ruled very low. In 1887 the market declined from an average of 71 cents in January to 59¼ cents in July. A movement among the oil producers was then started which resulted in the formation of the Producers' Protective Association, and an agreement was entered into to stop drilling new wells and shut in a third of the daily production. The object was to get rid of some of the surplus stocks and increase the price of oil at the wells. The movement proved a remarkable success. The net pipe line stocks at the close of July 1887 amounted to over 32,000,000 barrels, by the close of December 1888 had become reduced to 18,604,474 barrels. The production for the year 1888 showed a decline of over 5,000,000 barrels from that of the previous year. At the same time it was over 9,000,000 barrels less than the consumption, and the market value of the oil, which averaged 66⅔ cents per barrel in 1887, increased to 87 cents in 1888 and 94⅞ cents in 1889.

*Trenton Rock Oil Fields.*—For nearly 30 years Pennsylvania had maintained her position as the leading oil-producing State of the country, and during the first 10 years after Drake's discovery had been the source of the world's principal supply of illuminating oil. In 1885 oil was discovered in the Trenton rock at a well drilled for natural gas, near Lima, Ohio, which proved the beginning of the developments in northwestern Ohio and Indiana. This oil was of different quality from that produced in Pennsylvania and was impregnated with sulphur. It, however, had a paraffin base, but its value for illuminating purposes was not at once established. For many years it was marketed as a fuel oil, the supply being very much below the demand. When a process was found for converting it into an acceptable illuminant its market value was considerably enhanced. The production of northwestern Ohio, which amounted to 1,079,025 barrels in 1885, in 11 years increased to 20,575,138 barrels, and at the close of 1896 there was a surplus stock of over 25,000,000 barrels. Indiana came into prominence as an oil-producing State in 1891; its production is of the same general character as that of northwestern Ohio and comes from the same Trenton rock formation.

*West of the Mississippi.*—Oil has been known in California for many years, but it is only within the past five years that the developments have assumed large proportions. The production of California for 1904 exceeded 29,500,000 barrels, and it is now the foremost oil-producing State in the Union. The product is marketed chiefly for fuel purposes, and a considerable trade has been built up for it in the Hawaiian Islands, where it is used for fuel on the large sugar plantations. It is also employed to a large extent for fuel on the railroads of the Southwest

and for manufacturing purposes. This oil has an asphalt base, which is also true of the oils of Texas and Louisiana, and, although it makes a fair lubricating oil, the percentage of illuminating oil to be obtained from it is very small. It belongs to a newer geological period than the oil formations of the Eastern fields.

*Texas.*—Oil was discovered in Texas in 1867, and the first development was located about 15 miles south of Nacogdoches. About 100 wells were drilled and a pipe line built to the nearest railroad. This oil was of fair lubricating quality, but the yield was very small and the field quickly lapsed into disuse. In June 1894, in the process of drilling an artesian well for water near Corsicana, a good flow of oil was struck at a depth of 1,027 feet. The oil was cased off and the well continued down to 2,470 feet, when a good flow of warm water was encountered, but no more petroleum revealed itself. This was the beginning of the first successful oil development of any commercial importance in Texas. It was over two years later before outside capital was attracted to this district, which in 1897 was credited with a production of 65,975 barrels. In 1898 it produced 544,620 barrels and in 1899 668,443 barrels. The present yield of the field is about 500,000 barrels per annum, most of which is manufactured into illuminating oil. The great oil field in southeastern Texas was opened up in January 1901, when a well drilled on Spindletop, near Beaumont, in Jefferson County, started to flow at 70,000 barrels a day, and proved the forerunner of developments that soon placed the Lone Star State in the front rank of the oil-producing sections of the world. Like the California oil, this product has an asphalt base and is largely employed for fuel purposes, but a small amount of illuminating oil and a very fair quality of lubricating oil is manufactured from it. Texas produced about 22,000,000 barrels in 1904.

*Louisiana.*—Oil was discovered at Jennings, La., shortly after the opening of the prolific fields in southeastern Texas. The oil is of the same quality. As yet the Louisiana developments cover only a very small area, but the total production for 1904 reached 6,600,000 barrels, a large part of which was unsold at the close of 1904. Some of the largest wells known in this country at the present writing are found in Louisiana, and yet two years ago it was not considered of any importance at all as a factor in the world's supply of petroleum.

*Kansas, Indian Territory, and Oklahoma.*—For many years the oil territory in Kansas was confined to a small area in the vicinity of Neodesha, in Wilson County, where a small refinery was erected and connected with the wells by pipe lines. The developments were gradually pushed out, but it was not until 1903 that the great rush of development commenced. In 1904 wells were completed at the rate of 300 a month, and the production was increased at an enormous rate. The oil-producing territory has been enlarged, until a productive region 200 miles in length and 50 miles broad is now in prospective. At the present time this is the largest area of oil-producing territory known in the United States, and it bids fair to supply the country with petroleum for a long time to come and replace the declining production of the Eastern oil fields. In 1902 the production of the



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Kansas fields was 331,750 barrels, which was a gain of 82.5 per cent over the preceding year and the heaviest that had been known up to that time. In 1903 it increased to about 1,000,000 barrels, and in 1904 to 5,617,527 barrels. This enormous gain was not attended with any corresponding increase in consumption, and the pipe line company found it impossible to build storage tanks fast enough to accommodate the increasing surplus. A new refinery was erected near Kansas City and a pipe line built from that point to Neodesha. Another pipe line was also started to connect the field with the large refineries of the Standard Oil Company at Whiting, Ind. But at the close of 1904 the surplus stocks had increased to over 5,000,000 barrels, prices were declining, and the outlook for the future appeared rather discouraging.

*Colorado.*—The oil production of Colorado is confined to a small pool in the vicinity of Florence and another of still more limited dimensions at Boulder. The oil is of a dark green color and generally above 31° gravity Beaume. It is all refined at Florence, and is marketed in the Rocky Mountain States. The total production does not exceed 500,000 barrels per year.

*Wyoming.*—Wyoming has thus far produced only a small amount of heavy, dark petroleum, chiefly valuable for lubricating purposes. It commands a good price, but the yield is small and of little importance; the total output for any one year has never exceeded 12,000 barrels.

*Transportation of Petroleum.*—Oil from the Oil Creek valley was first transported down Oil Creek and the Allegheny River in flat-boats and barges to Pittsburg, where it found a market. It was also carried overland in wagons from Titusville to Union City and Garland, where it could be placed on railroad cars and sent to Eastern and Western points. A considerable portion was hauled to Shaws Landing and carried north by canal. Railroads were afterward built through the oil regions, and the tank car and the pipe line rapidly revolutionized the old methods of transportation. The first pipe line in the oil country was built from Pithole to Miller Farm, on the Oil Creek Railroad. It aroused the opposition of the teamsters, who saw in its successful operation the ruin of their occupation, and much rioting followed. The advent of the pipe line greatly decreased the cost of oil transportation and made the rapid development of the country possible. Now the entire production of the Eastern oil regions is handled by pipe line systems, which cover the oil country with a network of gathering lines that connect the small tanks of the producers with the large iron storage tanks of the pipe line companies. Trunk lines connect the tanks with the refineries at the seaboard and other petroleum-refining centres. The first seaboard pipe line was completed about 1879, and its route was from Olean, N. Y., through the southern part of New York State to Saddle River, N. J. At this point it was divided, one branch going to the Standard Oil Company's refineries at Hunter's Point, L. I., and another to Bayonne, N. J. The growth of the pipe line has been one of the most remarkable in connection with the development of the oil industry. The Transit Line to New York conveyed the petroleum of the great Bradford oil field to the

Eastern seaboard and supplied the markets of the world with American illuminating oil. The Tidewater Pipe Line, which antedated the New York Transit, did not succeed in reaching the Eastern coast until many years later. Its route was through Pennsylvania, from Bradford to Williamsport, where it halted and shipped the oil of the Bradford field in tank cars to New York and Philadelphia.

At the present time trunk lines convey the product of the Pennsylvania, West Virginia, New York, Ohio, Indiana, Kentucky, and Tennessee oil fields to New York, Philadelphia, Baltimore, Cleveland, Pittsburg, and Chicago. With the line now completed from Kansas City to Whiting, Ind., it is possible to pump oil through iron pipes from the remotest sections of the Kansas, Oklahoma, and Indian Territory oil fields to the Atlantic seaboard. Of the great trunk lines now in operation, the New York Transit extends from Olean to New York, the Southern Pipe Line from West Virginia to Philadelphia, while the Buckeye Pipe Line cares for the production of the Ohio and Indiana fields. The Tidewater Pipe Line Company transports oil from the Allegheny (N. Y.) and Bradford (Pa.) oil fields to the refineries at Bayonne and Philadelphia. The United States Pipe Line Company was the first to undertake the transportation of refined oil through pipe lines. It has a double line, one for conveying crude and the other refined oil. It receives its supply of crude oil from the Producers & Refiners Oil Company, a gathering line, which extends through northern Pennsylvania, into the oil fields of eastern Ohio and West Virginia. Its refined oil, which it ships to New York, is obtained from the refiners at Oil City, Titusville, Warren, and Bradford, Pa. There are a number of minor companies with lines that penetrate various sections of the Pennsylvania and Ohio oil regions. Pipe lines form an important part of the transportation system in Texas and California.

*Production of the United States.*—The total amount of oil produced in the United States in 1904 was 120,733,421 barrels. Of this nearly 64,570,000 barrels (53½ per cent) came from the comparatively new oil districts west of the Mississippi. The yield of the higher grade oil in the Eastern fields, which includes the production of nearly all the petroleum with a paraffin base, has remained remarkably uniform for a number of years past. The total yield of the Pennsylvania and Trenton rock oil fields in 1900 was 58,054,183 barrels; in 1901, 55,551,550 barrels; in 1902, 55,377,413 barrels; in 1903, 55,637,937 barrels; and in 1904, 56,097,751 barrels. Of the total production of petroleum in the Eastern fields, about 48 per cent is exported as illuminating oil, mineral crude, naphthas, lubricating and paraffin oil, and residuum. Little of the product of the sections west of the Mississippi is sent abroad. There is a considerable demand for California crude oil from our new possessions in the Pacific, but the amount of Texas oil shipped abroad from the Gulf ports was less than 500,000 barrels in 1904.

The following table shows the production of crude petroleum in this country and the value by years since the beginning, in 1859, to 1904, inclusive:



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QUANTITY AND VALUE OF PRODUCTION OF CRUDE PETROLEUM, 1859 TO 1904.

YEAR	Barrels (42 gallons)	Value
1859.....	2,000	\$ 30,000
1860.....	500,000	4,800,000
1861.....	2,113,609	1,035,668
1862.....	3,056,690	3,209,525
1863.....	2,611,309	8,225,623
1864.....	2,116,109	20,896,576
1865.....	2,497,700	16,459,843
1866.....	3,597,700	13,455,398
1867.....	3,347,300	8,066,993
1868.....	3,646,117	13,217,174
1869.....	4,215,000	23,730,450
1870.....	5,260,745	20,503,754
1871.....	5,205,234	22,591,180
1872.....	6,293,194	21,440,503
1873.....	9,893,786	18,100,464
1874.....	10,926,945	12,647,527
1875.....	12,162,514	11,863,133
1876.....	9,132,669	22,982,822
1877.....	13,350,363	31,788,566
1878.....	15,396,868	18,044,520
1879.....	19,914,146	17,210,708
1880.....	26,286,123	24,600,638
1881.....	27,661,238	23,512,051
1882.....	30,510,830	23,759,911
1883.....	23,449,633	25,740,252
1884.....	24,218,438	20,476,294
1885.....	21,858,785	19,193,694
1886.....	28,064,841	20,028,457
1887.....	28,283,483	18,856,606
1888.....	27,612,025	17,950,353
1889.....	35,163,513	26,963,340
1890.....	45,823,572	35,365,105
1891.....	54,292,655	30,526,553
1892.....	50,509,657	25,901,463
1893.....	48,431,066	28,932,326
1894.....	49,344,516	35,522,095
1895.....	52,892,276	57,691,279
1896.....	60,960,361	58,518,709
1897.....	60,475,516	40,929,611
1898.....	55,364,233	44,193,359
1899.....	57,070,850	64,603,904
1900.....	63,620,529	75,752,691
1901.....	69,389,194	66,417,335
1902.....	88,766,916	71,178,910
1903.....	100,461,337	94,694,050
1904.....	120,733,420	101,474,300
Total .....	1,386,485,005	\$1,363,083,713

The following tables give the rank and quantity of crude petroleum produced by each State for 1903 and 1904:

RANK AND QUANTITY PRODUCED IN 1903 AND 1904 BY STATES.

STATE 1903	Rank	Quantity (bbls.)
California .....	1	24,382,472
Ohio .....	2	20,480,286
Texas .....	3	17,955,572
West Virginia .....	4	12,899,395
Pennsylvania .....	5	11,355,156
Indiana .....	6	9,186,411
New York .....	7	1,162,978
Kansas .....	8	932,214
Louisiana .....	9	917,771
Kentucky } .....	10	554,286
Tennessee } .....		
Colorado .....	11	483,925
Indian Territory } .....	12	138,911
Oklahoma Territory } .....		
Wyoming .....	13	8,960
Michigan } .....	14	3,000
Missouri } .....		
Total .....		100,461,337

STATE 1904	Rank	Quantity (bbls.)
California .....	1	29,649,434
Texas .....	2	22,241,413
Ohio .....	3	18,876,631
West Virginia .....	4	12,644,686
Indiana .....	5	11,339,124
Pennsylvania .....	6	11,300,792
Louisiana .....	7	6,611,419
Kansas .....		
Indian Territory } .....	8	5,617,527
Oklahoma Territory } .....		
Kentucky } .....	9	998,284
Tennessee } .....		
New York.....	10	938,234
Colorado .....	11	501,763
Wyoming, etc.....	12	14,114
Total .....		120,733,421

WORLD'S PRODUCTION OF CRUDE PETROLEUM IN 1903 AND 1904.  
[Barrels of 42 United States gallons.]

COUNTRY	1903	1904
	bbls.	bbls.
United States .....	100,461,337	120,733,421
Canada .....	481,504	499,203
Peru .....	61,745	70,000
Russia .....	75,591,256	80,583,867
Galicia .....	5,234,475	5,914,000
Sumatra, Java, and Borneo.	6,640,000	7,273,260
Rumania .....	2,763,117	3,550,000
India .....	2,510,259	2,550,000
Japan .....	964,000	1,400,475
Germany .....	445,818	726,000
Italy and Algiers.....	20,000	35,000
All other countries.....	30,000	35,000
Total .....	195,203,511	223,370,226

*Petroleum and Its Products.*—The crude petroleum of the United States is largely converted into illuminating oil; the refined article is sold all over the world. Since 1864 it has been a common article of export, and at the present time stands fourth in respect to value of our products shipped abroad. The discovery of large deposits of inferior grades west of the Mississippi during late years has brought it into prominence as a fuel; it is a substitute for coal, being used extensively by the railroads and manufacturing in the Southwest and West. It likewise enters largely into the manufacture of lubricating oils of every grade, and its lighter products, such as the naphthas, benzines, etc., are employed to a great extent in running motors of small horse-power and for various purposes in the mechanical arts and sciences. Over 200 different products are now made from crude petroleum.

*Exports.*—Our production of crude petroleum has always been in excess of the home demand, and for many years over one half of the entire yield has been compelled to seek a market in foreign lands. Prior to the development of the Russian oil industry on the Caspian Sea on a large scale, American refined oil held almost undisputed sway in the markets of the world; latterly other countries have been competitors. Nearly all the oil shipped abroad is transported in bulk in tank steamers especially constructed for the purpose. Within the past dozen years a big



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fleet of these vessels has come into existence, and the ocean-carrying trade of oil in bulk has assumed vast proportions. These vessels are built of steel, and many of them use oil for fuel to furnish their steam-power. Their introduction has driven the old sailing vessels, which carried oil in barrels, almost entirely from the seas. By the old method, a sailing vessel carrying from 5,000 to 8,000 barrels of oil would only make three or four trips in a year. The modern type of tank steamer carries from 30,000 to 50,000 barrels of oil for a cargo, and can make 8 to 10 trips across the ocean and back in a year. There is also a large coast and lake trade in both refined and crude oil, which is carried in barges and tank steamers of enormous capacity. The change from barrel to bulk transportation means large economies in many ways. By the new method of transportation no time is wasted loading and unloading barrels; a steamer comes to the wharf, and the oil is quickly pumped from the refinery storage into her tanks, the largest ships being loaded in 10 or 15 hours. The record of petroleum and its products exported abroad since 1862, together with its value, is as follows, as reported by the United States Bureau of Statistics:

PETROLEUM EXPORTS AND VALUE FOR YEARS 1862 TO 1904.

YEAR	Exports	
	Gallons	Value
1862.....	2,664,280	\$ 1,598,568
1863.....	4,680,174	2,340,087
1864.....	23,210,369	10,782,689
1865.....	25,496,849	16,563,413
1866.....	50,987,341	24,830,887
1867.....	70,255,481	24,407,642
1868.....	79,456,888	21,810,676
1869.....	100,636,684	31,127,433
1870.....	113,735,294	32,668,960
1871.....	152,195,617	36,663,825
1872.....	144,318,707	33,761,685
1873.....	240,369,908	45,924,880
1874.....	235,108,168	33,042,276
1875.....	237,526,312	31,734,861
1876.....	263,449,455	49,545,219
1877.....	361,883,225	57,539,873
1878.....	349,346,253	41,022,007
1879.....	421,719,782	37,235,467
1880.....	346,779,443	34,505,645
1881.....	514,561,719	48,556,103
1882.....	503,492,462	44,623,074
1883.....	533,145,429	47,763,079
1884.....	544,495,608	49,457,116
1885.....	560,784,459	49,671,743
1886.....	591,884,302	48,145,204
1887.....	601,846,317	46,898,842
1888.....	572,457,975	48,105,703
1889.....	680,705,456	53,293,299
1890.....	693,829,848	52,270,953
1891.....	673,905,577	46,174,835
1892.....	744,638,463	42,729,157
1893.....	804,221,230	42,142,058
1894.....	908,252,314	41,499,806
1895.....	884,502,082	46,660,082
1896.....	890,458,994	62,383,403
1897.....	994,297,757	59,057,547
1898.....	986,480,610	52,551,048
1899.....	951,024,441	64,982,249
1900.....	975,123,476	73,276,282
1901.....	1,079,074,519	72,784,912
1902.....	1,064,233,601	68,597,143
1903.....	936,697,255	72,628,539
1904.....	1,022,116,276	80,624,207
Total .....	21,936,054,400	\$1,881,973,477

The above table includes crude, naphthas, illuminating, lubricating, and paraffin oils, and

residuum shipped abroad during the past 40 years. The aggregate amount of oil exported during this period was 21,936,054,400 gallons, valued at \$1,881,973,477.

The following table gives the annual exports of illuminating oils only, from 1 July 1863 to 30 June 1904:

YEAR ENDING JUNE 30	Gallons	YEAR ENDING JUNE 30	Gallons
1864 .....	12,791,518	1884 .....	415,615,693
1865 .....	12,722,005	1885 .....	458,243,192
1866 .....	34,255,921	1886 .....	469,471,451
1867 .....	62,686,657	1887 .....	480,845,811
1868 .....	67,909,961	1888 .....	456,487,221
1869 .....	84,403,492	1889 .....	502,257,455
1870 .....	97,902,505	1890 .....	523,295,090
1871 .....	132,608,955	1891 .....	571,119,805
1872 .....	122,539,575	1892 .....	564,896,658
1873 .....	158,102,414	1893 .....	642,239,816
1874 .....	217,220,504	1894 .....	730,368,626
1875 .....	191,551,933	1895 .....	714,859,144
1876 .....	204,814,673	1896 .....	697,346,150
1877 .....	262,441,844	1897 .....	761,367,900
1878 .....	289,214,541	1898 .....	806,096,250
1879 .....	331,586,442	1899 .....	713,353,600
1880 .....	367,325,823	1900 .....	710,002,700
1881 .....	332,283,045	1901 .....	769,487,250
1882 .....	488,213,033	1902 .....	842,829,070
1883 .....	419,821,081	1903 .....	699,807,201
		1904 .....	741,567,086

The average price per gallon of Pennsylvania crude petroleum at the wells, and the average price per gallon of refined petroleum of 70° F. Abel test, in barrels in New York, from 1861 to 1904, is shown in the following table:

YEAR	Cents per gallon		YEAR	Cents per gallon	
	Penna. Crude	Refined		Penna. Crude	Refined
1861.....	1 1-8	61 1-2	1883....	2 1-2	8
1862.....	2 1-2	36 3-8	1884....	2	8 1-8
1863.....	7 1-2	44 3-4	1885....	2 1-10	8
1864.....	19 1-4	65	1886....	1 7-10	7 1-8
1865.....	15 5-8	58 3-4	1887....	1 6-10	6 3-4
1866.....	8 7-8	42 1-4	1888....	2 1-10	7 1-2
1867.....	5 3-4	28 3-8	1889....	2 1-4	7 1-8
1868.....	8 5-8	29 1-2	1890....	2 1-10	7 3-8
1869.....	13 1-2	32 3-4	1891....	1 5-8	6 7-8
1870.....	9 1-4	26 3-8	1892....	1 3-10	6
1871.....	10 1-4	24 1-4	1893....	1 1-4	5 1-4
1872.....	8 3-4	23 5-8	1894....	2	5 1-5
1873.....	4 3-8	17 7-8	1895....	3 1-4	7 1-3
1874.....	2 3-4	13	1896....	2 3-4	7
1875.....	3 1-4	13	1897....	1 7-8	5 9-10
1876.....	6 1-8	19 1-8	1898....	2 1-8	6 1-3
1877.....	5 3-4	15 1-2	1899....	3 1-10	8
1878.....	2 7-8	10 3-4	1900....	3 1-4	8 1-2
1879.....	2	8 1-4	1901....	2 7-8	7 1-2
1880.....	2 1-4	9	1902....	3	7 1-3
1881.....	2	8	1903....	3 3-4	8 5-8
1882.....	1 7-8	7 3-8	1904....	3 7-8	8 1-4

In the above table, the cost of the barrel is included, which, during the past 20 years, has enhanced the price from 2.50 to 2.90 cents per gallon. The price of refined oil in bulk, loaded on tank steamers, can be obtained by subtracting 2½ to 3 cents a gallon from above averages.

*Lubricating Oil.*—The manufacture of lubricating oil in the United States has reached the highest degree of perfection. No other lubricating oil in the world is equal to that obtained from the paraffin petroleum of the Pennsylvania and West Virginia oil regions. Its reputation is in truth worldwide, and, besides the enormous amounts consumed by our own rail-



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roads and manufacturing plants of every kind, large quantities are shipped abroad. A very fair grade of lubricating oil is also obtained from the asphalt oils of Texas and California. In the following table the amount and value of our exports of lubricating oil since 1886 are reported:

YEAR	Lubricating (heavy paraffin, etc.)	
	Gallons	Value
1887.....	20,582,613	\$ 3,559,280
1888.....	24,510,437	4,215,449
1889.....	27,903,267	4,638,724
1890.....	32,090,537	4,766,850
1891.....	33,310,264	4,999,978
1892.....	34,026,855	5,130,643
1893.....	32,432,857	4,738,892
1894.....	40,190,577	5,449,000
1895.....	43,418,942	5,867,477
1896.....	50,525,530	6,556,775
1897.....	51,228,284	6,478,479
1898.....	63,968,341	7,385,054
1899.....	69,329,188	8,344,735
1900.....	68,997,715	9,542,618
1901.....	75,305,938	10,260,125
1902.....	82,200,503	10,872,154
1903.....	95,621,941	12,690,065
1904.....	89,688,123	12,393,382

*Petroleum Fuel.*—Petroleum that is to be transported and stored and used for fuel inside of buildings or steam vessels should not contain

of the gravity named has as high an evaporative test as the much lighter grades. The main condition requisite for good combustion is that the petroleum be completely atomized by a steam jet or by compressed air. The latter is preferable to the former, because it more easily produces complete combustion and it is more economical. To insure good results and secure good combustion, it is necessary in all cases to have the jet of oil spray on hot fire brick. Usually an arch is built over the grate bars to within 5 or 6 inches of the bottom of the boiler and parallel with it. About every fourth brick should be left out. Inside of this arch loose checkerwork of fire-brick should be placed, upon which the petroleum should spray, so that the fuel will come in contact first with the bricks and not with the cold sheet of the boiler, and only the necessary air to consume the petroleum should be admitted.

In actual practice, where the boilers are properly proportioned to their work, 1 pound of petroleum has evaporated 16 pounds of water into steam from and at 212° F., as compared to the evaporation of 10 pounds of water by 1 pound of good Pittsburg coal.

The following table shows the number of barrels of petroleum equal to one ton of the various coals, and the value of different coals per ton, as compared with petroleum at \$1 per barrel:

1 pound of combustible	Pounds of water evaporated at 212° per pound of combustible	Barrels of petroleum required to do the same amount of evaporation as ton of coal	Cost of coal per ton to equal petroleum at \$1 per barrel	Less 10 per cent, owing to the greater economy in handling petroleum
Petroleum, 18° to 40°.....	16.0	.....	.....	.....
Pittsburg lump and nut, Pennsylvania.....	10.3	4.1	\$4.10	\$3.69
Pittsburg nut and slack, Pennsylvania.....	8.0	3.2	3.20	2.88
Anthracite, Pennsylvania.....	9.8	3.9	3.90	3.51
Indiana block.....	9.5	3.8	3.80	3.42
Georges Creek lump, Maryland.....	10.0	4.0	4.00	3.60
New River, West Virginia.....	9.7	3.8	3.80	3.42
Pocahontas lump, Virginia.....	10.5	4.2	4.20	3.78
Cardiff lump, Wales.....	10.0	4.0	4.00	3.60
Cape Breton, Canada.....	9.2	3.7	3.70	3.33
Nanaimo, British Columbia.....	7.3	2.9	2.90	2.61
Co-operative, British Columbia.....	8.9	3.6	3.60	3.24
Greta, Washington.....	7.6	3.0	3.00	2.70
Carbon Hill, Washington.....	7.6	3.0	3.00	2.70

1 pound petroleum	= 16 pounds of water evaporated from and at 212° F.
1 pound coal	= 10 pounds of water evaporated from and at 212° F.
1 pound petroleum	= 1.6 pounds good coal.
( $\frac{2000}{16}$ )= 1,250 pounds petroleum	= 2,000 pounds coal.
312 pounds petroleum	= 1 barrel of petroleum.
( $\frac{1250}{312}$ )= 4 barrels petroleum	= 2,000 pounds coal.

any naptha or the lighter illuminating products usually found in it. Its gravity should usually be from 20° to 25° B., or close to 0.900 in specific gravity. A barrel of this gravity weighs 312 pounds. It should have a flash test from 180° to 230° F. Under these conditions it is safer to handle and the loss by evaporation is very slight. Tests have proved that petroleum

The cost per ton of coal compared to a barrel at other than \$1 per barrel can be found by substituting the price per barrel in the place of \$1, as used in the fourth column. Nearly all the crude petroleum and the distillates, when sold by the barrel, have nearly the same heating value.

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## PETRONIUS — PETTIGREW

**Petronius**, pe-trō'nī-ūs, **Gaius** (possibly Titus), Roman author, probably to be identified with the well-known favorite of Nero, at whose court he was *arbiter elegantiarum*. The influence thus gained by Petronius made him an object of dislike to the all-powerful Tigellinus. Accused of treason, he forestalled what he thought inevitable death by an eccentric suicide, opening his veins, but prolonging life for some time by the application of bandages (66 A.D.). Such is a brief résumé of the account by Tacitus in the 'Annales.' To this Petronius is generally assigned the book known as 'Satira' or 'Satiricon,' an incomplete work of picaresque fiction in prose and verse. The longest portion is the 'Banquet of Trimalchio' ('Cena Trimalchionis'), a satirical account of a dinner given by Trimalchio, a good-humored freedman and *nouveau riche*. The work is of interest from the fact that in the speech of many of the characters is preserved the *sermo plebeius*, or dialect of the lower classes, of which little remains. The best text is that of Bücheler (1862; smaller ed. 1895). There is an edition of the 'Cena,' with commentary, by Waters (1901); and an English translation of it, with introduction, by Peck (1898). Consult also Collignon, 'Etude sur Pétrone' (1892).

**Petropolis**, pāt-rō'pō-lēs, Brazil, capital city of the state of Rio Janeiro, and 30 miles by rail from the city of that name. Essentially a summer resort, it lies in the Serra d'Estrella, was built in 1845 and settled by a German colony who named it in honor of Dom Pedro. It has varied manufactures and a population in 1898 of about 12,000.

**Petrucchi**, pā-troo'chē, **Ottaviano dè** ("PETRUTIUS FOROSEMPRONENSIS"), Italian printer: b. Fossombrone, near Urbino, Italy, 1466; d. 1539. He invented the art of printing music by means of movable types, each note being cast complete with a staff line, and was granted sole right to its use for 20 years by the council of Venice. From 1498-1511 he prospered, but then attempted further experiments which proved so expensive that he was forced to sell his rights. He then secured rights for the Papal States for 15 years and established himself in business in his native town, but never achieved any considerable success there. The specimens remaining of his work are exceedingly neat and exact, and are both rare and valuable.

**Petruchio**, pē-troo'chō or -kī-ō, in Shakespeare's 'Taming of the Shrew,' the husband and subduer of Katherine, Baptista's high-tempered daughter, whom he treats with a mad turbulence even exceeding hers, in order "to kill her in her own humor." Under all his roughness he preserves his own good nature, and in the end the "taming" of Katherine is complete.

**Pettenkofer**, pēt'tēn-kō-fēr, **Max von**, German chemist: b. near Neuburg 3 Dec. 1818; d. 1901. He was graduated from the University of Munich in 1843 and in 1847 became professor of chemistry there. He was the earliest in Germany to give practical instruction in hygiene, which he began to do in 1866, and his name has since been associated with advances in that direction. He made many valuable contributions to science on subjects as various as

gold-refining, gas-making, ventilation, clothing, the influence of soils on health, epidemics,—his researches in regard to ventilation and cholera being of especial value. He was the first to demonstrate that cholera is propagated by a germ and that local conditions are largely responsible for the spread of the disease. He published 'Untersuchungen über die Verbreitungsart der Cholera' (1885); 'Ueber den Luftwechsel in Wohngebäuden' (1858); 'Populäre Vorträge'; 'Beziehungen der Luft zu Kleidung, Wohnung und Baden'; etc.

**Pettie**, pēt'ī, **John**, Scottish painter: b. Edinburgh 17 March 1839; d. Hastings 21 Feb. 1893. He exhibited for the first time in the Royal Scottish Academy 'The Prison Pet' (1859); went to London in 1862, and was elected Royal Academician 1875. His work as a historical painter was much admired and his pictures sold well. Of these may be mentioned, 'Disgrace of Wolsey' (1869); 'Juliet and Friar Laurence' (1874); 'Flag of Truce' (1873); 'Duke of Monmouth before James II.' (1882).

**Pettigrew**, pēt'ī-groo, **James Johnston**, American soldier: b. Tyrrell County, N. C., 4 July 1828; d. Bunker Hill, Va., 17 July 1863. He was graduated from the University of North Carolina in 1847, was professor in the naval observatory at Washington for a year when he resigned to study law in Charleston, S. C. He was admitted to the bar in 1849 and for a time acted as secretary of legation at Madrid, returning in 1852 to Charleston where he practised law with much success. In 1856 he was elected to the legislature and after the opening of the Civil War proved himself an able engineer in the construction of batteries and was appointed brigadier-general in the Confederate army in 1862. He defended Richmond against General Stoneman in 1863 and at the battle of Gettysburg led his brigade in Hill's corps against the Iron Brigade. He was in command of Heth's division on the third day and participated in the famous charge on Cemetery Ridge. In the retreat which followed the battle he was fatally wounded.

**Pettigrew**, **Richard Franklin**, American lawyer and political leader: b. Ludlow, Vt., 23 July 1848. He was educated at Beloit College, Wis., and at the law school of the University of Wisconsin. In 1869 he went to Dakota as surveyor in the United States service, and located at Sioux where he was engaged in surveying and real estate business, and after 1872 in the practice of law. He became prominent also in public life; was a member of the legislative council of Dakota 1877-81, represented the Territory in Congress in 1881-3, was a member of the Constitutional Convention in 1883, and of the Territorial Council in 1884-5. After the admission of South Dakota as a State, he was elected to the United States Senate on the Republican ticket, where he served from 1889 to 1901. In 1896 he left the Republican party on account of its opposition to the free coinage of silver, and its attitude toward the trusts, and in the elections of that year and of 1900 supported Bryan for the presidency. After the Spanish War he led the opposition in the senate against the annexation of the Philippine and the imperialistic policy.



## PETTY — PEWEE

**Petty**, pět'ī, **SIR William**, English political economist: b. Romsey, Hampshire, 26 May 1623; d. London, 16 Dec. 1687. He was educated at the Jesuit College at Caën, later studied at the universities of the Netherlands and at Paris. Returning to England he entered the Royal navy, but during the civil war lived on the Continent. In 1648 he was instructor in anatomy and chemistry at Oxford; in 1651 filled the chair of anatomy there, at the same time holding a professorship in music at Gresham College, London; and in 1652 he was appointed physician to the army in Ireland. He was secretary to Henry Cromwell when the latter was lord-lieutenant of Ireland, but upon the Restoration soon gained the confidence of Charles II., who appointed him surveyor-general of Ireland and knighted him. He was a founder of the Royal Society and one of the leading political economists of the day. He published: 'Political Anatomy of Ireland' (1672); 'Observations upon the Cities of London and Rome' (1687); 'Political Arithmetic' (1691); etc.

**Petty Sessions, Court of.** See COURT.

**Pettychaps.** See GARDEN WARBLER.

**Petunia**, a genus of viscid, straggling perennial herbs of the order *Solanaceæ*. The dozen or more species are mostly natives of southern South America, although one is Mexican and one, *P. parviflora*, has become naturalized in the Southern States. They have opposite leaves and showy, axillary blossoms of many colors, especially white and shades of purple in the numerous single and double flowered cultivated varieties and hybrids. The species which have been most used in the production of the modern garden petunias are *P. violacea*, which is probably not now in cultivation as a pure species, and *P. nyctaginalflora*, which may be found in some old gardens. The former has purplish-violet blossoms; the latter, white. Hybridization and selection have produced various tints of red and yellow.

**Peuerbach (Purbach or Peurbach), Georg von**, Austrian astronomer and mathematician: b. Peurbach 1423; d. 1461. He studied at Vienna and delivered astronomical lectures throughout Europe, later becoming professor of astronomy at the University of Vienna. He prepared a table of sines, which probably were the basis for the modern decimal fraction, but he died before it was done, and his pupil, Regiomontanus, completed it. He was also astronomer to the king of Hungary, and prepared for him a list of planets and the fixed stars.

**Peutinger's** (poit'ing-ērz) **Table**, a popular name for a map showing the military roads of the greater part of the kingdom of the Visigoths, drawn, it was formerly believed, for Theodosius the Great. It is so called after Conrad Peutinger, a German scholar (1465-1547). Among his papers was this famous map. Conrad Celtes, who found it in the Benedictine monastery of Tegernsee, borrowed and did not return it. Such a *mapa mundi in rotulo* was extant in that convent in 1502. Celtes gave this map to Peutinger, who intended to publish it. After his death it disappeared for many years, until Mark Welser published fragments of it. The manuscript of the map is at present in the imperial library at Vienna, where an additional leaf of it was

some time ago discovered. The characters and figures show that the map is not the original. Docen thinks that it belongs to the 12th century. Impressions have been published by Mannert (1824), Desjardins (1869-70), and Miller (1888), the last on a reduced scale.

**Pev'eril of the Peak**, a novel by Sir Walter Scott, published in 1823. The time of the story is the reign of Charles II., and the action takes place in the Peak region of Derbyshire, and on the Isle of Man.

**Pe'wee**, a name given to several species of American flycatchers of the subfamily *Tyranninæ*. The common pewee, or Phœbe-bird (*Sayornis fuscus*), is 7 inches long and 9½ in alar extent; the general color is dull olive brown above, darkest on the head, and yellowish white below; quills brown, most of the wing feathers edged with dull white; tail forked, the outer edge of the lateral feather dull white; bill and feet black. This lively species is found throughout eastern North America, from Newfoundland to Florida. In the Middle States it arrives from the south early in April, and gets out a first brood by the middle of May; it leaves again for the south in October, migrating by night. The nest resembles that of the barn swallow, being made of mud, grasses, and moss, lined with softer materials, and attached to a rock, wall, or rafter. The rough stone piers of a country-bridge are so often chosen that a widespread name for the bird is "bridge-pewee." The owners repair the same nest year after year; the eggs, four to six, are white, with a few reddish spots at the larger end; the young are hatched out on the 13th day, and leave the nest in 16 more; the parents show great affection for them, snapping the bill and darting boldly toward all intruders. The flight of this bird is rapid, with frequent sailings; it is fond of vibrating the tail, erecting the crest, and making a tremulous motion with the wings. It feeds on insects, which it takes with great dexterity and rapidity on the wing, swallowing them whole, and ejecting the hard parts.

The wood pewee (*Contopus virens*) is 6½ inches long, and 10¾ in extent of wings; the general color above is brownish olive, brownish black on the head; two pale grayish bands across the wings; a narrow white circle around the eyes; greenish yellow below, with a grayish tinge on the throat and breast. It is fond of forests and shady orchards. The flight is swift, with sudden sweeps in pursuit of its insect prey. Its notes are low, mellow, and sweetly melancholy when in its favorite haunts; its common name, like that of others of the sub-family, is derived from its utterance of the syllables "pe-wee," plaintively prolonged. The nest of this flycatcher is a tiny cup of soft materials covered by lichens, and so apparently a part of the branch upon which it sits as to be seen with difficulty; the eggs are 4 or 5, light yellowish, with reddish spots at the larger end; in the Middle States two broods are raised in a season; it boldly attacks man, beast, or bird approaching its nest.

Several other dark-colored flycatchers of this group are called "pewee" in various parts of the country, and most of them resemble the examples given above in general habits. Consult: Nuttall, 'Ornithology' (Chamberlain's edi-



tion. 1897); Bailey, 'Birds of Western United States' (1902).

**Pe'wit**, an English name applied to the lapwing plover (*Vanellus cristatus*), and sometimes to the black-headed gull (*Larus ridibundus*); also a former spelling of "pewee."

**Pews** (Old French, *pui*, from Latin, *podium*, a balcony), enclosed seats in a church devoted to the sole occupancy of a person or family. Pews were in use before the Reformation in England and are held in the Established Church by two tenures, first by prescriptive right, when they descend as an heir-loom; second, all pews not so held are at the disposal of the bishop of the diocese for use and benefit of the parish, and are under him distributed by the church wardens to the parishioners according to their rank. The bishop may grant the right to sit in a particular pew. In the disposal of the pews or seats in the area of parish churches in Scotland parishioners have a preferable claim according to the valued amount of their rent. The disposal of pews or seats in churches of other denominations is a matter of private arrangement. They are commonly let to defray the congregational expenses. In the United States pews are the property of the church corporation, who can sell or lease them. Whether property in pews is real or personal depends upon the provision made in the statutes of the different States. A purchaser or lessee of a pew may maintain an action at law for trespass, or disturbance in the enjoyment of his right.

**Pew'ter**, a generic term for a variety of alloys, of which tin forms the predominating component. The ordinary pewter is tin alloyed with lead. Plate pewter is a hard variety much used in olden times for plates and dishes.

**Pewter-muggers**, in American history, a popular name given to a New York faction of the Democratic party which was opposed to the Tammany candidates in 1828. Their meetings being held in a Frankfort Street resort where liquors were served in pewter-mugs the name was affixed by their opponents.

**Peyer's** (pī'èrz) **Patches** or **Glands** (also called Peyerian Glands), in anatomy, aggregate small circular patches, surrounded by simple follicles, with flattened villi occupying the interspace. They are situated near the lower end of the ileum, and their ulceration is the pathognomonic characteristic of enteric or typhoid fever, hence their importance. They were discovered and described in 1677, by Johann Konrad Peyer, a Swiss anatomist.

**Peyote**, pā-yō'tā, a small cactus (*Lophophora williamsii*) abundant in the southwestern United States and northern Mexico, formerly used by all the native redmen of that region as an exhilarant in connection with certain ceremonies, and as a remedy for various ailments; and is still so used among the remaining Indians and Mexicans. The effect is to produce a delightful and apparently non-injurious languor accompanied by a stimulated imagination. Some tribes look upon the plant as of divine origin and treat it with veneration. The name is derived from the Aztec word *peyotl*, and was originally applied to a composite plant of southern Mexico.

**Peyton**, pā'tōn, **Jesse Enlaws**, American patriot: b. Maysville, Ky., 10 Nov. 1815; d. Haddonfield, N. J., 28 April 1897. He was one of the founders of the Constitutional Union Party in 1860 and was sent by President Lincoln on a mission to Kentucky to dissuade that State from seceding. During the Civil War he organized at his own expense three regiments for the Union army, and was instrumental in promoting the centennial celebration of Independence Day, Bunker Hill Day, Yorktown Day, and of the inauguration of American constitutional government. At the time of his death he was attempting to organize an international celebration of the birth of Christ, to be held in Jerusalem in 1900.

**Pfäfers**, pfā'fërs, or **Pfeffers**, pfëf'fërs, Switzerland, a small health-resort in the canton and 31 miles east of St. Gall, famous for its warm baths, situated in the vale of the Tamina, in one of the most extraordinary gorges in Switzerland. Permanent population 600. The baths are built on a narrow ledge of rock a few feet above the impetuous torrent, the buildings which form them consisting of two piles connected by a chapel so deeply sunk between the rocks that the sun in the longest summer day is visible above them only from 10 to 4 o'clock. The spring has a temperature of nearly 100° F. Since 1840 the water has been conveyed by pipes to the village of Ragatz (q.v.) below the gorge, a distance of about 2½ miles, without losing its warmth. Near the village is situated the ancient Benedictine abbey of Pfeffers, a vast edifice, built in 1665, and now used as a lunatic asylum under the name of St. Pirminsberg.

**Pfaff**, pfäf, **Christian Heinrich**, German physicist: b. Stuttgart 2 March 1772; d. Kiel, Holstein, 24 April 1852. His interest in electricity was first awakened by the celebrated experimenter Gross, and in 1793 he went to Göttingen, where he published the results of his galvanic inquiries in 'Ueber thierische Electricität und Reizbarkeit.' In 1797 he became an extraordinary professor at Kiel and in 1801 was made professor of chemistry, with rank at the same time as a member of the medical faculty. He then directed his attention particularly to pharmaceutical chemistry, and was thus led to the composition of his most important work, 'System der Materia Medica nach chemischen Principien' (1808-24). Among other writings of his are: 'Handbuch der analytischen Chemie' (1824-5); 'Ueber und gegen den thierischen Magnetismus' (1807); 'Der Electromagnetismus' (1824); 'Parallele der chemischen Theorie und der voltaischen Contacttheorie der galvanischen Kette' (1845).

**Pfeiffer**, pfif'ër, **Ida Meyer**, Austrian traveler: b. Vienna 14 Oct. 1797; d. there 27 Oct. 1858. She received the education usually given a boy and was married in 1820 to Dr. Pfeiffer, a lawyer connected with the Austrian government. Her first long journey was a trip to Palestine and Egypt when she was but five and in 1842 she again visited the Holy Land. In 1845 she visited Scandinavia and Iceland, and in 1846-8 made a tour of the world traveling in Brazil, Chile, China, India, Persia, Armenia, Caucasus, and Turkey, and in 1851-5 made a tour which included Africa, Australia and America. Her



last long journey was to Madagascar in 1856 and after many hardships and a narrow escape from death at the hands of Queen Ranavola she returned to Vienna. Among her works which have been translated into English are: 'Journey of a Viennese to the Holy Land' (1843); 'Journey to the Scandinavian North' (1846); 'A Woman's Journey Round the World' (1850); etc.

**Pfen'nig**, a German monetary unit, equal to one-hundredth part of a mark. There are bronze coins of the value of 1 pfennig and 2 pfennige, or about one fourth cent and one half cent respectively. Nickel coins valued at 5, 10, and 20 pfennige are also in use, and in silver the coins less than a mark are 20 pfennige and 50 pfennige, or about 11 cents.

**Pfister**, pfis'tër, **Albrecht**, German printer: b. Bamberg, Germany, about 1420; d. there about 1470. He was engaged in card-painting in Bamberg and about 1455 began printing with movable type. He has been credited with the invention of printing, but whether he invented his process or learned it as an assistant of Gutenberg has been a matter of doubt. His types, though similar to Gutenberg's, still have some peculiarities. He printed prayer and school books, some of which are still in existence, as are also indulgences printed with metal types in the years 1454-5, an almanac of 1457 and a 'Biblia Pauperum.' His crowning achievement was his Latin 36-line Bible in three volumes and comprising 881 leaves. Consult Dziatzko, 'Gutenbergs früheste Druckerpraxis' (1890).

**Pfleiderer**, pfli'dër-ër, **Otto**, German Protestant theologian: b. Stetten, Württemberg, Germany, 1 Sept. 1839. He was educated at Tübingen and in 1870 was appointed superintendent and professor at Jena. The chair of systematic theology at the University of Berlin was accepted by him in 1875 and he has since become widely known as a writer and lecturer, his inclinations being toward a liberal theology. His lectures in London in 1858 and in Edinburgh in 1894 were published in English. Among his works are: 'Die Religion, ihr Wesen und ihre Geschichte' (1869-78); 'Religionsphilosophie auf geschichtlicher Grundlage' (1878-93); 'Geschichte der Religionsphilosophie von Spinoza bis auf die Gegenwart' (1893); 'Evolution and Theology' (English, 1900); 'The Early Christian Conception of Christ' (1905).

**Pflugk-Harttung**, pfloog' här'toong, **Julius von**, German historian: b. Warnikow, Germany, 8 Nov. 1848. He was educated at Bonn, Berlin, and Göttingen, accepted the chair of history in the University of Basel in 1883 which he held until 1893 when he was made head of the Secret State Archives at Berlin. He is an authority on mediæval and papal history and has published: 'Studien zur Geschichte Konrads II.' (1876-7); 'Norwegen und die deutschen Seestädte' (1887); 'Krieg und Sieg 1870-1' (1895); 'Die Bullen der Päpste bis zum Ende des 12. Jahrhunderts' (1901); etc.

**Pforzheim**, pförts'him, Germany, a town of Baden, 15 miles southeast of Carlsruhe, on the northern edge of the Black Forest, at the junction of the Würm, the Nagold, and the Enz. Among its buildings are the remains of an ancient castle, formerly the residence of the mar-

graves of Baden-Durlach; the castle church, dating from the 12th century, containing the tombs of many of the margraves; the town-house, a handsome building, rebuilt in 1892-5; the post-office; a fine museum, a gymnasium, and many other educational institutions. The chief industry of the place is the manufacture of trinkets, which employs over 10,000 hands. There are also chemical works, machine-works, forges, tanneries, copper-works, bleachfields, paper-mills, oil-mills, saw-mills, etc. The trade in wood is important, the timber being floated by the Enz and Neckar to the Rhine. There is also a considerable trade in oil, fruit, wine, and cattle. The inhabitants distinguished themselves in the Thirty Years' war. Reuchlin, one of the most distinguished precursors of the Reformation, was born here. Pop. (1900) 43,376.

**Pfuhl**, pfool, **Johannes**, German sculptor: b. Lowenberg, Silesia, 1846. He was educated at the Academy of Fine Arts in Berlin and later became an assistant of Schievelbein, under whom he had studied, and after his master's death completed his designs for the bronze memorial in the Dönhofsplatz, Berlin. His work includes several portrait busts, but his best work is seen in his colossal groups or reliefs. He has executed a frieze in rilievo in commemoration of the Franco-Prussian war, in the Military School of Lichterfelde (1876); an equestrian statue of William I., with Bismarck and Von Moltke, in Görlitz (1893); the Laube monument at Sprottau (1895); etc.

**Phædo**, fê'dō (Gr. *Φαίδων*), Greek philosopher: b. Elis. He was a scholar of Socrates, and founder of a school of philosophy in Elis. The dialogue of Plato on the immortality of the soul, which contains the last conversation of Socrates with his scholars while he was in prison, bears his name; but no inference can be drawn from it as to his teaching. None of Phædo's writings, which were in the form of dialogues, have come down to us; but Seneca, in his 'Epistolæ ad Lucilium,' has a translation of an extract from one of his works. Mendenius, who founded the Eretrian branch of the Eleatic school, was indirectly a disciple of Phædo, but to what extent he followed his views is unknown. See SOCRATES.

**Phædra**, fê'dra, in Greek mythology, daughter of Minos, king of Crete and of Pasiphaë, was the sister of Ariadne and wife of Theseus. Happening to meet Hippolytus, her step-son, whom she had never before seen, and whom she did not know to be the son of Theseus, she was inflamed with an ardent passion for the youth. He would not reciprocate, and to satisfy her revenge she accused him to her husband of a criminal attempt upon her honor. The father cursed his son, and Neptune soon carried his execrations into effect by bringing upon Hippolytus a violent death. When this event was known in Athens Phædra repented of her crime and hanged herself. Sophocles and Euripides have taken Phædra as the subject of their tragedies, which are now lost.

**Phædrus**, fê'drūs, Roman author. Little is known of him but from his own writings. He was a slave brought from the Pierian district of Macedonia to Rome, and manumitted by Augustus. By the publication of the first two books of his 'Fables' he drew upon himself the



## PHÆOPHYCEÆ—PHALANGES

ill-will of Tiberius' minister, the all-powerful Sejanus, and the remaining books did not appear until after the death of Tiberius (37). Phædrus introduced the fable into Latin literature, and a prose version of his work, prepared by one Romulus, was the basis of the mediæval fable. He was less a translator than an imitator—not always skilful—of Æsop, from whom only a small proportion of his material is taken. The five books remain in an imperfect state. They are written with more or less fluency in the iambic senarius. The best editions of the fables of Phædrus are those of Bentley (1726), Orelli (1832), Lucian Müller (1877), Riese (1885), and Havet (1895). Besides the above fables some have ascribed to Phædrus another group of 32, the 'Epitome Fabularum' or 'Fabulæ Novæ,' published from a manuscript of N. Perotti, archbishop of Manfredonia in the 15th century. The genuineness of these is doubtful. Consult Hervient, 'Les Fabulistes Latins' (1893-6).

**Phæophyceæ**, fē''ō-fī-sē'ē, a division of *Algæ* (q.v.) containing the brown seaweeds, whose color is due to the pigment phycophæin. The group is almost wholly marine, and mainly inhabits the cold seas, flourishing especially in the polar regions. The group includes the great kelps (q.v.) and other large-leaved forms, many of which have commercial value, or do an important service in protecting shores against excessive erosion. The various "rock-weeds" and "gulf-weeds" also belong here.

**Phaer**, or **Phayer**, fā'ēr, **Thomas**, English author: b. Kilgarran, Wales, about 1510; d. there 1560. He had a legal training and studied medicine at Oxford. He translated in heroic ballad metre the first nine books of the *Æneid*, publishing seven books in 1558.

**Phaëthon**, fā'ē-thôn, in Greek mythology, the offspring of Helios and Clymene, and brother of the Heliades. To please his unfortunate mother, and to satisfy those who doubted whether the Sun were his father, he desired the latter to grant him a favor. Helios imprudently promised it unconditionally. Phaëthon asked permission to take his father's place in the chariot of the Sun, and would not be denied. But he had scarcely mounted the flaming car and taken the reins, when the celestial horses, despising their weak driver, turned out of the path, and set everything on fire. The Ethiopians, on the left, were blackened by the near approach of the Sun; and when the chariot was drawn over the earth to the right, Zeus with his bolts plunged the thoughtless charioteer into the river Eridanus or Po. His sisters found him there lifeless, and lamented him. They were changed into poplars, and their tears into amber. The god of the sun was also called Phaëthon (the enlightener).

**Pha'ëton**, the tropic-bird (q.v.).

**Phagocytosis**, a process of destruction of foreign bodies by living cells. The term was originated by Metchnikoff, the Russian scientist, who founded upon the process a theory of immunity to disease. He observed that in many infectious diseases there was an increase in the number of leucocytes or white blood-cells in the body. These were observed to be greatly increased in the neighborhood of an infected area, and he further noted that these leucocytes were

capable of swallowing, as it were, the invading bacteria, and thus destroying them by a process of intercellular digestion. The white blood-cells were early termed by him the protecting army of the interior, which always stood ready to repel the bacterial foe. While Metchnikoff's early theory was extremely mechanical, and is now held to be true only in part, it has nevertheless stimulated an immense amount of research along this line, and the general theories of phagocytosis are broader now than formerly. It is now known that not all leucocytes are phagocytes; the lymphocytes are not; the eosinophiles are never phagocytic, although they are elements in the struggle of the body against infecting foreign bodies. The polynuclear and hyaline leucocytes are the chief agents in phagocytosis. It is further recognized that some of the fixed cells of the body have some phagocytic power. The endothelium that lines the blood-vessels can take up and destroy bacteria. Many epithelial elements, as in the mammary glands, and in the respiratory mucous membranes, can destroy bacteria; otherwise infections would be much more frequent than they are. The phenomenon of phagocytosis has been shown to be a much more complicated one than Metchnikoff at first supposed, but he has been able to defend and develop his theory with much skill in view of the many recent studies on immunity. It is certain that phagocytosis is an important mechanical process in the struggle with disease, but it is only one of the many biological agencies utilized by the body in this conflict. See BLOOD; IMMUNITY; INFLAMMATION.

**Phalangers**, fā-lăn'jêrs, a group of small polyprotodont marsupials, which owe their name to the fact that the slender fourth and fifth toes of the hind feet are united in a common integument. The great toes are opposable, and are destitute of nails, the other digits being provided with curved nails. The phalangers are adapted for an arboreal life, and inhabit the trees of the forests of Australia and the Papuan Archipelago. They are nocturnal in habits, and feed upon fruits and leaves, but appear also to devour young birds. In confinement they are found to prefer flesh as an article of diet. They are eaten by the natives of the countries in which they occur, although the flesh is said to emit a strong and offensive odor.

These animals are grouped in a family (*Phalangeridæ*) which is composed of several subfamilies. The *Tarsipedinæ* contains the genus *Tarsipes* alone. In the *Phalangerinæ* are included 10 or 12 genera and numerous species, among them the typical phalangers, the flying-phalangers and the flying-mouse. The flying phalangers are provided with a parachute-like expansion of the skin between the fore and hind limbs; by which they can make long skimming leaps from tree to tree as do the flying-squirrels of northern countries. The foremost genus is *Petaurus*, and the best known species is *P. breviceps*, which bears a remarkable resemblance to an American flying squirrel, but is somewhat larger. The flying-mouse is the minute *Acrobates pygmaeus*, which is not more than six inches long, including the plume-like tail. The koala and wombat (q.v.) are also phalangers.

**Phalanges**. See ANATOMY; OSTEOLOGY.



## PHALANGIDÆ — PHANARIOTS

**Phalangidæ**, fāl-ăn'jid-ē, a family of arachnidans, the daddy-longlegs (q.v.) or harvestmen, representing alone an order *Phalangida*, or with scorpions and false scorpions, the order *Arthrogastra* of Packard. The distinguishing feature is the fact that the abdomen is distinctly six-segmented, but the cephalo thorax is unsegmented. The legs are very long, and many-jointed, and the pedipalps are short and leg-like, and the chiliceræ chelate. The organs of respiration are tracheæ, and there are no spinning-glands. These creatures live in the grass for the most part, and feed upon plant-lice and other minute insects. Many common American forms may be found described and illustrated by Wood, in the 'Proceedings' of the Essex Institute (Salem, Mass. ), Vol. VI.

**Phal'anstery.** See FOURIERISM.

**Phalanx**, fāl'lānx or fāl'ānx, a word used by the Greeks to designate generally the line or ranks of an army in order of battle; more specifically the mode of formation of the heavy infantry of the Greek armies. Three Greek states acquired renown for their superior organization and use of the phalanx — Sparta, Thebes, and Macedon. In all of them it consisted of infantry in close array, heavily armed, with long spears as their principal weapon. The organization of the troops composing the phalanx varied in different states, but generally they were arranged in regular divisions under officers of various ranks, as in a modern army. The Spartan phalanx varied in depth, according to circumstances, but was commonly eight deep. The Theban phalanx, particularly under Epaminondas, was much deeper. At the battle of Leuctra he kept one of the two divisions into which the phalanx was usually divided retired, using it to strengthen the other wing in depth. The phalanx was perfected by Philip of Macedon. He increased the length of the spears to 24 feet, and the lines were arranged at such intervals that the spears of the fifth rank projected 3 feet in front of the first, so that the front was protected by a solid array of five lines of spears. The men were also armed with large shields which nearly covered their body.

**Phalaris**, fāl'a-rīs, ruler of Agrigentum in Sicily: b. near Cnidus, Asia Minor, 6th century B.C. He ascended the throne about 570 B.C. and though apparently elected by his fellow citizens appears to have usurped despotic authority. His history is largely enveloped in fable, and his name has become synonymous with tyranny, his most infamous act being the roasting alive of prisoners in the brazen bull, in which he is said to have executed the inventor, Perillus. In an insurrection 16 years after his accession to the throne Phalaris himself was overthrown and tortured in the same horrible manner. Later traditions paint him as a most humane and high-minded ruler, but the 148 letters (first printed in Venice, 1498) attributed to him, were proved by Richard Bentley (q.v.) in 1697-9 to be spurious. Consult Freeman, 'History of Sicily' (1891).

**Phalaris**, a genus of grasses, of which the fruit of one of the species (*P. canariensis*) or canary-grass, is canary-seed extensively employed as food for birds. See CANARY-SEED; GRASSES of the UNITED STATES.

**Phal'arope**, a snipe-like shore-bird of the family *Phalaropodidæ*, with a straight slender

beak and lobate toes, enabling it to swim well. The females are larger than the males, more brightly (and very handsomely) colored, and more aggressive than their mates. These birds spend their summers in the Arctic regions and nest there on the ground, laying three or four very dark-colored eggs, which are incubated by the male alone. Their flesh is oily and of poor taste. In winter they migrate southward, spreading over both the Old World and the New. Two of the three appear commonly in the United States,—the northern phalarope (*Phalaropus lobatus*) which in winter passes numerously all along the Atlantic coast; and Wilson's phalarope, which is rare on the coast but common all over the Rocky Mountain region, breeding in northwestern Canada as far south as the borders of Dakota. The red phalarope is rare here, but familiar in Europe and Asia. Consult Coues, 'Birds of the Northwest' (1874).

**Phallaceæ.** See FUNGI.

**Phal'licism.** See PHALLUS.

**Phal'lus** (Greek, *Phallos*), a symbol of the productive powers of nature which was in almost universal use in ancient religions. It is impossible to trace its origin, which probably had a spontaneous origin among different races, although its source was undoubtedly eastern. In Egypt this symbolism was associated with the adoration of the bull Apis, and with the feasts of Osiris, the solar divinity. The same symbolism is found among the Phœnicians and Babylonians; the Jews adapted it and were continually denounced by their prophets for so doing. Similar symbols have been found in Mexico, and in India they are everywhere common to this day. (See LINGAM.) In Greece these symbols did not appear in primitive mythology. They were introduced with the worship of Dionysus of other divinities, especially of Demeter, Aphrodite, and Apollo. The liturgical use of these symbols everywhere sooner or later became associated with licentious rites. This was especially the case in Rome in the latter part of its history, where these rites had to be forbidden by law. The women carried the emblem in procession from one temple to another. They wore them as amulets; and this practice subsisted long after the fall of the Roman mythology, and well on into the Middle Ages. It was prohibited by councils of the Church at Mans in 1247, and at Tours in 1396.

**Phanariots**, fa-nār'ī-ōts, or **Fanariots**, Greek inhabitants of Fanar, Constantinople. They were of Byzantine descent and when Mohammed II. conquered Constantinople he granted them the quarter of Fanar in recognition of their services. The district takes its name from the "beacon" which stood on the promontory extending into the Golden Horn. The Phanariots were descended from some of the oldest and noblest Byzantine families, and their superior intelligence soon gained for them an overmastering influence over the ignorant Turks. They were ambitious, avaricious and double-dealing, and their subtle intrigue soon gained for them high political places, in which they displayed much selfishness and greed. The offices of dragomans, secretaries, etc., were filled by them as well as many civil offices and the hospodars of Moldavia and Wallachia were appointed from their ranks. Their position be-



came one of great power and importance, but they never showed any appreciable degree of patriotism and when the war of Liberation broke out their services fell far short of the importance which their wealth and position should have made them. Since 1822 their power has been broken and as a class they have no longer any political influence in the affairs of Turkey. See Tennent, 'History of Modern Greece' (1845).

**Phan'erogams.** See CRYPTOGRAMMOUS PLANTS.

**Phantasiasts**, fān-tā'zī-asts, Monophysites of the 6th century, who believed that the Divine nature had so permeated the body of Christ from the very moment of his conception that this body had become imperishable and immortal. It felt neither hunger, thirst, fatigue, nor pain, but only semblances or phantasms of these affections. They were also known as Aphthartodocetæ, Docetæ, and Manichæans.

**Phantasmago'ria.** See MAGIC LANTERN.

**Pharaoh**, fā'rō, the name given in the Bible to the kings of Egypt, corresponding to the P-RA or PH-RA of the Egyptian hieroglyphics, which signifies the sun.

The Pharaohs mentioned in the time of Abraham and Joseph (the latter was, according to tradition, minister of Apophis II. Aa-Kenen-Ra), were probably the shepherd kings or Hyksos. The Pharaoh in the time of Moses was Rameses II., the Sesostri of the Greeks. He was succeeded by his son Menephtah II., and the Exodus took place either under the latter, or in the reign of his successors Seti II. and Si-Ptah. The two Pharaohs mentioned in the reign of Solomon, the one who gave his sister-in-law to Hadad the Edomite, and the one whose daughter Solomon himself married, were the last kings of the 21st dynasty. The Pharaoh mentioned as the opponent of Sennacherib was probably the Sethos of Herodotus. Pharaoh-Necho is the first Pharaoh mentioned in the Bible whose proper name is recorded. He is mentioned by Herodotus under the name Nekôs. Pharaoh-Hophra succeeded Necho. He is identified with Apries, who reigned from about 590-571 B.C., but the dates of both the beginning and end of his reign are variously stated. Several kings of Egypt are mentioned in the Bible who are not called Pharaoh. See EGYPT.

**Pharaoh's Ant**, the small red ant (*Monomorium pharaonis*), which is a pest in almost all parts of the world. (See HOUSE-ANT.) Why it is so called is not clear. Several other familiar and troublesome animals are called by the royal name as "Pharaoh's hen," the Egyptian vulture (q.v.), and "Pharaoh's rat," an ichneumon (q.v.).

**Pharisees**, a Jewish religious sect. This party probably became a distinct sect as a result of the reaction against the attempt of Antiochus Epiphanes to eliminate the distinctions between the Jews and the Greeks, and as a party were in opposition to John Hyrcanus, the high priest (135-105 B.C.), who reigned over the state founded when the Maccabean revolt was brought to a successful termination. They were also in opposition to the Sadducees, being essentially a religious sect, opposed to anything non-Jewish, and rarely engaged in political strife unless some of their rights or privileges had been out-

raged. The principles of the Pharisees were many and varied. As their name signifies (separatists), they held aloof from all intercourse with the lower classes; even their orthodox countrymen, unless they lived up to the Pharisaic interpretation of the laws, were shunned by them; and they carried their religious fanaticism to such an extent that laws were even imposed upon members of their body prohibiting trade with disbelievers. They, however, worshipped with their countrymen in the same synagogue under the command of their great rabbi: "Separate not thyself from the congregation." They insisted upon a strict observance of the laws as being necessary to righteousness, though they placed more weight on the belief in traditional laws than on the written laws, and extended the observance of these laws to the tithes, fasts, Sabbath worship, the ablution of hands, vessels, etc. They also believed in the existence of an oral law to complete and explain the written law (the Torah), in which was set forth the continuance of life after death, the immortality of the soul, the resurrection of the dead, human freedom, providence, etc. We find in the Mishna that "Moses received the law from Sinai, and delivered it to Joshua and Joshua to the elders, and the elders to the prophets, and the prophets to the men of the great synagogues." In the course of time these laws received many additions which were not supposed to be of divine origin, but were made by both the writers of the sacred books and the commentators.

The Pharisees came into prominence more particularly in the time of Christ because of their opposition to the principles of religion as taught by him. But their main objection to Jesus and the disciples lay in the fact that they associated so freely with the publicans and sinners, this being in direct contradiction to all the traditions and beliefs of the Pharisees. Jesus also taught that the religious relationship should be one of personal fellowship, while with the Pharisees this was held to be one only of legal compact. This doctrine the Pharisees perceived, if allowed to gain influence with the people, would lose to them their power, hence their desire to be rid of him, even if by death.

The Pharisees have, however, been misunderstood and maligned, especially as to being hypocritical. This party was the popular party of the day, having as members some of the most learned, pious, and patriotic men of the country, and, as in all sects where strict adherence to principle is an intensely religious duty, some defects of virtue crept in, but to stigmatize all as insincere and hypocritical is beyond reason.

The Pharisees survived until long after the fall of Jerusalem in 70 A.D., still believing in the restoration of the Kingdom of Israel through divine mediation.

**Pharmaceut'ical Schools.** See EDUCATION, PROFESSIONAL, IN AMERICA.

**Pharmacopœia**, fār''ma-kō-pē'ī-a, a book of directions or formulæ for the preparation of medicines which are recognized by the general body of practitioners. Such a book is a national publication of almost every leading country, and contains a list and description of the articles included in the materia medica (q.v.), with the



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chemical processes for obtaining them, their purity-tests, the prescriptions most approved, etc. After 1542, when the first pharmacopœia, that of Nuremberg, is supposed to have appeared, these books gradually superseded the treatises of apothecaries and increasingly acquired a more authoritative character. In 1618 the London College of Physicians issued its pharmacopœia, of which 11 editions afterward appeared, the last in 1851. Until the passage of the Medical Act in 1858, separate pharmacopœias were published by the colleges of physicians of London, Edinburgh, and Dublin. Since that act went into effect a British pharmacopœia issued by the medical council of the United Kingdom has been recognized by the general medical profession of Great Britain.

The pharmacopœia of Prussia, which is also used throughout Germany and in Russia, and that of France, are the most important published in the continental countries of Europe.

In the United States the first pharmacopœia was published in Philadelphia in 1778; in 1805 appeared another in New England; others were afterward issued by hospitals and other medical institutions; and in 1818 medical societies in New York planned a convention of delegates from medical colleges and societies in the various States, which was held in Washington, January 1820. Out of the transactions of that convention came, in the same year, the first pharmacopœia published in the United States. This is called 'The Pharmacopœia of the United States of America,' and is revised once in 10 years by a national convention of delegates from various authorized bodies, including the army and navy. It is not required by Federal law that this pharmacopœia shall be followed in the medical practice of the country, but it has been adopted as the legal standard in many States.

At the International Conference for Unification of the Formulas of Heroic Medicines, at Brussels, each country being represented by a physician and a chemist, new standards of strength for all very potent drugs were agreed upon and pledges were made by each government that the national pharmacopœia should conform. The new 'United States Pharmacopœia' has adopted the results of the Brussels conference, and it will be the first national pharmacopœia of international scope.

**Pharmacy.** *Definitions.*—(1) Pharmacy is the art of preparing and dispensing remedial agents. (2) The term Pharmacy is also applied to the place (shop or store) where medicines are prepared or sold, for example, a drug store or apothecary's shop. The pharmacist is the operator or dispenser, known also as druggist, or pharmaceutist (in England, chemist, or pharmaceutical chemist), while the product of his skill is called a pharmaceutical preparation or compound. At present, owing to the evolution that has largely transferred to manufacturing establishments, or factories, the making of specialties, and many compounds employed by physicians, such trade compounders are known as manufacturing pharmacists. Thus the differentiating terms retail pharmacist and manufacturing pharmacist now prevail.

The word pharmacy, derived from the Greek word *φάρμακον*, signified in early times either "the use of medicine" or "the practice of witchcraft." The past record of the art, in all

countries, seems to be fairly outlined by these definitions. In all cases, the early record of pharmacy is intricately connected with the practice of medicine, nor is it possible to write the history of one, without entering, somewhat circumstantially, into the story of the other.

*Beginning of Pharmacy.*—The beginning of the practice of pharmacy may be located in the efforts of primitive people of all ages, to counteract disease, or to relieve injuries. The very earliest literature of all nations gives proof of the study, as well as does the practice of the aborigines of every land. Scriptural reference to the "dead flies in the ointment of the apothecary," the fig poultice applied by Isaiah, and the many references in Jeremiah and elsewhere in the Scriptures to the medicinal virtues of leaves and plants are familiar to all readers of the Bible, and give proof of the practice of the art of pharmacy among the Hebrews.

In Assyria, cuneiform inscriptions teach that the healing art was practised by the priesthood at a very early date.\* Ancient Egyptian inscriptions<sup>1</sup>, illustrate the process of distillation, while a papyrus 3,300 years B.C.<sup>1</sup> gives prescription formulæ. Recent explorations have brought to light the interesting code of Hammurabi, king of Babylonia, 2250 B.C.,<sup>3</sup> in which we read of the doctor healing the sick, and the surgeon operating with the knife, but in which we find no reference to the compounding of medicines. By inference, then, we know that the physician and the pharmacist of ancient Susa must have been identical, since it is to be presumed that, had this not been the case, a document embodying such minutiae of details in law would have considered penalties for pharmacists' blunders, as well as for medical malpractice. In China and Japan, pharmacy, coexistent with their earliest records, is a curious art, while India, as shown in its "Charaka-Samhitā"<sup>4</sup> (8th century, or earlier), is to be credited with a wonderful detail study of drugs and preparations.

Glancing rapidly over the history of the world, we find in all countries and in all ages a like development of the pharmacist's art. Swayed originally by religious principles, the people looked naturally to the priest as councilor and helper, for physical as well as for moral ailments. In mediæval times, "Christ as an Apothecary," surrounded by the well-known implements of the art, was the subject of more than one painting. Of the semi-barbarous tribes of mediæval history, the Druids, who were held in such veneration by the people that their authority was almost absolute, were especially proficient in mystic rites and medicine.<sup>5</sup> It is recorded that "the nine rural arts known and practised by the ancient Cymry, before they became possessed of cities and a sovereignty," that is, before the time of Prydain ab Aldd Mawr, about 1000 B.C., was medicine.<sup>5</sup> The aborigines of America attained a considerable skill in pharmacy, as is evidenced by a collection in our own possession, of stone mortars from prehistoric Kentucky tombs, and lava mortars from the habitations of the lost Arizona Mound Builders. In fact, the records of early man, everywhere, give evidence of some form of the practice of medicine, and the rudiments of pharmacy. Said the erudite Dr. Alexander Wilder,

\* For references see end of article.



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"Every country having a literature of ancient periods of its history, possesses some account of a healing art."<sup>6</sup>

The early healing arts, among primitive peoples, were dominated by, or connected with religious rites, and consequently, with such, "the functions of the physician are usually united with those of the priest and civil ruler,"<sup>7</sup> to whom was relegated both the compounding and the administering of drugs. Ignorance and superstition led naturally to belief in sorcery, charms and witchcraft, as well as to confidence in the priest-physician, and faith in the wisdom of philosophers, astrologers, believers in divinations and the charm of soothsayers.<sup>8</sup> Hence we find the secondary meaning of the word *φάρμακον* to be sorcery, with which the primitive practice of medicine (and pharmacy) was often most intricately complicated, a practice exemplified to-day by belated people, for example, by the "pow-wow" methods of the American Indian "Medicine Man," and the "Ordeal Tests" of the African. The separation of the duties of the physician as we know him, from the offices of the priest or charm healer, came as a natural sequence to civilization's progress, and marks the first step in the development of the pharmacist.

*Evolution of Pharmacy.*—For a long period this process necessarily consisted of a picking out, or establishing, of remedial agents, and an excision of ceremony. By slow degrees, the sacred groves and pagan temples lost the confidence of the people as hospitals for the sick, and priests and mystics were no longer regarded as special physicians for disorders of the body. The magic touch of a love draught, or philter, the legendary "cry of the mandrake root," the casting of the horoscope, the influence of metals, plants, constellations, the foreboding bad sign, and the acts of witches and wizards, these and such as these became severally less conspicuous, and were gradually eliminated from the domain of medicine. A majority of such remedial agents as were used even to the very door of the 19th century, were likewise destined to be displaced, including a multitude of loathsome mixtures and concoctions, such as preparations of vipers and toads, excrement, hog lice, dead creatures, selected parts of dead human beings, etc., etc. In the march of events, the alchemistic complexities of the Middle Ages, such as Van Helmont's Amulet, Albertus Magnus' "Elixir of Life," the "Elixir Album," "Elixir Rubrum," and a multitude of elixirs of the Disciples of Hermetic Philosophy disappeared, as did also the numberless complex distillates and illogical compounds of mediæval Europe, a few of which, however, have left fragments of their skeletons, reclassified, to cumber our pharmacopœias. As examples of such lingering compounds that came thus to our doors may be cited "Elixir of Vitriol," which gave us Aromatic Sulphuric Acid; "Elixir Salutis," which gave us Compound Tincture of Senna; "Elixir Proprietatis," which gave us Compound Tincture of Aloes; "Elixir Stomachicum," which gave us Compound Tincture of Gentian; "Elixir Sacrum," which gave us Tincture of Rhubarb and Aloes. Taken as a whole, we perceive in the history of medicine a mighty struggle or turmoil through the passing ages, in which reason gradually took the place of both fancy and faith, and in which the

action of definite drugs replaced charm, superstition, and the attractive mystery of occultism. As a factor, as well as a shadowy actor in it all, is to be seen the growth of:

*The Pharmacist.*—Not until the 18th century had well passed into history, did the pharmacist appear as a distinct factor in his unhappy struggle for individuality. Into the field where religion, legend, superstition and medicine were commingled, the alchemists, those searchers for the "Alkahest," the "Philosopher's Stone," the "Quinta Essentia," or "Soul of the Four Elements," wedged themselves. Not only were these men destined to serve their parts in the birth of modern chemistry, but in the evolution of the pharmacist as well. Such as Paracelsus, Cagliostro, the healers by vegetables (Galenical pharmacy), the advocates of minerals (remedies originated by fire), each in turn combated for supremacy, while the votaries of Sulphur (the "Home of the Spirit"), Mercury (the "connecting link between spirit and body"), the users of animal and vegetable nostrums, the believers in the doctrines of signatures, of charms, of mysticism and astrology, by turns deceived the people, and themselves as well, and racked and tortured humanity. Charlatanism was ever rampant; mystery, deception, fallacy and legend reigned supreme. Fact concerning both remedies and diseases dovetailed so closely into fancy, both of form and expression, as to mystify both the actors and beholders, and to distract the historian. But at last, as a result of this ordeal and struggle, the physician, freed largely from the realm of mysticism, became a self-existing entity. Yet, for a long period, he served a dual part, for he was both the giver and the maker of medicine, while the surgeon and the barber were still one. Now came a cry for the separation of the art of compounding from the art of prescribing medicine, but it is impossible, in a limited article, to locate with exactness the dates of the varying differentiations, inasmuch as the process has not been a uniform proceeding, so far as either periods or countries are concerned. Different countries moved separately, as indeed did different sections of the same country, nor do they to-day parallel each other. There have been ebbs and flows in the march of civilization, and to these medicine has ever responded, and yet responds. For example, as early as the time of Aristotle,<sup>7</sup> the "physician" practised medicine, and the business of the "apothecary" consisted in "preparing and dispensing medicines"; and yet, not until 1754 did the code of the College of Physicians of Edinburg prohibit their Fellows and Licentiates from "keeping an Apothecary Shop." In England, a still greater license prevailed in the selling of medicines, which were not infrequently carried by grocers as a part of their stock, until 1617, when it was by law enacted that "no grocer should keep an apothecary's shop, and no surgeon should sell medicines." Even when the shop of the apothecary finally took a recognized place as a supply for medicine, the apothecary did more or less prescribing. This, proportionately, led to a degree of rivalry and even antagonism between physicians and apothecaries, an antagonism which had come down through the Middle Ages and the 15th, 16th and 17th centuries, lasting even into the 19th century.<sup>9</sup> Finally, under the inroads of modern science and the higher ethics of the



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leading professional men of healing, the physician turned his attention more directly to therapy, while the coexisting barber and surgeon separated. Chemistry became a modern science, and pharmacy a recognized art, but one whose limits are even yet undefined, for never has the "apothecary" been regarded merely as a "collector or compounder of drugs."

The latter part of the pharmacist's evolution may be graphically shown by a study of the successive issues of the European pharmacopœias, to which we may briefly allude. The first English pharmacopœia, issued (1618) by the College of Physicians, carried many curious mixtures and many cumbersome, ridiculous compounds. "Theriaca Andromachi," containing 60 ingredients (one of them a preparation of vipers), and other prescriptions of similar complexity held place, even in the revision of 1650. But animal drugs and similar products were gradually relegated to obscurity, and finally, when chemistry became the master of alchemy, and the art of compounding became separate from the art of prescribing, mysticism practically vanished from the field of European pharmacy, leaving a number of pharmacopœias, each bearing modified relics of formulæ that had sifted to them from the past.<sup>10</sup>

*American Pharmacy.*—In the early practice of American medicine, remedies similar to those employed in England naturally prevailed. In our infancy, such works as the Dispensatory of Quincy, and the Dublin and Edinburg dispensatories were conspicuous authorities. English text-books and English educational institutions, directly or indirectly, schooled the majority of American physicians. From them the professors in the American medical colleges drew their inspiration.\* Familiar English compounds, such as Dover's Powder, James' Powder, Fowler's Solution, Elixir of Vitriol, Sweet Spirit of Niter, Hiera Picra, Black Drop, Laudanum, Paregoric, etc., were everywhere in evidence.

Early American pharmaceutical preparations, like the practice of American medicine, were thus but the outcome of the transplanted English art, which, as has been shown, was a conglomerate from out the siftings of mediæval Europe, which in turn had heired the remains of ancient sects and systems. As an example, although Sassafras† and Sarsaparilla were introduced into the Cordic Dispensatory in 1592, American remedial agents were not taken seriously, even in America, until long after this date. American medicine, as well as therapy, were, until the opening of the 19th century, in the hands of the physician, who prescribed from his own stock of drugs. There is no evidence that a pharmacist, as now known, existed in America preceding the Revolution. The first American attempt at separating the two factors then vested in the physician, was made by Dr. John Morgan, of Philadelphia, in an address (30 May 1765), for which he was severely criticised for "trying to transplant into a new country, ideas that were suited only to Continental practice."<sup>12</sup> Not until 1774 did another physician write a prescription, when Dr. Abra-

ham Chovert of Philadelphia presumed to make the innovation.

No author, no committee, even, ventured to issue an American pharmacopœia before 1778, at which date William Brown published at Lancaster, Pa.,<sup>13</sup> a little work of thirty-two pages for the use of the military hospital of Washington's army.\* This was followed, 1808, by the Pharmacopœia of the Massachusetts Medical Society, and in 1820 by the first edition of the Pharmacopœia of the United States, which has since been revised each decade, although in 1830, owing to a split in the convention, two revisions appeared, one from New York, the other from Philadelphia. See PHARMACOPŒIA.

The American Pharmaceutical Association, which met first in 1852, and continuously each year thereafter, excepting 1862, has been of invaluable service in advancing American pharmacy. To their endeavors may be added the influence of the State Pharmaceutical Societies and their publications, as well as the many journals on pharmacy. The attention of observing physicians and botanists practising in rural American districts, and others, was finally drawn to the possibilities of the American flora, which was destined, eventually, to contribute its quota of remedial agents. Among the keen observers of that time may be mentioned B. S. Barton, Benjamin Rush, Manasseh Cutler, Wm. Tully, C. S. Rafinesque, Jacob Bigelow, Robley Dunglison, Samuel Thomson, Stephen Elliott, Daniel Drake, Wooster Beach, R. E. Griffith, Wm. Zollicoffer, John King, and numerous others.

In the first half of the 19th century, the Thomsonian and Eclectic schools of medicine arose, whose efforts were conspicuously devoted to the study of American vegetable products. In 1821, the Philadelphia College of Pharmacy was instituted, while the New York College of Pharmacy opened in 1829. 'The Journal of the Philadelphia College of Pharmacy' (the first journal on pharmacy in the English language), appeared in 1825, and the 'American Druggists' Circular' in 1857, to be followed by a number of journals on pharmacy, now current. A power in themselves, great has been their influence.

These separated and often antagonistic factors led to a remarkable interest in American medicines, which was furthered by the rivalries both of the American sects in medicine, and by the sects and factions practising medicine in America, from which must not be excluded those using "Domestic Medicine," and the so-called "Indian Doctors." About this period (middle of the 19th century), pharmacists began to give their attention more liberally to remedies that were increasingly American, while simple preparations, equally as effective but more pleasant, were devised to replace the more complex Pharmacopœial mixtures. The "Compound Tinctures" (the elixirs of old), "Compound Powders," etc., were largely displaced by fluid extracts, and simple tinctures, while the great class of foreign confections or conserves, the numerous treacle mixtures, the many electuaries, the distilled waters of herbs and mixtures of herbs, familiar in European Pharmacopœias, also mostly disappeared.

Let us now briefly consider this evolution

\* The first in America to teach medicine, including materia medica, pharmacy and pharmaceutical chemistry, was Dr. John Morgan, 1765, Philadelphia.

† The first American remedy introduced into Europe, about 1562. First described in detail by the Spanish physician, Monardes, of Sevilla, in 1754.<sup>11</sup>

\* The Botanical treatises of Manasseh Cutler, 1785, and Schoepf, 1787, could scarcely be called *medical*.



## PHARMACY

of medicinal products in its connection with the practice of American medicine, for medicine and pharmacy are inseparable. Until the middle of the 19th century, remedies nasty and violent were not only prevalent, but were prescribed in heroic doses. The public, as well as the medical profession, had been taught by both herbalists and mineral advocates, to consider drug action to be necessarily connected with systemic shock. Pharmaceutical preparations, as well as dosage, were such as usually violated the patient's conception of pleasure, rest and peace. Distasteful decoctions and concoctions, salivating mercurials, violent emetics, blisters and escharotics, bleeding and torturing mechanical processes, were conspicuous. This condition confronted pharmacy when Coxe's American Dispensatory appeared (1806), and the first edition of the Pharmacopœia, already mentioned (1820). No less was it a factor when appeared in 1833 the first edition of the 'Dispensatory of the United States,' fashioned like that of Coxe, after the European dispensatories, but yet evidencing a spirit of unrest and independence. Already had arisen in America a growing questioning of such methods of medication, a questioning that was fostered, if not instigated, by the attacks of the irregulars, the faddists, the various curers by secret mixtures, and by agitators outside the medical profession, who, without much hope of success, and with no systematic plan, demanded reform, both in method and medicine. Their incipient attempt was first a questioning cry, next a plea, then a demand for kindness to the sick. But these alike met the resistance of a body of physicians trained by the authority of centuries in the belief that disease was due to devils, and that the devil must be fought by fire. The crusade that followed made Wooster Beach (see ECLECTICISM) and Samuel Thomson conspicuous. European drug conglomerates were finally bitterly and publicly assailed, as well as were the generally accepted methods of those who treated disease by such authority as reigned supreme, especially bleeding, blistering, and mercurials. Thoughtful physicians likewise became imbued with a desire for new and more kindly agents to take the place of harsh and disagreeable remedies. All this gave both an incentive and an encouragement to pharmacists, and now it was that American substitutes for European remedies, both drugs and pharmaceutical preparations, began to creep into conspicuity. The resultant more elegant pharmaceutical preparations and more direct remedies, led also to simplicity of medication, that was fortified by the discovery of a few proximate principles of plants. New processes and new classes of pharmaceutical preparations now began to prevail, by pharmacopœial authority.

As in medicine, so in pharmacy. The reform began in the early part of the 19th century with the application of the process of percolation to powdered drugs, suggested by Count Real in 1815, and adopted by Roullay Brothers, Paris, France, 1837. This process took deep root in America, and owing chiefly to the impetus given the subject by the French pharmacist, Duhamel, in his paper republished in the 'American Journal of Pharmacy' (1838), and to the efforts of Proctor, Graham, Parish, Squibb, and others, it was adopted in the 1840 Pharmacopœia, in making "Fluid Extracts."

This new class of pharmaceutical preparations, the "Fluid Extracts," was a great improvement on the decoctions, infusions and common tinctures then so commonly employed. Manufacturing pharmacists and pharmaceutical factories now for the first time became a factor in pharmacy, and turned their attention to the cultivation of this promising field. By means of special studies, improved appliances, and expert manipulative talent, they accomplished more than could have been expected of the circumscribed apothecary, of endless cares, limited opportunities, and innumerable shop diversions. Factory-made, sugar-coated pills were introduced (followers of French coated *drages*), and attained a wonderful popularity (1860 to 1880). These were closely followed by gelatine coated pills (known long previously, but nearly forgotten), and under the force of these machine-made products and their numberless combinations, the art of extemporaneous pill-making by prescription, practically disappeared from the realm of the American pharmacist. Then came factory-made, empty, gelatine capsules for encasing powders and masses, and finally, at the close of the 19th century, with a rush, came mechanical tablets of various fancy colors, carrying divided amounts of drugs, and stamped into a variety of pleasing forms. These were advertised to physicians, and have largely brushed aside the prescription-made powders of the apothecary. Trade emulsions and trade-marked specialties also took a place in medication, while elixirs, in the way of sweetened and aromatized liquids, arose in numberless combinations to help the manufacturer in his aggressive inroads. The Eclectic school of medicine felt the touch of the times, and turned its attention to the evolving of remedies more effective and more pleasant than were their very disagreeable early products. The first edition of King's 'American Dispensatory' (1852), had been a great factor in correlating and somewhat simplifying Eclectic preparations, after which Scudder's aggressive attacks on the complex in Eclectic medicine, and in behalf of kindlier, more effective and more pleasant remedies, established the reformation. The heroic methods of Samuel Thomson were likewise abandoned by his followers (now known as the Physio-Medical school), until the past harshness of Thomsonian practice contrasts with their present methods, about as favorably as does the evolution in the Eclectic school. The pleasant granules and dilutions of Homœopathy found favor with the public, and although of European origin, found a fertile and responsive field in America, serving American pharmacy and medication even more than its disciples appreciate, or its antagonists concede. The inroad of these discordant factors came between 1820 and the century's close. With increasing rapidity they followed each other, and together led to a brushing out of the disagreeable *old*, and its replacement with a more pleasant *new*.

Looking back over this period, one perceives the bitterness of rivals and antagonists, the calumnies, and attacks of individuals, the contentions of sects in medicine, and of factions in pharmacy. But this discord of the factors was accompanied by a harmonious movement of the whole, in which pharmacy and medicine were slowly uplifted, and by which the people have surely benefited.



## PHARNACES — PHARSALUS

*The Present in Pharmacy.*—Contrasted with half a century ago, the art of pharmacy in America is scarcely to be recognized by either the constituents of physicians' prescriptions, or by classes of pharmaceutical preparations. True, the Pharmacopœia still gives place to tinctures, syrups, pills, decoctions, infusions, etc., while old style bottles still cumber the pharmacists' shelves, but in practice the remedial preparations of the last century are no longer supreme, and many vital drugs of that date are obsolete. Bitter has been the crusade that resulted in their displacement, a revolution has it been, largely to be credited to the factors that America has evolved and fostered, since she arose to take an active, critical part in the evolution of modern pharmacy.

An American "pharmacy" (drug store) now embraces not only medicines, but many foreign substances which permit of profit. The country drug store carries a miscellaneous assortment of nearly every description, even, at times, including groceries, wall paper, paints, glass, and oils. In our cities, the past 50 years have, as a rule, excluded oils, paints and glass from the pharmacist's province, but have introduced candies, fancy soda beverages, and many similar substances fully as foreign to medicine. Prescriptions are to a less degree than formerly compounded from preparations prepared by the pharmacist, factory-made products being favored by physicians to a great extent, and increasingly. Ready made specialties for the self-cure of disease are becoming familiar to the public, who purchase tablets and pills of active drugs so freely, as increasingly to breed harmful drug habits, a wrong that now demands the urgent attention of law makers and philanthropists. The past decade has brought from Germany a number of patented, copyrighted, and trademarked synthetics, introduced first to the medical profession, who prescribed them by name. Thus they became known to the laity, who soon became self-prescribers of energetic remedies, such as the hazardous heart depressants, whose employment is not without risk, even under the watchful eye of a physician. This pernicious effect of over-drugging by these substances, as well as by the narcotics of old, has perhaps led an increasing class of citizens to discard all remedies, and to discredit all physicians, their beliefs reminding one of the healers of the far distant past, when the Church cared for both spiritual and temporal ailments. And lastly, may be briefly noted the introduction of animal extracts and toxines and serums, which came at the very close of the 19th century, and must be judged by the leveling touch of the future.

All these conspiring influences, together with annoying State pharmacy laws, and the inroads of cut-rate druggists and aggressive department stores, have no doubt harassed the dispensing pharmacist. And yet, the literature of pharmacy to-day is the highest in all its record, the Pharmacopœia of the United States is superior to anything that has preceded, and pharmaceutical education is the most comprehensive and exacting in all American history.

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The author is indebted to the Lloyd Library for the data on which this paper is based. The titles of Pharmacopœias and Materia Medica,

numbering several hundred, in this collection, need not be given, but it is desirable that a few volumes concerning the historical record be referred to by consecutive text numbers. These are as follows:

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2. Ebers, 'Papyrus Ebers,' Leipsic 1889.
3. 'Laws of Hammurabi,' found in ruins of ancient Susa. The most ancient code of public laws yet discovered. 2250 B.C. (700 years before the time of Moses.) Translated and described in 'Records of the Past,' Washington, D. C., March 1903.
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5. Wellcome, 'Ancient Cymric Medicine,' London 1903.
6. Wilder, 'History of Medicine,' New Salem, Me., 1901.
7. Watson, 'The Medical Profession of Ancient Times,' New York 1856.
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9. Bell and Redwood, 'Progress of Pharmacy,' London 1880.
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11. Lloyd, 'Historical Story of Sassafras,' Chicago 1898.
12. Wilbert, 'Life of John Morgan,' 'Amer. Jour. of Pharm.' 1904.
13. 'Am. Jour. Pharmacy,' Vol. 56, 483-491, 1884; Vol. 63, 156-7, 1891.
14. Lloyd Library Bulletins, Reproduction Series, Nos. 3 and 4.

Other valuable volumes consulted in the preparation of this paper should also receive special mention.

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Hoffman, 'History of American Pharmacy.' Transactions Am. Pharm. Ass'n, 1902.

Park, 'An Epitome of the History of Medicine,' Philadelphia 1897.

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JOHN URI LLOYD,  
President Lloyd Library, Cincinnati, Ohio.

**Pharnaces**, fār'na-sēz, king of Pontus, son of Mithridates the Great. He usurped the throne of his father, who was compelled to commit suicide, 63 B.C., and by friendly embassies to Pompey enjoyed for a time the friendship of Rome. The civil war between Cæsar and Pompey tempted him to make an effort to extend his territory, thereby bringing on a war with Rome. Cæsar himself met him near Zela (47 B.C.), utterly routed his armies, and sent to Rome the famous message, "Veni, vidi, vici." Reports conflict concerning the fate of Pharnaces, some accounts having him slain in battle, while others make him die in captivity.

**Pharsalia**, fār-sā'li-a, a plain of southern Thessaly, whose principal city is Pharsalus (q.v.). The name of the district is sometimes applied to the battle, better known as that of Pharsalus; and served Lucan (q.v.) as the title for his republican epic glorifying Cato and the other opponents of Cæsar, many of whom were killed in that battle.

**Pharsalus**, fār-sā'lūs (now FERSALA in Greek; CHATALJA in Turkish), city of southern



## PHARYNGITIS — PHEASANT

Thessaly on the Enipeus, south of Larissa. A town of considerable antiquity with fortifications commanding the important defiles of the Othrys, one of the gateways of northern Greece, it played no part in Greek history, but was the scene of a Roman victory over Philip V. of Macedon in 196, and in 48 B.C. (9 August, or possibly 6 June), of the complete defeat of Pompey (q.v.) by Julius Cæsar (q.v.), the beginning of the end of republican Rome. In the war between Greece and Turkey the Greeks were defeated near this town 5 May 1897, and the Turks occupied it the next day.

**Pharyngi'tis.** See NOSE AND THROAT.

**Phar'ynx**, the region included in the back part of the mouth and upper portion of the throat. It receives the food after mastication in the mouth, and then transfers it to the œsophagus or gullet. The pharynx is funnel-shaped, about four inches in length, and its walls are chiefly composed of muscular tissue. It is attached superiorly to the basilar process of the occipital bone. Its broadest part lies opposite the hyoid bone. Its lowest boundary is at the cricoid cartilage of the larynx, that is, about the level of the fifth cervical vertebra, where it passes into and becomes continuous with the narrower "gullet." It is loosely attached behind to the bodies of the cervical vertebræ by areolar tissue destitute of fatty elements.

The pharynx is composed of three coats — the inner being the mucous layer, the middle a fibrous coat, and the outer a muscular layer. The muscular coat is composed of various distinct muscles, chief among which are the three constrictor muscles of each side. The inferior constrictor arises from the sides of the cricoid and thyroid cartilages; the middle constrictor takes origin from the great cornu or horn of the hyoid bone, from the lesser cornu, and from part of the stylo-hyoid ligament; while the superior constrictor, situated at the upper part of the pharynx, arises from the hamular process of the sphenoid bone. All of these muscles are inserted into the middle line of the pharynx. The stylo-pharyngeal muscle of each side arises from the inner aspect of the base of the styloid process. The constrictor muscles of the pharynx contract upon food and cause it to pass downward to the œsophagus, the action of the stylo-pharyngeal muscles being to draw the sides of the pharynx outward and upward and so to widen the cavity for the reception of food from the base of the tongue. The pharynx forms only part of the mechanism connected with deglutition, the tongue and the palate (q.v.) and its arches and muscles being also intimately concerned in the process. The pharynx is also concerned in the modulation of the voice.

Seven apertures open into the pharynx: The two Eustachian tubes of the ear; the two posterior nares or hinder openings of the nostrils; the single aperture opening backward from the mouth, termed the isthmus facium; the cordiform or heart-shaped opening of the larynx, guarded by the epiglottis; and the opening of the œsophagus or gullet, into which the pharynx itself is continued. See ALIMENTARY SYSTEM; BRAIN; DIGESTION; NOSE AND THROAT.

**Phascogale**, fās-kōg'a-lē (more correctly *Phascologale*), a genus of small dasyures, found throughout Australia, New Guinea, etc. They

bear some resemblance to rats, but are usually rather smaller. They feed on insects, and climb trees (except *P. virginia*) in order to get them. *P. penicillata*, or Tapoa Tafa, is one of the commonest species, and is a pretty little animal with a bushy tail. See DASYURE.

**Phases**, or **Phasis**, in astronomy, one of the gradual changes undergone by the moon in passing from an unilluminated state (new moon) through that of a continually broadening crescent to a complete orb (full moon), and back to a new moon again. (See MOON.) Similar phases are undergone by the inferior planets. Mars, through a superior planet, has slight phases; when in opposition his disk is circular, at all other times it is gibbous. So also have Saturn's rings.

**Phasis**, fā'sis, in ancient geography, a river of Colchis, now called Rion (q.v.), after one of its tributaries, the Rhion of antiquity. Near it pheasants were plentiful and their name is derived from that of the river, *Phasiani* in Latin meaning "belonging to the Phasis."

**Phas'midæ**, spectre insects or walking-sticks, a family of orthopterous insects allied to the *Mantidæ*, restricted to warm countries, and remarkable for their very close resemblance to the objects in the midst of which they live, this peculiarity, known as mimicry, being their only protection against their enemies. The family includes the genera *Phasma*, *Phyllium*, etc. Some of them are destitute of wings, and have the appearance of dead twigs, while the absence of motion in the insects adds to the deception. In others, as the genus *Phyllium*, the wings have the appearance of withered leaves, while the brighter hue of the wing-covers of a few of larger size give to the animal the appearance of a fresher leaf. See LEAF-INSECTS; MIMICRY; WALKING-STICK INSECT.

**Pheasant**, the common appellation of a group of magnificent gallinaceous birds generally considered to constitute a family (*Phasianidæ*). The name is an Anglicized form of the Latin *Phasianus*. The upper mandible is arched, overhangs the lower at the tip, and is naked at its base; the nostrils are placed at the base of the mandible, and are covered by a scale. The cheeks, region about the eyes, and often other parts of the head, are naked and often provided with fleshy outgrowths. The wings are short; the tail long, wedge-shaped, and consisting of 18 feathers, but with its coverts often presenting a remarkable development. The three front toes are united by a membrane up to the first joint, and the hinder toe is articulated to the tarsus. The males possess horny tarsal spurs. The food consists of grains, soft herbage, roots, and insects. Pheasants are chiefly terrestrial in habits, taking short, rapid flights when alarmed. They are polygamous, the males and females consorting together during the breeding-time, which occurs in spring. The simple nest is commonly formed amid long grass or bushes, and the female performs the entire duties of incubation. No true pheasants are indigenous to America, but all of the 12 or 15 genera and 50 or 60 species belong to Asia and are particularly represented in India and Indo-China. The common English pheasant, which is a somewhat familiar bird in this country, having been introduced into pheasantries and preserves, consists chiefly of hybrids between the ring-necked pheasant (*Phasianus torquatus*),



## PHEASANT'S EYE — PHELPS

imported from China about a century ago, and *P. colchicus*, which is supposed to have been brought to Great Britain by the Romans, but may have been native. This pheasant is found throughout southern Europe, and was known to the ancient Greeks and Romans; Jason is reported to have brought it from Colchis in the famous ship Argo.

These birds breed freely in a domesticated state. The pheasant will interbreed with the common fowl, the Guinea fowl, and even with the black grouse; and there are white and pied varieties of the common species. The hybrid produced by the union of a cock-pheasant with the common hen is termed a *pero*. The female pheasants when old may, like pea-fowl, assume the feathers and general plumage of the males.

The pheasant is a famous game-bird in England and parts of the Continent. Great numbers are reared and fed artificially, and liberated in selected coverts on English estates. Considerable numbers have been placed on preserves in certain parts of the United States; but, while these handsome birds undoubtedly add interest to the landscape, pheasant shooting cannot be commended as a sport. As practised in England it differs little from a slaughter of barnyard fowls.

The green pheasant (*P. versicolor*) and the copper pheasant (*P. soemmerringi*) have also been introduced into the United States from China and Japan respectively. Many of the Asiatic species of pheasants, the males of which exhibit strikingly handsome colors or peculiar modifications of the plumage, are well-known objects in aviaries and fancy-poultry yards in this country. The golden pheasant (*Chrysolophus pictus*) of China is a beautiful species, colored scarlet, blue, black, and yellow, and having a brilliant golden erectile crest borne on the head. The silver Chinese pheasant (*Gennæus nycthemerus*) possesses a generally silver-white plumage, the feathers being marked by fine black lines; the under parts are colored black. The tragopan pheasant (*Cerionis satyra*), found in the Himalayas, approaches the fowls. The males of this species possess peculiar bluish, fleshy, horn-like processes on the head, and wattles of a similar color. The male plumage is colored red with white spots, that of the females being brown. The argus pheasant (*Argusianus argus*), included by some naturalists in the peacock group (*Pavoninæ*), is a large species found in Sumatra and the Indo-Malayan region. The males of this bird measure from five to six feet from the tip of the beak to the extremity of the tail. The plumage is exceedingly beautiful, the secondary quills of the wings being each adorned with a series of ocellated or eye-like spots of brilliant metallic hues. The general body plumage is colored brown. The flight is feeble, owing to the length of the secondary feathers, which latter, however, assist these birds in running.

The Impeyan pheasant (*Lophophorus impeyanus*) is found in South Kashmir. This, and related species of the same genus inhabiting the Himalayas, are of surpassing beauty, with their tufted heads and brilliant metallic greens, purples, golden, and coppery colors, set off by patches of silvery white and velvety black. The pea-fowl, jungle-fowl, and fire-back also belong to this family. In parts of the United States the ruffed grouse is known under the name of

"pheasant." The turkeys belong to a family closely related to the pheasants, which they represent in the native avifauna of America. Consult: Gould, 'Monograph of the Phasianidæ' (London 1872) and Tegetmeier, 'Natural History and Management of Pheasants' (London 1881).

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**Pheasant's Eye**, a name of several garden flowers. See ADONIS; PINKS.

**Phe'lan, Richard**, American Roman Catholic bishop: b. near Ballyragget, County Kilkenny, Ireland, 1 Jan. 1828; d. Idlewood, Pa., 20 Dec. 1904. He was educated in the College of Saint Kyran, Kilkenny; came to this country in 1850 and studied in Saint Mary's Theological Seminary at Baltimore. Ordained to the priesthood in 1854 he was pastor at Freeport, Pa., for 10 years, was subsequently administrator and vicar-general, and in 1885 was consecrated coadjutor bishop of the diocese of Pittsburg, succeeding to the headship of the see in December 1889.

**Phelps, Anson Greene**, American merchant and philanthropist: b. Simsbury, Conn., 12 March 1781; d. New York 30 Nov. 1853. He was by trade a saddler and at 18 established himself in business at Hartford, Conn., afterward owning a branch business at Charleston, S. C. In 1815 he removed to New York where he became a dealer in tin plate and heavy metals, and amassed a large fortune, which was augmented by fortunate investments in real estate. His later years were spent in benevolent enterprises; he was president of the American board of commissioners for foreign missions, of the New York asylum for the blind, and the New York branch of the Colonization Society. His will bequeathed large sums to charitable institutions. Ansonia, Conn., was named for him.

**Phelps, Austin**, American Congregational clergyman and author: b. West Brookfield, Mass., 7 Jan. 1820; d. Bar Harbor, Maine, 13 Oct. 1890. He was graduated from the University of Pennsylvania in 1837, studied theology and was pastor of the Pine Street Congregational Church, Boston, 1842-8. In the last-named year he became professor of sacred rhetoric in Andover Theological Seminary, resigning in 1879, having been president of the institution from 1869. The rest of his life was spent in retirement. His published works include: 'The Still Hour' (1859); 'The New Birth' (1867); 'Studies of the Old Testament' (1879); 'Theory and Practice of Teaching,' a much valued work (1881); 'Men and Books' (1882); 'English Style in Public Discourse' (1883); 'My Study and Other Essays' (1885); 'My Note Book: Fragmentary Studies in Theology and Subjects Adjacent Thereto' (1889). Consult 'Life,' by his daughter, Elizabeth Stuart Phelps-Ward (1891).

**Phelps, Charles Edward**, American soldier and jurist: b. Vermont 1 May 1833. He was graduated from Princeton in 1852, from Harvard Law School in 1853, and established a law practice in Baltimore, Md. He served in the Union army, winning the rank of brevet brigadier-general and a medal of honor for gallantry at the battles of the Wilderness and Spottsylvania. He was elected to Congress in 1864 and 1866, and in 1882 elected to the supreme bench,





GOLDEN PHEASANT.







## PHELPS

Baltimore, for a 15-year term. Re-elected in 1897 for a like term, a special act of the legislature in 1902 permitting him to continue in office, though past the constitutional age limit. He was professor of law at the University of Maryland and wrote: 'Juridical Equity' (1894) and 'Falsity and Equity' (1901).

**Phelps, Edward John**, American diplomatist: b. Middlebury, Vt., 11 July 1822; d. New Haven, Conn., 9 March 1900. He was graduated at Middlebury College in 1840; studied at the Yale Law School; was admitted to the bar in 1843; and settled in Burlington, Vt., in 1845. In 1851 he was appointed comptroller of the treasury and remained in the office through Fillmore's administration. He was strongly opposed to the Civil War, was a member of the Vermont Constitutional convention in 1870, and in 1881 was president of the American Bar Association. In 1881-5 he was professor of law in the Yale Law School and also lecturer on constitutional law in Boston University. He was minister to England 1885-9. During the Bering Sea dispute in 1893 he was senior counsel for the United States, after which he resumed his chair at Yale and continued there until his death. He wrote 'The Life and Character of Charles Linsley'; 'Orations and Essays' (published posthumously 1901); etc.

**Phelps, Elizabeth Stuart** ("H. TRUSTA"): American author: b. Andover, Mass., 13 Aug. 1815; d. Boston, Mass., 30 Nov. 1852. She was married to Austin Phelps (q.v.) in 1842 and subsequently devoted much attention to writing. Her 'Sunny Side' (1851) reached a sale of over 100,000 in one year, and among her other works are: 'The Angel over the Right Shoulder' (1851); 'The Last Sheaf from Sunny Side' (published with a memorial by her husband 1853); etc.

**Phelps, Elizabeth Stuart.** See **WARD, ELIZABETH STUART PHELPS.**

**Phelps, John Walcott**, American soldier and politician: b. Guilford Center, Vt., 13 Nov. 1813; d. Brattleboro, Vt., 2 Feb. 1885. He was graduated at West Point in 1836; entered the artillery and served against the Creeks and Seminoles 1836-8. In the Mexican War he fought at Monterey, Vera Cruz, Cerro Gordo, Contreras, Molino del Rey, and City of Mexico. He resigned from the army in 1859, but enlisted in 1861 as colonel of the 1st Vermont Volunteers and was with Farragut in the lower Mississippi in April 1862. He occupied New Orleans 1 May 1862, issuing a proclamation against slavery, which resulted in a quarrel with General Butler, and at Camp Parapet, near New Orleans, organized the first negro troops in the summer of 1862. In August 1862 he was declared an outlaw by the Confederate government for having "organized and armed negro slaves." He resigned from the army in the same year. In Vermont he took a prominent part in educational work and in historical research, and was an eminent anti-Mason. He was nominated for the presidency by the American (or Anti-Masonic) Party in 1880. He opposed all secret societies, and in 1864 translated de la Hodde's 'Sociétés secrètes de France' under the title 'The Cradle of Rebellions.' He also wrote a 'History of Madagascar' (1884). Consult biographical sketch by Howard (1887).

**Phelps, Oliver**, American merchant and land speculator: b. Windsor, Conn., 1749; d. Canandaigua, N. Y., 21 Feb. 1809. He was a merchant in Suffield, Conn., and in Granville, Mass., and amassed a large fortune. In 1788 he formed a partnership with Nathaniel Gorham and purchased a tract of 6,000,000 acres of land in New York for £300,000, to be paid for in "consolidated securities." The land was within the charter limits of both New York and Massachusetts, but a compromise was effected whereby the sovereignty remained with New York and the ownership of the territory was ceded to Massachusetts. Phelps secured the Indian title to 2,600,000 acres of the land and opened at Canandaigua the first land office in the country. The rise in value of the "consolidated securities" made full payment impossible and Phelps relinquished to the State the portion of the land still unpaid for. In 1790 he sold to Robert Morris his remaining share, 2,100,000 acres, and in 1795, in partnership with several others, purchased from Connecticut 3,300,000 acres in Ohio, known as the Western Reserve. Later he sold his interest and returned to Canandaigua. He was a member of Congress in 1803-5, a circuit judge, and took an active interest in the Erie Canal and the Welland Canal. He also engaged in building steamboats on Cayuga Lake.

**Phelps, Samuel**, English actor: b. Devonport, Devonshire, 13 Feb. 1804; d. near Epping, Essex, England, 6 Nov. 1878. He was apprenticed to a printer, but in 1825 made his début as an actor. In 1837 he made his first appearance in London in the character of Shylock, at the Haymarket Theatre and scored a success, appearing later in the same season with Macready in Covent Garden Theatre. He came rapidly to the front as an actor, rivaling Charles Kean in many Shakespearian roles. In partnership with Greenwood he took the management of Sadler's Wells Theatre, Islington, in 1844, and there achieved a great success, producing more than 30 of the plays of Shakespeare and other famous dramatists. He published an edition of Shakespeare in 1853.

**Phelps, Thomas Stowell**, American naval officer: b. Buckfield, Maine, 2 Nov. 1822; d. New York 10 Jan. 1901. He was graduated from the United States Naval Academy in 1846, served in the Mexican War, was engaged in the coast survey, and participated in the Indian war in Washington Territory in 1855-6. In 1858-9 he served on the Paraguay expedition, and at the outbreak of the Civil War was engaged in making surveys of southern harbors. He took a creditable part in many engagements, particularly distinguishing himself at Fort Fisher, where he commanded the Juanita. He afterward served on the southern coast until 1867, when he was transferred to the California navy yard. In 1881-2 he was commandant of the Mare Island navy yard and in 1883-4 commanded the South Atlantic squadron. In 1884 he was promoted rear-admiral and was retired in that year, after 45 years of active service. He published: 'Sailing Directions for the Straits of Magellan' (1855); and 'Reminiscences of Washington Territory' (1882).

**Phelps, William Walter**, American diplomat: b. New York 24 Aug. 1839; d. Teaneck, N. J., 16 June 1894. He was graduated from Yale in



1860 and from the Columbia Law School in 1863, engaged in law practice for six years, and in 1872 was elected member of Congress from New Jersey and took an active part in the proceedings of that body. He was appointed minister to Italy in 1881, resigned in the following year, and in 1882-8 was again in Congress. In 1889 he was one of three United States commissioners to the International Conference on the Samoan question, held in Berlin, and in 1889-93 was United States minister to Berlin. In the latter year he was appointed judge of the New Jersey court of errors and appeals, which office he resigned a few weeks before his death.

**Phelps, William Lyon**, American educator: b. New Haven, Conn., 2 Jan. 1865. He was graduated from Yale in 1887 and is now (1904) professor of English literature there. He is the author of 'The Beginnings of the English Romantic Movement' (1893); 'The Permanent Contribution of the 19th Century to English Literature' (1901).

**Phenacetin**, fě-năs'ě-tin, in pharmacy,  $C_2H_5O.C_6H_4.NH.COCH_3$ , para-acet-phenetidin, is formed by the action of the strongest acetic acid on para-phenetidin, a body related to both aniline and phenetol. Colorless crystalline scales, odorless, tasteless, slightly soluble in cold water, more so in hot water or alcohol. It has found extensive use as an antipyretic and an analgesic, being one of the safest and most efficient drugs of its kind. Frequently combined with caffeine when used for headache, neuralgia, and the like. See ANALGESICS; ANTIPYRETICS.

**Phenacite**, a colorless, transparent mineral, not unlike quartz, for which it may be easily mistaken. It possesses extraordinary hardness, 7.5 to 7.8, and yields gems of much brilliancy. It occurs in prismatic or in lenticular crystals in Russia and France, also in the United States, at Florissant, and on Mount Antero, Colorado, and in New Hampshire. It is a baryllium and orthosilicate.

**Phenaco'dus**, a typical representative of the early extinct, ungulate group *Condylarthra* (q.v.), whose well-preserved remains are recovered from the Lower Eocene (Wasatch) formations of the central Rocky Mountain region. Two species are well known,—*P. primævus*, about as large as a tapir, and *P. wortmanni*, smaller. The head was remarkably small, and the brain-cavity relatively so, and the brain itself is smooth; the halves of the lower jaw are not fused at the chin; the dentition is generalized; clavicles are absent; the hind limbs are much larger than the fore limbs, and the feet are nearly plantigrade and five-toed; with the axis passing through the third digit, foreshadowing the condition of the single-hoofed animals (horses). Consult: Woodward, 'Vertebrate Palæontology' (1898); Beddard, 'Mammalia' (1902).

**Phe'no'l, Poisoning by.** See TOXICOLOGY.

**Phenols** (derivation uncertain, but probably from a Greek word signifying "purple-red," in allusion to certain color reactions that the phenols yield), in chemistry, a class of compounds derived from benzene and its homologues, by replacing one or more atoms of the hydrogen of the benzene ring (see AROMATIC COMPOUNDS) by an equal number of molecules of hydroxyl (OH). The simplest representative

of the group is ordinary "carbolic acid" (q.v.), and this is the compound that is understood when "phenol" is mentioned without qualification. Carbolic acid has the formula  $C_6H_5.OH$ , and is derived from benzene by replacing a single hydrogen atom by OH, the benzene being otherwise unchanged. If a second atom of the hydrogen of the benzene ring is replaced by a radical, the resulting compound is still called a "phenol," whether the second radical thus introduced is hydroxyl or not. If the second radical is hydroxyl it may be introduced in the "ortho," "meta," or "para" position, as explained under AROMATIC COMPOUNDS; and although all three of the resulting phenols will have the same empirical formula,  $C_6H_4.(OH)_2$ , we cannot conclude that they are identical in properties. In fact, we know that they are very different; for they have all been prepared and studied, and they are known, respectively, as "catechol" (or pyrocatechin), "resorcinol," and "hydroquinone" (or quinol). The cresols (of which there are also three) may be cited as examples of disubstitution derivatives of benzene, in which the substituted radicals are unlike. They have the formula  $C_6H_4.(CH_3).OH$ , one of the substituted radicals being methyl ( $CH_3$ ), and the other hydroxyl. The cresols are classed as phenols, because the hydroxyl replaces a hydrogen atom that formed part of the original benzene ring. If one of the hydrogen atoms of benzene is replaced by methyl, we have the compound  $C_6H_5.CH_3$ , which is called "toluene," or "methylbenzene." If we replace one of the hydrogen atoms in the benzene ring of this compound by OH, we shall thereby obtain a phenol; in fact, we shall obtain one of the cresols, just considered. But if we substitute OH for one of the hydrogen atoms in the  $CH_3$  radical of toluene, we shall obtain a compound having the formula  $C_6H_5.CH_2.OH$ , which is known as "benzyl alcohol," but which (although it has the same empirical formula,  $C_7H_8O$ , as cresol), is not a phenol, since the OH group does not replace a hydrogen atom of the original benzene ring.

The phenol group, it will be seen, is a very extensive one, and its chemistry is also quite involved. It is likewise highly important in industrial organic chemistry, and many of its members are used as dyes, or in the preparation of dyes. (Consult: Benedikt, 'Chemistry of the Coal Tar Colors.') As a class, the phenols bear more or less resemblance to the acids and to the alcohols. They dissolve in caustic alkalies with the formation of compounds known as "phenates," but many of them are too weakly acid to decompose sodium carbonate in the cold. When some of the substituted radicals are of an acid nature, the resulting phenol is much more acid in nature. Picric acid, for example, which has the formula  $C_6H_2(NO_2)_3.OH$ , is a phenol, but the presence of the three nitro-groups gives it so acid a character that it forms very stable salts. The resemblance of the phenols to the tertiary alcohols of the fatty series is somewhat marked, but there is no analogy among the products of oxidation in the two cases. Many of the phenols give violet, blue, or green colors when treated with a neutral solution of ferric chloride, ordinary "carbolic acid" giving a violet. Many also give a blue or a purple, when treated with a mixture of nitrous acid and strong sulphuric acid.



## PHENYL — PHIGALIAN MARBLES

**Phe'nyl.** See BENZENE.

**Pheræ**, fē'rē, now **Velestino**, a town of southeastern Thessaly, in the Pelasgiotis, 10 miles from its harbor city of Pagasæ; both towns were intimately connected with the myth of Alcestis (q.v.) and Admetus. In the last years of the 4th century B.C. a tyranny was established here by Lycophron, whose son Jason succeeded him, became the practical master of all northern Greece and thus the fore-runner of Philip and Alexander of Macedon, and was assassinated in 374, probably by his brothers. They quarreled quickly; Polyphron killed Polydorus, and was himself assassinated by his nephew Alexander in 369. But his reign was short; about 359 his wife killed him. Philip of Macedon, after an unsuccessful experiment with democratic government at Pheræ, made it a part of the province of Thessaly.

**Pherecydes**, fēr-ě-sī'dēz, early Greek philosopher, probably belonging to the middle of the 6th century B.C. He was a native of Syros (and is not to be confused with Pherecydes of Leros, 485-400 B.C., an Athenian historian, of whose works only fragments remain). His philosophy had an admixture of the Egyptian and probably inculcated metempsychosis. His great work, entitled 'Heptamychus' or 'Pentemychus,' — even its title is uncertain — has been the cause of much fruitless speculation as to its contents. Cicero says that Pherecydes was the first Greek to teach the immortality of the soul. Pythagoras was his pupil, and Philo Judæus is reckoned among his followers. The few remains of his writings, in the Old Ionic dialect, are edited in Müller's 'Fragmenta Historicorum Græcorum' (1850), and the recently discovered 'Marriage of Zeus and Chthonia' in Grenfell, 'New Classical Fragments' (1897).

**Phi Beta Kappa Society.** See GREEK-LETTER SOCIETIES.

**Phidias**, fid'i-as, Greek sculptor: b. Athens about 500; d. there 432 B.C.; and therefore flourished in the age of Pericles. He was the son of Charmides, and a pupil of Hegias the Athenian and probably of Ageladas, the sculptor of Argos. The works of himself and his pupils were exceedingly numerous, and he is said to have executed three statues of Athena alone, all of which were standing in the time of Pausanias (175 A.D.). One colossal statue, "Athena Promachos," that is, the champion, was of bronze, the metal for which was taken from the spoils of Marathon. It stood between the Parthenon and the Propylæum. Upon her shield, in rilievo, was wrought the battle of the Centaurs, from designs by Parrhasius. Near the statue stood an owl, the bird of Athene goddess of wisdom. This statue towered so high on the acropolis that mariners, doubling the promontory of Sunium, saw her helmet and her spear. The second of his most famous statues was made of ivory and gold. It was the statue of the Parthenon, or the temple of Parthenos, the virgin goddess, and was about 41½ English feet in height. This was the renowned chryselephantine statue, formed of wood overlaid with ivory. The arms were of gold, as was the peplos or garment, and the metal was either beaten or cast with such exquisite skill that this robe might be put off or on, and could be weighed by the treasurer of the temple. Thus the sculptor was

enabled to refute the charge of peculation afterward made against him. The gold weighed 44 talents. The eyes were of marble, painted according to the Homeric description of the blue-eyed goddess. The figure stood upright, ægis on breast and spear in hand. A serpent or dragon stood near it, supposed to be that of Ericthonius, one of the gods of the hill. In the right hand of the goddess was the figure of Victory, of ivory, with a vestment of gold, four cubits high. By her side stood the shield; on the convex side of which was carved the battle of the Titans. Phidias is said to have introduced portraits of himself and of Pericles in the carvings of this shield. The Olympian Zeus of Phidias was ranked for its majestic beauty among the wonders of the world. Zeus was here seen sitting upon a throne, with an olive wreath of gold about his temples; the upper part of his body was naked; a wide mantle covering the rest of it, hung down in folds to his feet, which rested on a footstool. The naked parts of the statue were of ivory, the dress was of beaten gold. In the right hand stood Victory facing the statue, and carved, like it, out of ivory and gold; she was holding out, as if offering to the deity, a fillet of triumph. In his left hand Zeus held a sceptre, made of various metals skilfully joined, and on the sceptre an eagle had alighted. Power, wisdom, and goodness were admirably expressed in his features. Cicero relates that the artist was led by a passage in the Iliad to conceive such a figure. The statue was surrounded and concealed by hanging tapestry, which was drawn aside only on particular occasions. This statue was removed to Constantinople by Theodosius I., and destroyed by fire in 475.

Phidias was, moreover, employed by Pericles as an architect, and by his genius Athens was made the most magnificent city in Greece. During the government of Pericles, which lasted 20 years, it was adorned with more temples, colonnades, and works of art than Rome could boast the construction of in seven centuries. Materials and artists were abundant. Phidias superintended these improvements; and the sculptures with which the Acropolis was adorned were partly from his own hand and partly worked out by pupils in the spirit and after the ideas of this great master. Phidias received great honors from the Athenians, but was subsequently accused first of peculation and then of impiety for putting his own likeness and that of Pericles on the shield of Athena. He died in prison.

Consult: Murray, 'History of Greek Sculpture' (1890); Waldstein, 'Art of Phidias' (1885); Gardner, 'Handbook of Greek Sculpture' (1896-97); Collignon, 'Phidias' (1886); Müller, 'Commentatio de Phidiæ Vita et Operibus' (1827).

**Phigalian** (fī-gā'li-an) **Marbles**, a frieze from the temple of Apollo Epicurius at Bassæ, four miles from Phigalia in Arcadia, rediscovered by Bochor and by Chandler in 1765, when the temple was practically intact, having been nearly hidden by the vegetation of the mountain slopes below which it lies. The temple was unique in that its orientation was north and south, instead of east and west, and in that its frieze was on the inner walls of the cella, a circumstance which preserved it from weathering.



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The frieze contained 23 bas-reliefs, each 2 feet 2½ inches high; it was purchased by the British government in 1814 for £15,000 and is poorly executed, although the original design was evidently excellent. The restoration of the temple, a Doric building, 125 x 46 feet, of yellowish limestone, has been undertaken by the Greek Archæological Society. Consult Cockerell, 'The Temples of Jupiter Panhellenius at Ægina and Apollo Epicurius at Bassæ' (1860), and Smith, 'Catalogue of the Sculptures in the British Museum' (1892).

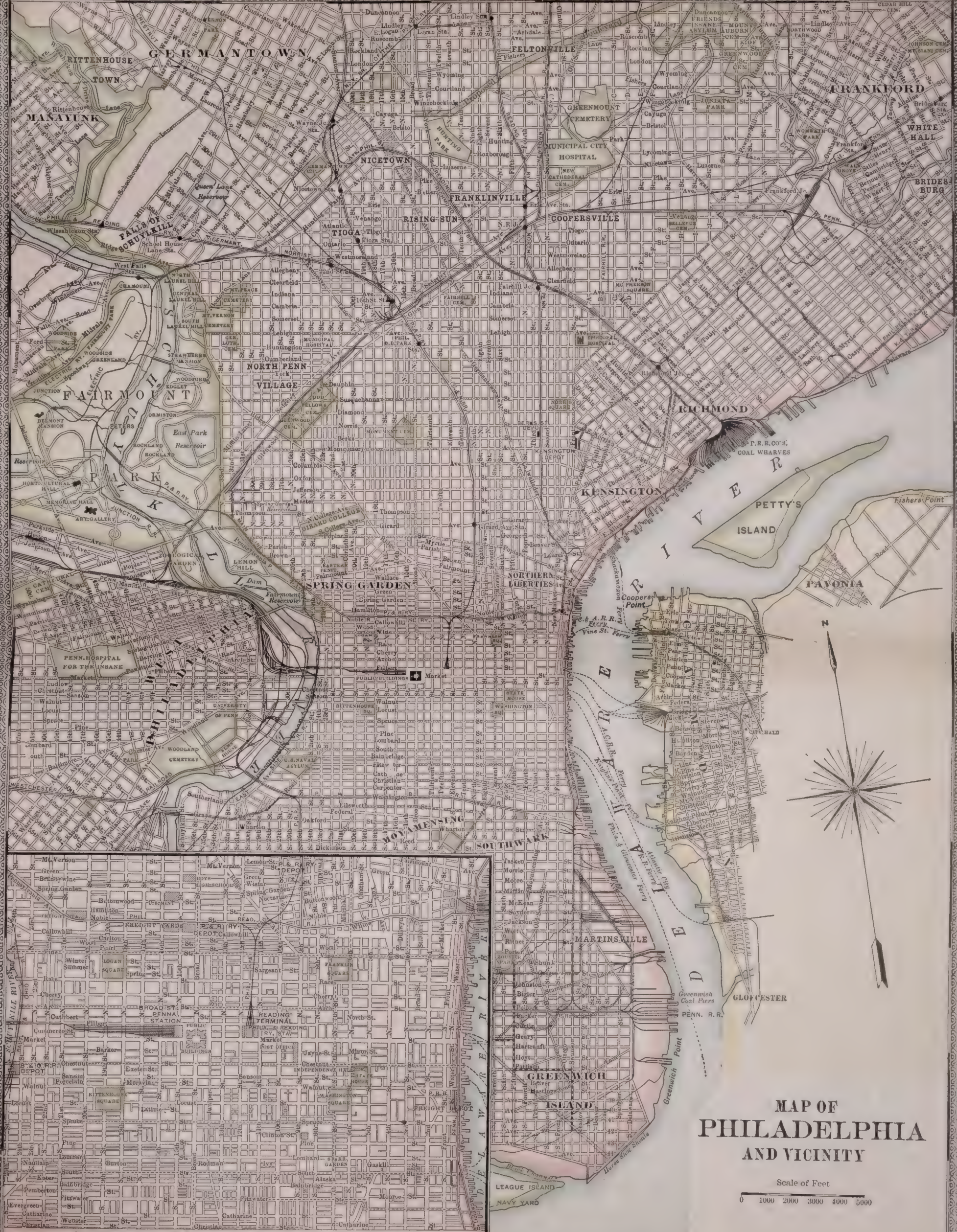
**Philadelphia**, Pa., city, the largest in the State, and the third largest in the United States; at the junction of the Delaware and Schuylkill rivers (Independence Hall, lat. 39° 56' 57.5" N., and lon. 75° 8' 54.75" W. The site was decided by the "Falls line," which on the Schuylkill set a limit to inland navigation and to deep sea craft on the Delaware. Both causes established the centre of population between the Hudson and Chesapeake Bay on the peninsula, partly alluvial and partly glacial drift where the Delaware and Schuylkill meet, 96 miles from the Atlantic and about the same distance from New York and Baltimore. Its area, 83,340.12 acres land and 1,593 water or 84,933.12 acres, 132.7 square miles in all, is an irregular figure whose curving eastern boundary is the Delaware, on whose right bank the city was founded. The southern limit is a line east and west drawn across the junction of the two rivers. Its western and northern limits are Delaware, Montgomery and Bucks counties along boundaries due to the early colonial administrative lines of old Philadelphia County, resting on proprietary grants and having no natural boundaries. The longer axis of the city, running north and south, is 23 miles, and the shorter from 5 to 12 miles. Within this area are three regions: first, the low flat peninsula between the rivers, from 8.7 to 40 feet above Delaware mean low tide, a 20 foot contour line crossing at Reed street, and including nearly all the area built over. The second region is bounded to the south by a 40 foot contour line, whose southern angle reaches to Broad and Callowhill, and rises over on a strike of azoic schists and gneisses (Spring Garden Street), crossing from the Schuylkill to the Delaware (Bush Hill). This region runs to the north, with lower ground near the Delaware, culminating in the northwest in Chestnut Hill, reservoir 431 feet high, and other elevations of like height. The third region is west of the Schuylkill (West Philadelphia), a rolling country 200 feet high in West Park and 100 in the region built over. The old city was laid out from river to river and the peninsula. The factory section grew up in the second region, with Germantown and Chestnut Hill on the elevations. West Philadelphia began and remains an open suburban residential district. Three lower streams crossing the city originate outside its limits. One, the Wissahickon, draining an upland plain outside the city, has cut a cañon-like valley through primitive rocks and enters the Schuylkill at Manayunk, furnishing a remarkable park feature. Across northeastern Philadelphia, as yet little built, the Pennypark and Tacony flow, both draining the plateau north of Philadelphia. The drainage of the main city site is by parallel

streams entering the Delaware, Wingohocking and Gunner's Run being the most important, originating on the elevated region in the northwest of the city. These and parallel streams have been made the basin of a sewerage system, which has in nearly all the built-up city a fall of from 20 to 40 feet. The soil on which the city is built is fertile, and conducive to the growth of trees. The rivers give a navigable frontage of some 40 miles, 20 miles on the Delaware, of which only about five miles are yet furnished with docks. An abundant water supply is obtained from the rivers. The low level and uniform contour lines, and the absence of restraining physical features have led to the spread of houses in all directions, and the city has grown by accretion rather than extension, settlements starting at favorable points, as Germantown began on the sunny southern and fertile slope toward Chestnut Hill, or about mill, shipyard or furnace, and being gradually included in the city as the limits were extended. Philadelphia in this respect resembles the amœba-like growth of London, rather than the organic extension of Paris or the protension of New York.

Philadelphia was the first of the long series of modern municipalities, of which Dalny is the last, whose plan was prepared for a particular site. This plan, prepared by Thomas Lloyd, a London surveyor for Penn, laid out the old city in a parallelogram 10,922 feet 5 inches east and west and 5,370 feet 8 inches north and south, extending from river to river and from Vine to Cedar, now South, comprising two square miles. In this area two streets, Broad and High, now Market, were laid out at right angles, six perches; the main streets were made 3 perches and the alleys a perch and a half. The main streets defined squares of about 400 feet, containing four acres, bisected by alleys. This gave 30 per cent of the area to street surface, twice the usual proportion in the European city of the day, as the two chief arteries were twice the width of the broadest streets provided for in London, or 3 perches. Broad is now 113 feet, Market 110, main streets 50, and alleys 25. This rectangular plan has been extended over the entire area, and has guided the plan of all American cities since. This rectangular system was followed by Randell in New York, and by reducing all realty to a lot of uniform size has rendered its transfer easy and certain. On the original plan the streets running north and south were numbered, and those east and west named after trees. These have since been supplemented by the names of governors of the State and a wider nomenclature. At irregular intervals avenues 100 feet wide have been added, several running diagonally. The numbered streets now extend to 63d, a centenary system of numbering, under which the century changes for every block, renders the house number a co-ordinate, which fixes the place of any lot in the city system. Lastly in 1899, duplicate street names and those altering at a remove in distance were abolished and the lesser streets between the main streets given the same name all over the city, even where they exist only fragmentarily and run for a square or two.

The area thus plotted is now built over for about 40 per cent of the city; in about one fourth streets have not been planned on the





**BUSINESS PORTION OF PHILADELPHIA  
ON ENLARGED SCALE**

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## PHILADELPHIA

city plan, and the rest has streets laid out and often improved, but not yet covered by buildings. These increase on an average of 6,000 yearly, the number rising in some years to 11,000. Of this yearly increase but a few hundreds are small dwellings averaging under \$3,000 in cost. The constructed city in 1903 consists therefore of about 52 square miles, on which stand 323,783 buildings, of which 298,144 are dwelling houses. There are in all 1,661.89 miles of streets, of which 1,224.89 are paved, or 18,750,801 square yards as follows:

Cobble and rubble.....	73.12
Granite block .....	367.80
Vitrified bricks .....	141.73
Sheet asphalt .....	337.69
Block asphalt .....	19.30
Macadam .....	262.66
Granolithic .....	12.77
Slag block .....	9.82

Of this 817 miles of improved pavement and 262 of macadam have been laid since 1880, a period in which the entire city has been repaved. The sewerage is 951 miles; in 1883 only 238 miles were laid on a "combined system" in 23 sewer districts, 148 miles main and 773 branch. These in general follow the drainage basin of old streams and are calculated to dispose of a rainfall whose maxima and minima run from 23 to 67 inches annually. Surface drainage for household slops and waste water still exists in a large area in the older part of the city, and the number of houses not directly connected with the sewer system is still large.

The waterworks of the city, gravity supply from Schuylkill, begun in 1799, have cost, 1902, \$56,498,000, of which \$5,543,722 was for new sand filtration works, which are to cost in all \$26,000,000. The average annual supply is 243 gallons per day per capita, an excessive supply due in part to leaking mains and waste, no meter system being in use, and in part of the lavish conveniences of a city in which 298,144 dwellings are supplied with 282,798 baths. Only 2,000 houses are without water. The filtration plant is to provide 300,000,000 gallons per day, pumped from both the Schuylkill and the Delaware. The former, like the latter, receives the sewage of a large population, and typhoid fever has been for years endemic; deaths in 1899, 948, and averaging 611 annually for five years, 1898-1902, with some 12,000 cases. A special fire reservoir covering 425 acres, pressure 70 pounds, has been installed in the business centre.

*City Government.*—Penn granted the first city charter, 1701, on the model of Bristol, following English precedent, establishing a body corporate of mayor, council, and freemen of its liberties. This was altered by Act of March 11, 1789, creating a city government which remained substantially unchanged until 1854; the city was made conterminous with the county, absorbing 13 townships and, 1885, a new charter was passed, "Bullitt Bill." The Act of 1789 created an elective mayor, chosen biennially, the city's executive head, whose chief duties were the charge of the police, a select council, one from each ward, three year term, common council, one for every 2,000 taxables, a health board, park commission, park wardens, selected by common pleas judges, 12 guardians of the poor, chosen by councils, whose committees conducted most of the executive administration of the city. The Act of 1885 ex-

tended the mayor's term to 4 years, greatly enlarged his power, gave him the appointment of all city officials and consolidated the multifarious city officers under departments with a single head: works, public safety, police, fire, etc., charities and corrections and supplies, the parks, public schools; city trusts, including management of Girard estate, remain under boards named by judges. This charter, which has received much less amendment than is usual from American legislatures, has unquestionably aided the dominance of a single powerful political machine, but it has also greatly improved city administration. Of 5 mayors under this charter, 4 have been men of high character. Besides the mayor, receiver of taxes, city treasurer, city controller, city solicitor are elected. Park wardens 19, 16 elected by councils, one each by Chester and Bristol, and a master warden appointed by governor.

*History.*—The original site of Philadelphia was occupied by Delaware Indians, tributary to the Iroquois, peaceful and industrious. Through the 17th century, Swedes and Dutch made a number of settlements on Delaware River and Bay, most of them abortive, of which the only permanent monument is "Old Swedes Church," Gloria Dei, erected 1700 on the site of a Swedish fort, 1653. Some 368 Swedes and Dutch and over 800 English immigrants, newly arrived, were in and about future Philadelphia, when in 1681 Penn received his charter as proprietary, and a year later visited it and laid out its plan. The city grew with great rapidity and became the grain and lumber mart of the Atlantic coast. In 1725, it was overbuilt and passed through its first reaction. For 40 years in the middle of the 18th century Franklin was the dominant figure, founding the American Philosophical Society, Philadelphia Library and Pennsylvania Hospital, all growing out of the Junta, a body which, with various mutations, led to the Committee of Safety, which governed the city through the Revolution. Peace brought a rapid expansion of population and commerce, checked by yellow fever, which from 1741 to 1798 was frequent, and in the last decade of the century twice ravaged a most filthy city. It was 20 years before the city recovered from the loss of trade, the embargo and bank failures. By 1820 growth began; many institutions, deaf and dumb, blind, city almshouse, etc., were founded, and building went on rapidly, until 1837. Ten years of disaster succeeded, culminating in the failure of the Bank of the United States. Coal and railroad connection with anthracite developed manufactures, and from 1850 to 1880 they led in aggregate product this field. This industrial expansion culminated in the Centennial Exhibition, 1876, (q.v.), attended by 9,910,966 persons. A reaction succeeded, and when the city emerged from this in 1879-80, it was to begin a new period of development in highly skilled manufactures, the quality of its textiles greatly improved. Cramps, shipbuilder; Baldwin, locomotives; Dobson, carpets; Stetson, hats, and 8 other like establishments were at the close of the 19th century the largest in their line known anywhere.

*Population.*—The early population of Philadelphia shares the usual doubt attaching to all colonial statistics. In 1683 the city proper was



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estimated to have 80 houses and 500 inhabitants. It quadrupled in a year, and in 1699 a rude census showed 4,500 inhabitants. In 1720 it was estimated at 20,000 inhabitants, and the count in houses in 1772, 4,474 indicates a population of 26,844. House census in 1777, which found 5,743 dwellings, indicates a population of 35,000.

It is noticeable as an indication of the higher comfort of the 19th over the 18th century that while the average persons to a dwelling was  $6\frac{1}{2}$  in the latter, it has never exceeded 5 and is now a little over 4. Exact statistics began with the Federal census, 1790. In comparing the population by decades, it must be remembered that it is not until 1860 that the area of the city and county are the same. In the following table, the population of city and the total population of the county are given side by side up to 1850, the population after this date being the same for both city and county.

	City	County
1790 .....	28,522	54,391
1800 .....	41,220	81,009
1810 .....	53,722	111,210
1820 .....	63,802	137,087
1830 .....	80,462	188,797
1840 .....	93,665	258,037
1850 .....	121,376	408,462
1860 .....	565,529	.....
1870 .....	674,022	.....
1880 .....	847,170	.....
1890 .....	1,046,964	.....
1900 .....	1,293,697	.....

The population of the county of Philadelphia down to and including 1820, was larger than the population of New York, though the population of the city of Philadelphia was smaller. In 1830 and 1840, the city was exceeded by New York and Baltimore, in 1850, by New York, Baltimore, and Boston. It remained after its annexation of the entire county, second, until the census of 1890, when it remained as it still is, the third city in the Union, being exceeded by New York and Chicago.

The population of the wards composing the original city is 94,724, almost exactly what the population of the same area was in 1840, 60 years ago. The early population of Philadelphia had a larger proportion of Germans, French (Huguenots), and Swedes than any colonial city, New York early losing its preponderance of Dutch. This mixture of races has continued, but an unusually large share of its population is native-born. No other large Northern city has so large a proportion; 63 per cent, born in its own State, and the foreign-born share 22 per cent, 295,340, is only less in Baltimore and Saint Louis. The share of persons of foreign parentage is over one half, 55 per cent. Only a little less than a fourth, 24 per cent, or 390,157, are of native birth, and native parentage. The colored population, 62,613, is larger than any Northern city; but a century ago it was a tenth instead of a twentieth. Of the foreign-born population, 295,340, 98,427 are Irish, 71,319 German, and 36,752 English.

*Manufactures.*—Consolidation began in the manufactures of the city, when 8,481 establishments in 1880 rose to 18,166 in 1890, and diminished to 15,887 in 1900. Capital which had not grown from 1870 to 1880, trebled by 1900, and was \$470,529,407. One sixth of the population, 246,445, was employed, on the average, with wages \$111,847,076, and a total product of

\$603,466,526 and raw materials \$32,687,744. Children, 8 per cent in 1880, were 5 per cent in 1900, and women, 30 per cent in 1880, were 25 per cent in 1900, though women at work had increased. New York and Chicago were the only cities with larger manufactures, and expenses are relatively larger in both, rent and taxes being far higher. The product in leading lines is, the numeral in parenthesis indicating the position of Philadelphia, with reference to American cities: Bookbinding and blank-books (2) \$1,571,502; boots and shoes (9) \$5,931,045; carriages (5) \$1,960,779; cars (4) \$3,651,401; chemicals (1) \$7,810,456; clothing (3) \$27,254,896; cotton goods (5) \$15,723,654; foundry and machine shop (3) \$38,372,971; hats and caps (3) \$1,364,100; hosiery (1) \$13,040,905; iron and steel (12) \$7,208,948; leather (1) \$18,187,231; malt liquors (5) \$12,606,551; lumber, planing mills, etc., (3) \$3,200,142; patent medicine (3) \$3,013,034; printing (3) \$10,066,740; newspapers and periodicals (3) \$13,076,840; silk (5) \$4,531,794; tobacco, cigars and cigarettes (2) \$8,687,349; woollens (1) \$18,340,012; worsteds (3) \$16,242,250.

*Buildings.*—The architecture of Philadelphia was early determined by glacial clay-giving brick, azoic marbles and red sandstone. These combined to give house fronts a common aspect jointly derived from South England and the Palatinate. The pre-Revolutionary house is illustrated by Penn's house in the Park, his grandson's mansion in the Zoological Gardens, and various early houses of Germantown. Independence Hall and Christ Church, both following Gibbs' models in London and designed by John Kearsley, begin the list of historical edifices, with two of the best colonial residences known. The custom-house (Doric), designed by Ebuchland, and MacArthur's Girard College (Corinthian) illustrate neo-Grecque at its best. Le Bruni, Roman Catholic Cathedral and Academy of Music, reflect the first appearance of Renaissance, while Notman's St. Mark's is one of the earlier of our Gothic buildings. The vast clumsy Renaissance marble pile of the City Hall, "Public Buildings," covers  $4\frac{1}{2}$  acres, 90 feet high in front, central pavilion 303 feet, and tower 547 feet  $11\frac{1}{4}$  inches, is  $2\frac{3}{4}$  feet shorter than Washington Monument, which it was intended to exceed. It is 470 feet square, has 15 acres of floor and has cost \$25,000,000, and follows MacArthur's design derived from the second empire.

On the same square fronts the Masonic Temple, granite Norman, J. T. Windrim architect, and the Pennsylvania depot (Frank Furness) in English Civic Gothic with a florid sculpture by Carl Bitte. The Reading terminal is the other large depot of the city. Other buildings are Trinity Church, First Baptist Church, Art Club, and Horticultural Hall, both designed by Frank Miles Day. The sky-scraper appeared late in Philadelphia, but there are the Real Estate Trust, Land Title, Girard Trust, and Betz Building, a number steadily increasing.

*City Transit.*—The width of the city streets permits on all but the few 100-foot thoroughfares, some 30 miles in length, street cars in only one direction, but one third of the paved streets of the city, 410 miles, are tracked, or taking double track 475 miles. This is now consolidated





INDEPENDENCE HALL AND SQUARE, PHILADELPHIA.

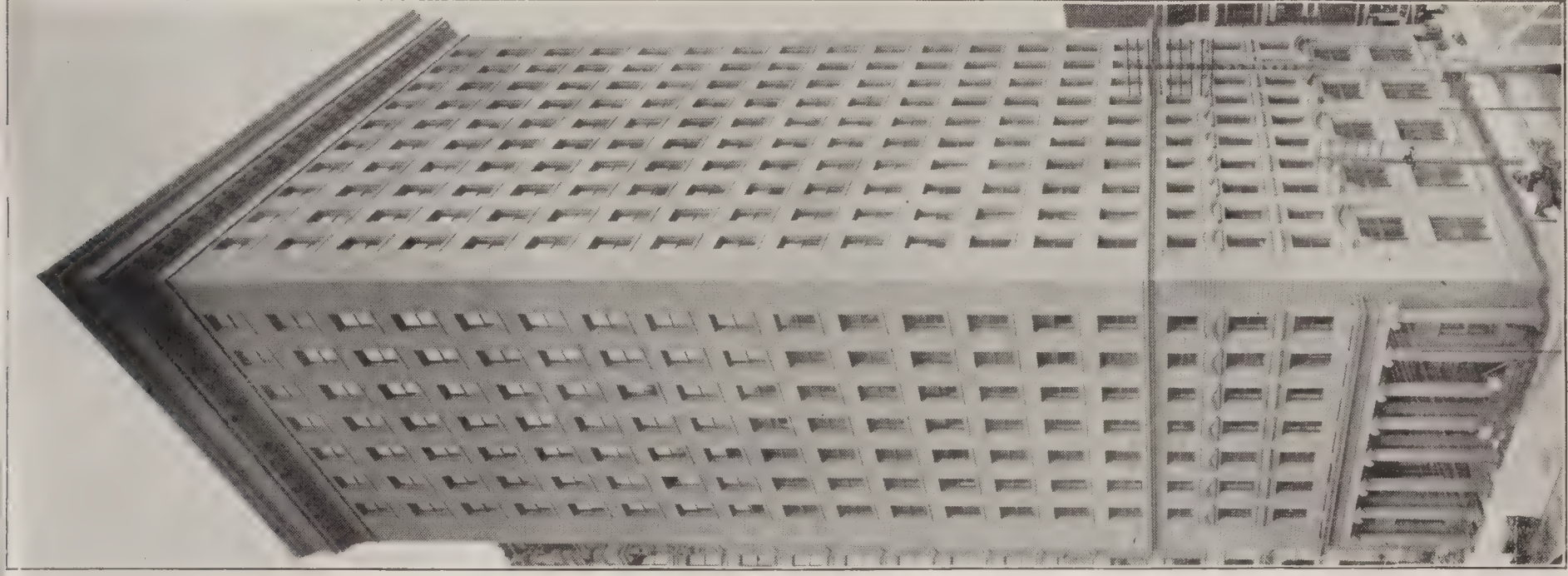




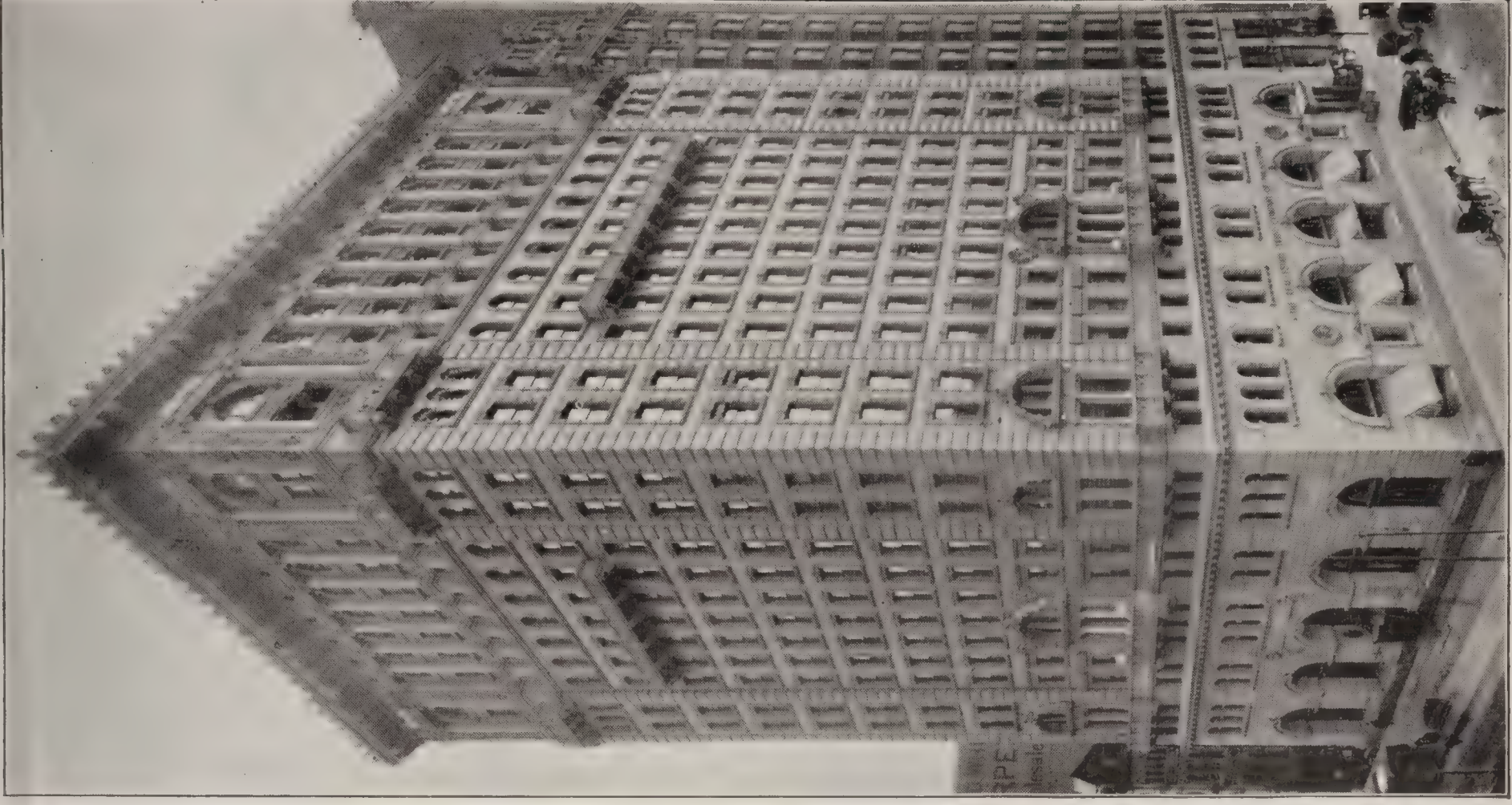




LAND TITLE BUILDING.



NORTH AMERICAN BUILDING.  
MODERN OFFICE BUILDINGS, PHILADELPHIA.



REAL ESTATE TRUST BUILDING.







## PHILADELPHIA

under one corporation, Philadelphia Rapid Transit Company with a capital of \$130,000,000, an overhead trolley system transporting 325,000,000 yearly and with 9,000 employees. While the valuable franchises held were conferred without payment, taxes are from 6 to 8 per cent of gross receipts and \$10,000,000 has been spent in paving streets occupied by the lines, a condition of the original franchise. The Pennsylvania & Reading own 360 miles of track, reaching the centre of the city on viaducts and furnishing belt freight lines. The city and Reading expended \$7,500,000 to sink and elevate the tracks of the latter. Grade crossings, of which there are several hundred, cause an average of a death a week and are to be removed by joint expenditure.

*Parks.*—The original plan of the city contained five small squares, each about 4 acres, to which Independence Square of the same size was added. The present park system of the city consists of Fairmount Park, 2,968 acres, with 373 acres of the Schuylkill River. This is divided between the East Park, 633.7 acres; West Park, 1,323.8 acres, and Wissahickon, 1,010.8 acres. There are besides Fairmount Park, League Island Park, 300 acres; Honting Park, 41 acres, and 46 small parks, including the 5 already mentioned 401 acres, in all 4,010 acres. Fairmount Park began with 5 acres purchased in 1812 and opened in 1825, for the waterworks; enlarged to 41 acres in 1855 and to its present dimensions in 1867–8, when a number of country estates on the Schuylkill were expropriated. In the first decade, an agitation for small parks has led to the purchase of over 20 small tracts, usually the house and grounds of some former suburban estate. Of these, the most important is Bartranis Garden, which preserves unchanged the house and arboretum of the first American botanist. The park system of the city is rich in forest growth and has lacked intelligent and trained landscape management.

Philadelphia has 18 cemeteries and 35 burial places, of which the largest, West Laurel Hill, 136 acres, was begun in 1836. Its monuments are estimated to have cost \$3,000,000. Intramural interment in the churches and church-yards in the centre of the city is still permitted to an extent (5,048 in 1902) allowed at present in no other large city.

*Libraries and Reading Rooms.*—In all 57 libraries and reading rooms. The Library Company of Philadelphia, established 1731, has 200,000 volumes divided between two buildings a mile apart, at Locust and Juniper, and Broad and Christian. The Mercantile Library has 189,000 volumes. Both are subscription libraries and open to the public only for consultation, required of all libraries in return for exemption from taxation. In the Philadelphia Library considerably over half the expenditure is from endowed funds, the largest foundation being from Dr. James Rush, \$1,000,000. The other large libraries of the city are technical and special in character. Academy of Natural Science (Scientific) 50,000 volumes and 15,000 pamphlets, Athenæum, subscription, 35,000; Drexel Institute, 27,000; Franklin Institute (technical), 51,000; American Philosophical, principally Transactions, 35,000; University, 60,000. While Philadelphia was the only city in the country with public libraries in the 18th

century, it was the last of the larger cities to establish a free public library. Founded on the branch libraries established by the Board of Education, it has developed its circulation through these and has 14 branches over the city. Its circulation in 1903 was 1,719,452 volumes, with 403,000 readers. Over 100 branch libraries are circulated in fire, police, telegraph stations, schools, etc. This library has an interesting collection of incunabula. Other collections are Americana, particularly of the Middle States in the Pennsylvania Historical Society, and the Franklin papers, American Philosophical Society, and early printed books, Philadelphia Library.

*Education.*—The education of the city has gone through three stages. From 1681 until 1817 the city was unprovided with any public schools, the only education being in schools for which a fee was charged. Between 1817 and 1830, while free schools existed, they were expressly set apart for those unable to pay a fee. Since 1830, public schools of the city have been free to all. The Provincial Council, 26 Oct. 1663, provided for the hire of a schoolmaster, and established the fees to be charged for his tuition in the ordinary English branches. In 1689, the "William Penn Charter School" was opened, chartered 1697, and has been continuously in operation down to the present time, its building standing now, as it has for many years, at 12th and Market.

In 1743, the Academy and Charitable School of the Province of Pennsylvania was outlined by Benjamin Franklin, urged in a pamphlet in 1749, and the Common Council of the city began in 1750 the policy followed by the city since, of establishing scholarships by giving £200 in cash, £50 per annum for five years, and £50 additional for each scholar sent to the Charity Department. Out of this Academy grew the University of Pennsylvania. The chartered Academy or Grammar School, and the teacher hired or licensed by the State by charging a fee to all pupils, continued the education of the city during the 18th century. In 1818, public provision was made for the education of "indigent" children. In 1819 the public schools had 10 schools, 10 teachers, 2,845 pupils, or about one fourth of the school population; adding the attendance at private schools, somewhat less than one half of the school population was then in attendance. At the present time the attendance in public and private schools together, is between 90 and 95 per cent of the total, those absent being almost altogether children representing the wayward, feeble, undeveloped, or semi-criminal classes. The total enrolment December 1903, is 161,066, of which 6,065 is in the high schools. The attendance is 135,315; 5,419 in high schools; teachers, 3,827; schools, 327, of which 249 are elementary, 13 cooking schools, 7 special schools for those unable or unwilling to maintain their standing or attendance in the regular schools; 6 high schools, 1 industrial art, and 1 elementary manual training, with 15 evening schools which are only open one half the year.

For boys there are the Central High School and 2 manual training schools; for girls, a high school, a commercial high school, and a normal school, training for teachers. The city in addition pays the tuition fee of 200 graduates in its high schools of both sexes, in col-



## PHILADELPHIA

leges, and professional schools, and provides over 400 more scholarships in the various art schools in the city. Besides the public schools, the parochial schools in the city—chiefly Roman Catholic—contain 30,000 pupils, maintaining a high school, and private schools, add to this nearly 3,000 more. Girard College, receiving white male orphans from 9 to 18, has 1,600 pupils.

In higher education, the University of Pennsylvania had in 1903 281 instructors, and 2,578 students. It maintains in its college department besides the usual arts course, technical courses in architecture, mechanical engineering, music, etc. Its medical school—a four years' course—had 475 students, and its law school 339. The University, originally at Ninth and Chestnut, upon the site now occupied by the federal post-office and court-house, is at Woodlawn and 33d Street, where since the removal in 1876, 29 buildings have been constructed, including a library, free museum of sciences and art, a hospital, and a botanical garden. In return for the grant of the land on which the university stands, the city receives 50 scholarships in the university and pays the tuition of some 75 students more.

Divinity schools are maintained in the city by the Presbyterian, Lutheran, Protestant Episcopal, Roman Catholic and Reformed Church.

Besides the medical school of the University of Pennsylvania, there are the Jefferson, Medico-Chirurgical, Philadelphia Medical School of Temple College, Woman's, and Hahnemann.

The attendance on these schools has for a number of years averaged from 1,500 to 1,600. Four dental schools have an attendance of about 1,200, and the pharmacy schools, 550. Philadelphia has been notable for large foundations intended to provide industrial training for the indigent. Girard College, founded by Stephen Girard, has an endowment of nearly \$15,000,000. The Williamson Trade School, just outside of Philadelphia, received an endowment of nearly \$2,000,000, and the Drexel Institute, a day and night school (the others boarding their pupils) gives technical courses in art, mechanical engineering, architecture, chemistry, cooking, dressmaking, etc. Art and applied art are also taught in the Pennsylvania Academy of Fine Arts, the oldest art school in the country, Pennsylvania Museum and School of Industrial Art, the Woman's School of Design, Spring Garden Institute, aggregating nearly 3,000 pupils.

*Churches and Charities.*—There are, 1903, 2,376 associations of all orders, churches, hospitals, libraries and charities, devoted to humane ends. The exempt realty of these bodies aggregates about \$50,000,000, and is divided in nearly equal shares between churches and charitable and educational foundations. Churches and mission congregations number 364 and there are 265 societies religious in object or membership.

In 1890 when the last complete returns on this subject were collected, the city had 610 religious organizations owning \$28,023,365, of property, and having 335,189 members. Of these 163,658 were Roman Catholics, an enumeration including all baptized persons. Of the remainder, 161,531. 35,185 were Presbyterians, 32,925 Methodists, 28,319 Protestant Episcopal, 25,193 Baptists and 11,653 Lutherans.

About 1,200 agencies are directly engaged in various forms of physical relief. Of these 40 are special and 22 general hospitals, with 16 dispensaries. There are 40 children's asylums, 12 day nurseries, and 8 general agencies for the relief of children. No general statistics exist as to the expenditure or population of these various societies. The 35 hospitals reported by the State Board of Charities have 4,500 beds. The Philadelphia or City Hospital is the largest of these with 1,300 beds and the Pennsylvania Hospital, founded 1752 by Benjamin Franklin and others, occupies a square at Ninth and Pine Streets and has a front of 218 feet, front building 1,752, main edifice 1,795, large additions in the past decade. The other large hospitals are Episcopal, St. Joseph's, Methodist, German, Jefferson, Polyclinic, Medico-Chirurgical and University. The Pennsylvania Institution for the Deaf and Dumb, established 1820, 500 inmates; Home for training in speech infant children, 60 inmates; Pennsylvania Institution for Blind, established 1820, 192 inmates; Pennsylvania Training School for Feeble-Minded Children, established 1853, 1,050 inmates; Children's Aid Society, Society to Protect Children from Cruelty, are conspicuous societies, supported by public appropriations, endowments and private charity.

TALCOTT WILLIAMS,  
*Editor of 'Philadelphia Press.'*

**Philadelphia, Destruction of the,** one of the greatest exploits in naval history. This American frigate pursued a piratical Moorish vessel into the harbor of Tripoli, 3 Oct. 1803. In endeavoring to beat off from the harbor the Philadelphia struck on a sunken rock, which was not laid down in the charts. The Tripolitans at once trained their powerful batteries on the helpless vessel, and Captain Bainbridge, in command of the Philadelphia, had no resort except to surrender. He and his men were treated humanely, the Bey having learned to respect the courage and dread the vengeance of the Americans. Captain Bainbridge succeeded in sending information of his misfortune to Commodore Preble, in command of the American squadron, at Malta. Meantime the Tripolitans had worked the frigate off the rock, and removed it into the harbor, where they were fitting it out to be used against the Americans. Commodore Preble assigned Lieutenant Stephen Decatur to the dangerous task of entering the harbor of Tripoli, and destroying the Philadelphia under the guns of the forts. Lieutenant Decatur with 70 volunteers, started on his errand in a small vessel called a "ketch," which had been captured by the Americans, and christened the Intrepid. It was a moonlight evening, and as the officers and men were concealed below, the Intrepid looked to the Tripolitans like an innocent merchant vessel. A hail from the Philadelphia was answered in Maltese, and as the Intrepid was warped alongside the frigate, the Americans sprang from concealment, rushed on board, and after a fierce hand-to-hand fight, drove the Tripolitans into the sea. Then the Philadelphia was set on fire, and under the glare of the flames, and amid the thunder of cannon Decatur and his men retired in safety from the harbor.





PENNSYLVANIA RAILROAD STATION, PHILADELPHIA.







## PHILADELPHIA ACADEMY OF SCIENCES — PHILÆ

**Philadelphia Academy of Sciences**, an institution for the advancement of learning in the natural sciences, founded in 1812. It has a large and handsome building in the city of Philadelphia, and a number of valuable scientific collections, including the largest collection of shells in the world, a rich collection in fossils, and several collections of birds. It also provides scientific education without charge to young students. It publishes a 'Journal' and 'Proceedings.'

**Philadelphia (Tenn.), Military Operations at.** Philadelphia, a station on the railroad from Chattanooga to Knoxville, south of Holston River, was held in September 1863 as an outpost to Burnside's army, which was north of the Holston. On 27 September the Union troops were driven from the place and other points south of the river by the Confederates, who had advanced to threaten Burnside at Loudon and to cover a cavalry raid upon Rosecrans' communications with Nashville. In this advance the Confederates captured at various points 6 guns, 50 wagons, and some 600 to 700 prisoners. About 8 October Philadelphia was reoccupied by Col. Wofford, with his Union cavalry brigade of 1,200 men and 6 guns. On the 19th Gen. C. L. Stevenson ordered the Confederate cavalry brigades of Cols. Dibrell and Morrison to move upon Philadelphia and capture Wofford or drive him across the Holston. Dibrell was to move from Cleveland and attack from the south, while Morrison, marching from Wolf River Bridge, was to gain the Loudon road and attack from the north. Morrison, with 1,800 men, in approaching the Loudon road from the west, on the morning of the 20th captured a foraging train with its guard of 40 men, and in quick succession the 11th and 1st Kentucky Cavalry were sent by Wofford to recapture it. A fight ensued, with varying success, but Morrison finally interposed between the two regiments and Philadelphia, drove them in the direction of Loudon, and gaining the road two miles in rear of Philadelphia. Meanwhile Dibrell, moving through Sweetwater, came in sight of Wofford's 12th Kentucky and 45th Ohio, with the 6-gun battery, and at 1 P.M. opened with his artillery, and charged with his cavalry, but met with such a determined resistance that he was held at bay, and the action on that front lapsed into an artillery duel. Morrison now came up in Wofford's rear, dismounted his men, and began his attack. Leaving a small party to oppose Dibrell, Wofford, with his two regiments of 700 men and his battery, turned upon Morrison, repulsing several attacks. After three hours' fighting the artillery ammunition was entirely exhausted, and the carbine ammunition nearly so; Dibrell was closing in on one side and Morrison on the other; and Wofford ordered a sabre-charge to cut his way out to Loudon. He dashed against Morrison and broke through, just as Dibrell was cutting into his rear, detaching scores of prisoners. He left his guns, ambulances, 50 wagons, many horses and mules, and 447 prisoners in the hands of the Confederates, and made his way in some confusion to Loudon, being joined on the road by the 1st and 11th Kentucky. Morrison followed until he came in sight of Burnside's infantry near Loudon. The Union loss was 32 killed and wounded and 447 captured. The Confederate loss was 15 killed and 82 wounded.

E. A. CARMAN.

**Philadelphia.** See ALA-SHEHR.

**Philadelphians**, a sect or society of mystics founded in London toward the close of the 17th century by followers of the German mystical philosopher, Jacob Boehme, whose complete works had been translated into English and published at intervals between 1644 and 1662. There had already existed a society or sect of Boehmenists in England with a membership made up of cultured people and simple, but it became merged into Quakerism. The philosophy of Boehme had a special attraction for cultured mystics, and such were Dr. John Pordage, Jane Lead, Francis Lee, Bromley and the other founders of the Society of the Philadelphians or of Brotherly Love.

**Philadelphus, Syringa, or Mock-orange**, a genus of deciduous or sub-evergreen shrubs of the order *Saxifragaceæ*. The species, of which about 30 have been described, are natives of the northern hemisphere. They have three-nerved leaves, flowers in racemes or solitary on little twigs, and many-seeded dehiscent fruits (capsules). Twenty of the species recognized by Koehne are indigenous to North America. The popular name, "syringa," by which several of the species are widely known in America, is misapplied. *Syringa* is the generic name for lilac. The species are mostly hardy in the Northern States, tropical and sub-tropical species generally excepted. They are readily propagated by means of layers, suckers, cuttings, and seeds. But since the species readily intercross, seeds are rarely used except for producing new varieties. They will thrive in any ordinary well-drained soil and in any degree of sunlight; some will even stand shade. Since the flowers appear upon twigs of the previous year, pruning should be given, when necessary, in summer just after the plants have blossomed. The popular garden forms are much alike in appearance, but some are much more fragrant than others. Probably *P. coronarius* is the most common. It is a native of western Asia and southern Europe, and is one of the most fragrant.

**Philæ**, fi'lê, an island of the Nile in upper Egypt, on the old boundary of Ethiopia, about 7 miles south of Assouan and on the southern side of the First Cataract. The name Philæ seems to be an attempt to reproduce in Greek *Pilak* or *Pilakeh*, a Coptic word meaning "corner" or "end," given because of the border site of the island; it is now called Jeziret el-Birba, "Temple Island," or Jeziret Anas el-Wogud, "Island of Anas el-Wogud," as the scene of a tale in the 'Arabian Nights', whose hero is so called. The present site of the island is in the Assouan reservoir; see plate accompanying article ASSOUAN. The flood waters overflow the island, but elaborate precautions have been taken to strengthen the foundations of the various temples; these are described in the article ASSOUAN. "Temple Island" is the most expressive appellation for this place, which was sacred to Isis and is covered with remains of the best preserved temples of all Egypt. The island is scarcely less remarkable for its position high above the surrounding waters, so that it was never overflowed until the building of the Assouan dam, and for its beautiful vegetation, luxuriant palms and mimosas, than for the adaptation of Egyptian architecture, usually massive



and majestic, to the exigencies of an island scarcely 1,200 feet long and 400 feet wide. The monuments of Nectanebo II. (4th century B.C.) are the oldest now existing on the island or anywhere mentioned in inscriptions as having been built here. The temple of Isis, which was doubtless antedated by an important cultus, was begun in the time of Ptolemy II. Philadelphus, carried out by his successor, Ptolemy Euergetes, and added to by Neos Dionysos in the 1st century B.C., when the decorations on the walls were made by Augustus and Tiberius, whose votive offerings in the form of reliefs decorate the exterior, and by Hadrian, who reared a shrine at the west of the main temple. Other buildings are the pavilion of Trajan, a portico of 14 columns; a temple to Hathor, built by Euergetes II. and finished by Augustus; and a shrine of Imhotep. For a full description of the island see Bénédict, 'L'Ile de Philé' (1893); Edwards, 'A Thousand Miles up the Nile' (1877); and Baedeker's 'Egypt.'

**Philander**, fī-lăn'dēr, Dutch knight in Ariosto's 'Orlando Furioso' (1516). He is represented as making love to Gabrina, the wife of his host, and his name has come to be synonymous with masculine coquetry. It was used for the character of the lover in many old plays, and from it came the verb "to philander."

**Philander Smith College**, at Little Rock, Ark. It was founded in 1877 under the auspices of the Methodist Episcopal Church. The college offers in addition to the regular collegiate work, a business course, and a normal course; there is also a preparatory department. The collegiate work is arranged in two courses, the classical and philosophical, and the degrees of A.B. and B.Ph. are conferred. Women are admitted to all courses. The grounds and buildings in 1904 were valued at over \$40,000, and the library contained 1,700 volumes. The annual income for 1903-4 amounted to \$6,600. The students in that year numbered 521, and the faculty 17.

**Philanthropy**, the love of mankind as exhibited most ordinarily by the foundation of public institutions for the relief of the indigent, or suffering. In German pedagogics the term is applied to the theory of those who advocate Rousseau's plan of education; chief among whom was Basedow (q.v.) who founded the Philanthropinum at Dessau in 1774.

**Philaret**, fē-lā-rēt' (VASILI DROSODOV), Russian prelate: b. near Moscow 1782; d. Moscow 1 Dec. 1867. He was ordained priest and in 1812 became rector of the Alexander Nevski Academy at Saint Petersburg. In 1817 he was made bishop of Reval, in 1819 archbishop of Tver, and in 1821 metropolitan of Moscow. He was an eloquent orator and long one of the most influential of the Greek clergy.

**Philaster**, fī-lās'tēr, or **Love Lies a-Bleeding**, a tragedy by Beaumont and Fletcher. The greater part of the play is by Beaumont, and some critics have considered it the work of Beaumont alone. It was first acted about 1610 and printed in 1620, and long held the stage. Settle brought out an unsuccessful version of it in 1695 and the Duke of Buckingham published another version entitled 'Restauration, or the Right Will Take Place,' in 1714. A third version was produced by the elder Colman in 1764.

**Philatelic Associations, American**, various associations in the United States devoted to the study of philately or the science of postage stamps. There are local societies in the larger cities and a national association organized in 1885. The New York city association has a club house and a large and valuable library. See PHILATELY.

**Philatelic Society of London, The**, an association founded in London in 1869, for the study of postage stamps. The society publishes the 'Monthly Journal of Philately.'

**Philately**, fī-lăt'ě-lī, is a term embracing the collecting and study of the postage stamps of all nations and the trade which has resulted therefrom. The origin of this pursuit or pastime dates to about 1850, and it has since developed into a recognized science. The word philatelist comes from the Greek *philos*, a friend or admirer, and *ateleia*, exemption from taxation. Taxation at the time it derived its name in Greek was represented by a small printed piece of paper or check used as a postage stamp is now used. Primarily philately is an intellectual pursuit. It teaches geography and history. It develops a taste for art and science, and stimulates research in nearly every branch of learning. Postage-stamp collecting is subject to more or less ridicule, simply because the idea of gathering together parcels of torn and seemingly useless stamps is absurd. A collector of paintings, prints or engravings is never subjected to ridicule, yet postage stamps have in their designing and execution, the same care bestowed upon them as the finest engravings. By its relation to the fine arts philately brings to notice the art of the many countries issuing stamps. It likewise shows the progress made in these countries in designing, engraving, lithographing and printing. Philately, too, has produced the developed and unique class of designers, among whom are found the portrait, figure, heraldic and arabesque artist.

The knowledge that philately gives of the state of the fine arts in various stamp-issuing countries proves that it is a science. It shows clearly by demonstration and by comparison the history, language, geography, chronology, politics and the fine arts of the many countries that issue stamps. The revenue or bill stamps of Canada present upon their face the most truthful likeness of Queen Victoria known to exist. The only authentic view of the city of Sydney, in New South Wales in its earlier days, exists upon an old postage stamp, crudely engraved, yet wonderfully accurate.

Postage stamps generally bear upon their face the effigy of the reigning king or prince, or the national arms, or various other attributes of sovereignty. The various alterations to which stamps of a country have been subjected during the passing years have furnished in many instances proofs of political or dynastical movements of certain states or countries. History is taught in the stamps bearing portraits of rulers. There have been issued for Great Britain and her colonies over 1,325 stamps of different designs and value, bearing the portrait of Queen Victoria. The stamps of other countries are embellished by numerals, heraldic devices and arabesques, the latter emanating from Mohammedan lands. Others bear the figures of gods



PHILAE.



1. Colonnades of the Temple of Isis.

2. Colonnade of Ptolemy IX.







## PHILATELY

and goddesses and various devices, thus enabling the collector to tell whence they come. The collector can trace the changes of governments, kingdoms, and empires that have become republics, and republics that have provisional government regencies, insurrections, rebellions and confederacies. Upon the simple postage stamp can be studied the rise, decline and fall of empires, monarchies and republics. The displacement of the stamps of the Roman States, of the Church and the Kingdom of Naples, tells of the establishment of the kingdom of Italy. The disappearance of the Confederate stamps from circulation told of the close of the Civil War in America. The absence from circulation of the beautiful stamps of New Brunswick and Nova Scotia heralded the fact of the confederation of these provinces under the Dominion of Canada. The rise of the German Empire made obsolete various continental stamps as well as those of Alsace and Lorraine. In other instances old stamps have been superseded by stamps of newer design, but the majority of obsolete stamps have been set aside by external forces and thus illustrate history and political geography. The more recent rise and rapid progress of Japan is noticed by a series of stamps engraved by native artists and printed upon paper of native manufacture.

The 5-cent stamp of the United States first issued bears the face of one of the heroes of the Mexican War. Insidiously, the collector is led to inquire into the history of the war, and in a short time learns the relation existing between Mexico and other countries. He learns that Spain was known to the Romans as Hispania, that France was known as Gallia, and what now comprises the Ottoman Empire was formerly a group of provinces of Greece and Rome. He learns where each stamp-issuing country is located, and by what government it is ruled, in order to understand and classify his stamps properly, and in the chronological order of their issue. The relation philately bears to the study of languages is an important feature of the science. Native letters and Arabic numerals are found upon the stamps of many countries, including Montenegro, Bulgaria, Serbia and Russia. There are countries employing both native and Roman letters and numerals, such as China and Japan, Egypt and Turkey, and some of the native Indian and Oriental States.

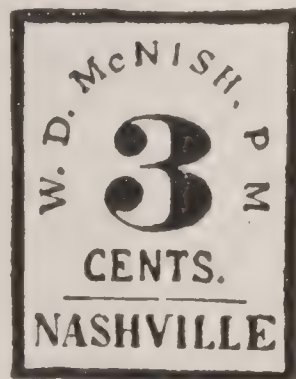
There are 750,000 collectors scattered throughout the world in about the following proportions: United States, between 150,000 and 180,000; Canada, 30,000 to 50,000; South America, 4,000 to 5,000; Great Britain, 120,000 to 140,000; France and Belgium, 90,000 to 120,000; Germany, 50,000 to 80,000; Austria, 30,000 to 60,000; Italy, 6,000 to 8,000; Spain and Portugal, 4,000 to 7,000; Switzerland, 6,000 to 8,000; all other European countries, 30,000 to 55,000; Asia, 1,500 to 3,000; Africa, 600 to 1,500; Australia, 2,000 to 3,000; West Indies, 600 to 1,400; countries and colonies not included in the above list, about 1,000, or a total of about 700,000.

Among celebrated philatelists are kings, queens, presidents, prominent financiers and men of affairs. There are many collections valued at from \$10,000 to \$100,000, and the Rothschild collection is said to be worth \$175,000. One of the most valuable is that in

the British Museum. There are other than philatelists proper who collect stamps. A great many artists gather the more beautiful specimens to study designs. These are also very valuable guides in the matter of engraving on tinted paper. The stamps of the French Republic are masterpieces in this respect. Until they appeared, it was never thought possible to give such effects in engraving on tints. The engraving companies now have in many instances beautiful collections of stamps, but they are, of course, of the uncanceled varieties.

The American Philatelic Association has over a thousand members scattered throughout all the States of the Union. The members in New York City are among the representative men of the country. Among them may be found clergymen, physicians, lawyers, merchants and stock-brokers, there being some 20 members of the New York Stock Exchange in the Association. In addition to the American Association there are branch societies in nearly all the large cities of the United States.

The first sale of postage stamps by public auction took place in London 18 March 1872.



Confederate States Provisional Stamps.

The catalogue comprised some 275 specimens, and the time of the sale was about four and one-half hours.

Among the rare American stamps highly prized by collectors are the early United States provisionals, issued in 1845. The government, being unwilling to undertake the expense of a general issue of postage stamps, permitted the postmasters of certain towns and cities to issue stamps at their own expense and for their own convenience. The postmasters of Alexandria, Va., Brattleboro, Vt., Baltimore, Md., New Haven, Conn., New York, N. Y., Providence, R. I., and St. Louis, Mo. adopted the plan with such success that the government undertook in 1847 a general issue. Other rare stamps are the Confederate provisionals issued during the Civil War, by the postmasters in several Southern cities. These stamps were superseded by the regular issue of the Confederate Government.

The philatelist collects not only postage stamps, but revenue, telegraph and express



## PHILEMON—PHILETAS OF COS

stamps, now long since obsolete. The internal revenue stamps formerly used on proprietary articles were of varied design. There was a common stamp for them just as there is now for tobacco. But under the law any manufacturer who was willing to bear the additional expense of preparing a special die, and the further cost, if any, of printing stamps after his own design, could have special stamps printed for him at the government bureau. So many of the proprietors of well-known articles, particularly patent medicines, availed themselves of the privilege because of the prestige and advertising which it carried. A unique branch of philately is that of State revenue stamps. These stamps, which are exceedingly rare, represent the tax imposed upon the citizens by the State government in addition to a regular tax imposed by the United States Government. Only a few States have ever issued revenue stamps. They are Alabama, California, Louisiana, Oregon and Nevada. Those of Alabama have arms in the centre and are printed in vermilion, red and dark blue. Their values are \$1 and \$2. Telegraph and express stamps are much prized by collectors on account of their extreme rarity. They are not issued by governments, but by private corporations, and are both stamps and franks.

Second only in importance to stamps themselves is the literature relating to them, and the collector who desires to keep abreast with the latest developments in matters pertaining to stamp collecting must devote considerable time, space, and money to his philatelic library. The most rapid growth in this line has occurred within recent years. About 1863 the first journal devoted to the "literature" of postage stamps appeared in Belgium. It was a monthly publication, 'Le Timbre Poste.' The first stamp paper started in the United States was the 'Philatelic Journal of America.' Philatelic papers are published most numerous in this country, though the highest class of them come from foreign lands. Among the countries that contribute liberally to philatelic literature, outside of the United States, are England, Germany, France, Belgium, Italy, Austria, Spain, Switzerland, Denmark, Mexico, Brazil, Argentine Republic, Chile and Peru, one or more papers being issued from each of these. But more important and desirable to the collector than all the regular philatelic publications are the catalogues, giving a list of all the stamps ever issued and the prices of most of them. Up to a recent date there was but one American catalogue that was generally accepted by collectors and dealers alike, but now there are several catalogues issued in the United States by different houses, all of which will be much fuller and more comprehensive than any heretofore published. The catalogues issued by English, German and French dealers are also utilized to some extent in this country as the basis of valuation, as they are usually more correct as to the actual market value of foreign stamps. Handbooks play no small part in a philatelic library. They are usually the production of a student of the stamps of some particular country, and the exhaustiveness with which the subject is entered into indicates a marvelous amount of patience and research on the part of

the author. These monographs are mostly in demand by advanced collectors and specialists.

Stringent laws have been adopted by the United States and other countries prohibiting under penalty of fine and imprisonment the making in any manner of fac-similes of the regular issues of postage or revenue stamps. These laws prevent also the printing or publishing of fac-similes of government stamps in books, newspapers, periodicals, or other publications, as a protection against counterfeiting. See POST AND POSTAGE.

WILL M. CLEMENS,

*Editorial Staff, 'Encyclopedia Americana.'*

**Philemon**, fī-lē'mōn, Greek comic poet: b. Soli, Cilicia, about 360 B.C.; d. 262. He became a citizen of Athens before 330 B.C., and wrote nearly 100 comedies (unless the grammarians have confused variant titles or have assigned to him plays written by his son), of which fragmentary quotations, mostly from Stobæus, remain (ed. in Kock, 'Comicorum Atticorum Fragmenta,' 1884). An idea of his wit, which was ranked above that of Menander in his own day, may be obtained from Plautus' imitations in the 'Mercator,' 'Trinummus' and 'Mostellaria' of Philemon's 'Emporus,' 'Thesaurus,' and 'Phasma.'

**Philemon and Baucis**, bâ'sīs, in Greek mythology, a couple celebrated for their faithful affection even in advanced age. Jupiter and Mercury traveling through Phrygia in a human form found no one willing to entertain them except this aged couple, who received them hospitably, washed their feet, set before them a rustic meal, and prepared a couch for their repose. The deities then took their hosts to a neighboring mountain, and when they looked behind them they saw their village sunk beneath the waves; but the cottage in which they had welcomed the pilgrims had become a magnificent temple. Jupiter promised also to fulfil all their wishes; but they only asked that they might die together as servants in that temple. At length, at a very advanced age, as they sat at the temple door they were at once transformed, Philemon into an oak, and Baucis into a linden. They were conscious of their change, which came gradually upon them, and while they were able to see and speak they took the most affectionate leave of each other. The trees were considered sacred.

**Philemon, Epistle to**, one of the four letters written by Saint Paul while he was detained a prisoner at Rome for the first time; it is the shortest of all the extant Pauline epistles; its genuineness is hardly questioned by any of the biblical critics. The epistle possesses a deep human interest as defining the relation of brotherhood subsisting between Christians, and the equality of all men, regardless of station, in God's sight and in the face of the Christian Church; while at the same time it makes no pronouncement upon the question whether the man who is a slave is bound in conscience to be ever subject to his master till duly liberated. The epistle is a model of what such a writing should be; it is marked by the graces of style and the highest courtesy and delicacy of feeling.

**Philetas** (fī-lē'tas) of Cos, Greek poet and grammarian: b. island of Cos, about 350 B.C.; d. about 290 B.C. He was preceptor to Ptolemy



## PHILHARMONIC SOCIETIES — PHILIP

II. Philadelphus and is quoted by Theocritus as his model. He was author of elegies, epigrams and grammatical works which were imitated and much admired by Propertius, and as a poet was ranked by the Alexandrian critics second only to Callimachus. Fragments of his poems still in existence were collected and published in 1829. Consult Couat, 'La Poésie Alexandrine,' and Weber, 'Elegische Dichter der Hellenen' (1826).

**Philharmon'ic Societies**, are organizations for the cultivation of orchestral music, and are generally found in all large cities. The London society, founded in 1813, has not only produced many works by British composers, but has also brought to England several great foreign composers to conduct at its concerts. Among these are Cherubini (1815), Spohr (1820 and 1843), Weber (1826), Mendelssohn (1829, 1842, 1844, 1847), Wagner (1855), and Gounod (1871), some of whom wrote works expressly for the society. Beethoven's great ninth symphony was written for the London society and its timely aid helped to soothe the sadness of the great composer's last hours. Among its regular conductors have been most of the best-known of English 19th century musicians. The Philharmonic Society of New York was organized in 1842. Among its conductors have been Bergman, Damrosch, Thomas, Seidl, Paur, and Walter Damrosch (1902). The orchestra numbers over 100 performers. There are also philharmonic organizations in Vienna, Berlin, Cincinnati, Chicago and other cities.

**Philhellenes**, fīl'hēl'ēnz (Greek, *philellēn*), a term employed to designate those who were friendly to the Greeks in their struggle for independence in the first quarter of the 19th century. They were of all nationalities, Lord Byron being one of the most noted, and associations of Philhellenes occupied themselves in collecting resources in aid of the struggling Greeks.

**Philidor**, fīl'ī-dôr, the assumed name of FRANÇOIS ANDRÉ DANICAN, French musician: b. Dreux 7 Sept. 1726; d. London 30 Aug. 1795. He became a choir-boy in the royal chapel; traveled in Holland, England and Germany, where he became known as a chess player; returned in 1754 to Paris, where he wrote several successful comic operas, among them 'Le Maréchal ferrant' (1761), some original and able tragic operas, 'Ernelinde' (1767) being the best known, and various religious compositions. His 'Analyse du Jeu des Echecs' (1777) was long an authoritative work on chess. Consult Allen, 'The Life of Philidor' (1864).

**Philinte**, fī-lānt, a character in Molière's 'Misanthrope' (1666). His easy-going tolerance of the faults of his friends due to his recognition of the impossibility of reforming them makes him a strong contrast to the impatient hero Alceste.

**Philip the Apostle**, one of Jesus Christ's chosen twelve. In the synoptical gospels he is merely named on occasion as one of the twelve; in the Fourth Gospel he is individualized; there the manner of his call is told. Jesus "found Philip," who "was from Bethsaida" and said to him, "Follow me." He appears to have been a disciple of John the Baptist. Immediately after he was himself called he brought to Jesus his companion Nathaniel (called also Bartholo-

mew). Philip is the only one of the apostles who had a Greek name; probably he spoke Greek, as it was to him that "certain Greeks came" to request to be admitted to the presence of Jesus. He is one of the two apostles who alone are named in the narrative of the miracle of the feeding of the five thousand. Of his life after the apostles went forth on their mission very little is known. According to Theodoret and Eusebius his special field was the two Phrygias. His festival is observed in the Eastern Church on 14 November, in the Latin Church on 1 May.

**Philip the Evangelist**, or **Philip the Deacon**, was with Stephen and five others chosen by the apostles to administer the economic affairs of the faithful in Jerusalem. After the death of Stephen, Philip went as an evangelist into Samaria, where his ministry was exceedingly fruitful (Acts viii.), and where Simon Magus professed the faith, convinced by Philip's preaching. Other incidents of Philip's life recorded in the same chapter of Acts are, the conversion of the Ethiopian eunuch, and the preaching of the gospel in all the cities of Philistia till he came to Cæsarea. He appears to have fixed his residence there, for, several years after, when Paul visited Cæsarea he was entertained in the house of Philip, who at that time "had four daughters, virgins, which did prophesy" (Acts xxi.). The history of this Philip has been by many ancient writers confounded with that of Philip the Apostle. The Latin Church commemorates Philip the Deacon on 6 June.

**Philip** (MARCUS JULIUS PHILIPPUS), styled "the Arabian," Roman emperor: b. Arabia about 204; d. 249. He entered the Roman military service and became Prætorian prefect 243. The Emperor Gordian was forced to receive him as a colleague on the throne by the army which had conquered Sapor, king of Persia; and in 244 Philip put his rival to death and became sole emperor. In 248 he celebrated the thousandth anniversary of the founding of Rome by a remarkable exhibition of the secular games. He was killed in battle by the soldiers of Decius.

**Philip I.** (Fr. fê-lêp), king of France, son of Henry I. and Anne of Russia: b. 1052; d. 29 July 1108. He succeeded to the throne in 1059, ruling for a year jointly with his father, and from 1060-6 under the regency of his uncle, Baldwin V. of Flanders, and his mother. His reign was troubled by frequent contests between his great feudatories, among whom was William I. of England, Duke of Normandy, yet he succeeded in greatly extending his domain. He married Bertha of Holland in 1071 and though a son was born to them in 1081, who later became Louis VI., he repudiated his wife and lived openly with Bertrada, Countess of Anjou. In 1095, a year after Bertha's death, he was excommunicated, and in 1100 was forced by the legates of Paschal II. to acknowledge his son Louis VI. co-regent.

**Philip II.**, or **Philip Augustus**, king of France, son of Louis VII.: b. Gonesse, near Paris, 21 Aug. 1165; d. Mantes 14 July 1223. He became co-regent in 1179 and a year later succeeded his father. He persecuted the Jews, driving them in 1182 from the country, and profited by Henry II.'s quarrels with his children to force the English king to do him homage for



## PHILIP

his continental fiefs. He undertook the third crusade with Richard I. of England in 1190, but the two kings quarreled after the capture of Acre and Philip returned to France, intrigued with the German emperor to imprison Richard on his way home, made an alliance with John, whom he had assisted to the English throne, and, in spite of this, invaded Normandy. His quarrel with John was renewed in 1199, when Philip's five-year war with Richard ended with Richard's death. A nephew of both Richard and John, Arthur of Brittany claimed the crown from John, at Philip's instigation, but was seized and killed by the English king, who as Philip's vassal was condemned for this crime to lose his continental fiefs of Normandy, Maine, Touraine, and Anjou. Only a part of Guyenne remained in the possession of the English. But John formed an alliance first with Ferrand of Portugal, count of Flanders, and then with Otto IV. of Germany, only to be defeated by Philip's splendid military organization at Bouvines in 1214, the foundation of the continental greatness of the French kingdom. During John's struggle with the nobles Philip assisted them and put his son Louis forward as a claimant to the English throne. His internal policy was no less active; the crown was made more powerful by a reformed system of administration; papal influence in France was obstinately combatted; the feudal system made subservient to the king; and in Paris he aided in the building of the first Louvre and Notre Dame, and in the foundation of the University. Philip married Isabella of Hainault, who died in 1190; then Ingeburga, daughter of Waldemar of Denmark, whom he repudiated in less than three months (1193); and in June 1196 Agnes of Meran (in the Tyrol). This marriage was declared null by the Pope and Philip was forced to receive Ingeburga again. Agnes died in 1201; her children were legitimatized by the Pope. Philip was the ablest of the Capetian kings of France. Consult: Delisle, 'Catalogue des Actes de Philippe-Auguste' (1856); and Cartellieri, 'Philipp II. August' (1898-1900).

**Philip III.**, king of France, called **LE HARDI**, "The Bold": b. Poissy 3 April 1245; d. Perpignan 5 Oct. 1285. He succeeded his father Louis IX. in 1270; inherited in 1271 from his uncle Alphonse, count of Poitou and Toulouse, much of Languedoc; was under the influence of Pierre de Broce until 1274 when he married Marie of Brabant, who ruled the king thereafter; and undertook to punish Peter of Aragon for the massacre known as the Sicilian Vespers (q.v.), making war on him in 1283. He died on his way home after an unsuccessful campaign. Consult Langlois 'Le Règne de Philippe le Hardi' (1887).

**Philip IV.**, king of France, called **LE BEL**, "The Fair," son of the preceding: b. Fontainebleau 1268; d. 29 Nov. 1314. He came to the throne in 1285, was crowned at Rheims 6 Jan. 1286, and began his reign with Champagne and Brie as appanages, thanks to his marriage (1284) with Johanna of Navarre. Guyenne he won from Edward I. of England in 1294 only to restore it in 1299, when he gained the most of Aquitaine. Almost immediately afterward he occupied Flanders, but ruled there so cruelly as to arouse a great revolt under the leadership

of the weaver Peter de Koninck. The French nobles were terribly beaten by these Flemings at Courtrai (Kortrijk) 11 July 1302, the "Day of Spurs," "after which 4,000 gilt spurs were hung as trophies in Courtrai cathedral." Two years later Philip made peace with Flanders, giving up his title to the country. The subjection of Lyons to the crown (1312) was his last and most important addition to the royal territory. But neither temporal strife nor territorial change is the most important event of Philip's reign. His relations with the papacy and his internal and financial policy are the two things that mark out Philip's rule—if not Philip's self, for it is impossible to decide how far his personality was a factor in diplomacy or administration; contemporary mention of him gives no hint of any vigor, force, or ability, whereas modern historians are loath to describe the far-reaching events of his reign without intimating that they were primarily the result of his own definite policy. His break with Boniface VIII., whether due to the King or to his civil jurisconsults, began in the early years of Philip's reign, when the Pope attempted to bring Philip and Edward of England to a peaceable understanding. In 1296 the Pope issued a bull bidding the clergy pay no taxes to the crown or any other temporality without papal consent, under pains of the ban. An apparent reconciliation took place in 1297, but three years afterward the Pope's legate to France was arrested by the King on the charge (speciously trumped up) of treason, specifically of rousing the people to revolt. In the following year Philip and the French kingdom were interdicted by papal ban. The countermove was sharp and decisive; Nogaret, Philip's greatest lawyer-diplomat, with the help of the Colonne, seized the person of the Pope, who died soon after (1304). Moreover Philip succeeded in electing the Bishop of Bordeaux, Bertrand de Goth, as Pope Clement V., and in keeping the curia out of Rome and in Avignon, the beginning of the "Great Captivity," during which the Papacy was under French control for 70 years. The internal administration of Philip was significant in that fresh and cruel taxes were levied, the Jews (1306) and Lombards (1311) persecuted for their wealth, the Templars condemned (1312), and the coinage of the realm debased. Consult: Boutaric, 'La France sous Philippe le Bel' (1869); Renan, 'Etudes sur la Politique religieuse du Règne de Philippe le Bel' (1899).

**Philip V.** (**LE LONG**, lè lǒng), king of France, son of Philip IV.: b. about 1294; d. 1322. He succeeded to the throne in 1316 by the Salic law which excluded the daughter of his brother Louis X. In 1317 Philip settled the dispute with Flanders, acquiring additional territory, and throughout his reign endeavored to make various reforms, but was usually thwarted by the States-General. In 1320 a cruel persecution against the Jews was begun and Philip's death occurred in the midst of it. Consult Lechugeur, 'Histoire Philippe V. le Long' (1897).

**Philip VI.**, king of France, originally count of Valois, and hence founder of the House of Valois and styled **PHILIP OF VALOIS**: b. 1293; d. Nogent-le-Roi 22 Aug. 1350. He was grandson of Philip III. le Hardi (q.v.), and had shown himself an able soldier before he became



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count, 16 Dec. 1325, and as count a fiery feudal lord before he came to the throne 1 April 1328. A cousin of Charles IV. his claim was preferred by the second application of the Salic law (the first in 1616 when Philip V. came to the throne) to that of the posthumous infant daughter of Charles. The claim of Philip was admitted in 1330 by Edward III. of England. Putting himself at the head of the nobles, who were eager to take vengeance on the Flemish for the defeat of Courtrai, the King won the battle of Cassel 23 Aug. 1328 and made Flanders a French county. Philip's interference in Scotland, his attempt to close Flanders to English merchants, and a story that he had become Count of Valois by trickery, and so King of France, prompted Edward III. of England to reconsider his acquiescence in Philip's accession to the throne, and he claimed the French crown for himself as son of Isabelle, sister of Charles IV. (in spite of the Salic law). In 1337 the Hundred Years' war broke out. Its main events occurring in this reign are the defeat of Philip's fleet at Sluys (1340), which laid the foundation of British supremacy in the Channel, and the loss of the great battle of Crécy (1340) and of the city of Calais (1347). The terrible Black Death devastated France during the last years of Philip's life. His reign, though the source of so much mediate loss to France, was not without territorial gain; Valois, of course, came to the crown; Champagne and Brie were ceded by Philippe d'Ébreux; and Montpellier and Dauphiny were bought. Philip VI. was succeeded by his son John II., called "The Good." Consult Gaillard, 'Histoire de la Querelle de Philippe de Valois et d'Édouard III.' (1819), and Longman, 'Life and Times of Edward the Third' (1869).

**Philip II.**, king of Macedon: b. Pella 382 B.C.; d. 336 B.C. He was the youngest son of Amyntas II., and obtained at Thebes a careful education, gaining knowledge of military institutions and statecraft from Epaminondas (q.v.), the victor of Leuctra, and familiarizing himself also with the intellectual culture of the Greeks. He was later regarded as an orator of considerable ability. On the death of his brother Perdiccas III. (359 B.C.), he became the supreme ruler of Macedonia as guardian of his nephew Amyntas, whom he soon set aside in order to assume for himself the regal title. At that time Macedonia was in very real danger. Pausanias, a pretender who had been expelled from the kingdom, and Argæus, who had once held the throne for two years while Amyntas II. was a fugitive in Thessaly, now asserted claims to the royal power. The Pæonians were making attacks at the north, the Illyrians on the west. Philip reorganized the army, increasing its efficiency by the invention of the well-known Macedonian phalanx; a compact mass protected by round shields and bristling with long spears. In a year he had completely freed himself from his enemies, and having thus made his small domains secure proceeded to enter upon that career of aggrandizement which extended Macedonian sway over Greece. There were then three powers upon the position of which his success depended. These were Amphipolis, a city at the mouth of the Strymon, once a colony of Athens, but later successful in revolt; Olynthus, the strongest town of the Thracian peninsula; and Athens. Philip agreed in secret negotiations

with Athens to restore Amphipolis; on condition of being given control of Pydna, the latter having a harbor on the Thermaic gulf, then commanded by Athens. He captured Amphipolis, and then marched on Pydna, the easy conquest of which by his own forces and not through Athenian aid afforded a pretext for refusing to keep his agreement. He prevented any co-operation between Athens and Olynthus by taking Potidæa from the former and giving it to the latter in 356 B.C. Not long after he took the Thracian settlement of Crenides, which he renamed Philippi, and which was the valuable centre of a gold-mining district. His capture of Methone in 352, after a long siege, gave him the key to Thessaly, where he quickly established his ascendancy. He marched as far south as Thermopylæ, which he found so strongly guarded that he retired. Already, in 352, Demosthenes (q.v.), in his first philippic, had endeavored to arouse Athens to a sense of its danger. Philip conquered Thrace, by 347 was in possession of all the Chalcidian cities, and in that year took Olynthus, which had received tardy and ineffectual assistance from Athens, with whom Philip concluded peace in 346. He then entered Phocis, destroyed the Phocian cities, and had their place in the Amphictyonic council given to himself. His Hellenic influence was further conceded by his joint appointment with the Thessalians and Thebans to the presidency of the Pythian games. In 340 he began the siege of Byzantium and Perinthus, but Athens, finally alarmed, sent aid under Phocion, who in 339 compelled Philip to raise the siege of both towns. Philip now seemed to turn his attention to the peoples of the north; but his agents were busy compassing his designs. The Amphictyonic council declared war in 339 against the Locrians of Amphissa for having seized part of the sacred territory, but the commander of the army sent accomplished nothing. In 337, therefore, Philip was appointed general. He marched through Thermopylæ, and took Elatea. Again Demosthenes thundered; the Athenians were aroused and formed an alliance with Thebes. But the combined army was defeated by Philip at Chæronea (August 338). Thus ended the independence of Greece. Athens was treated with leniency, but Thebes resisted, and fared hardly. Philip had long contemplated the invasion of Persia, and had now the means of accomplishing it within reach. A congress was held at Corinth, to which all the states of Greece but Sparta were invited. At this congress the war with Persia was determined on, and Philip appointed commander of the confederate forces. In 336 B.C. he celebrated with great pomp the marriage of his daughter Cleopatra with his brother-in-law Alexander of Epirus, by which he hoped to heal this division, but he was assassinated during the feast by a Macedonian youth, Pausanias, who had a private grudge against him. Alexander (q.v.) and his mother Olympias were suspected of complicity in the plot. Philip was a bold and warlike ruler, with the craft which he found necessary if he were to carry out an ambitious foreign policy by means of a small state. He was a patron of art and literature. Consult the study by Brückner (1837) and standard histories of Greece. See GREECE, *History*.



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**Philip V.**, king of Macedon: b. 237; d. Amphipolis 179 B.C. He was eight years old at the death of his father, and came to the throne in 220 after nine years of capable regency of his uncle, Antigonus Doson. Philip was a general but no statesman. In 217, having joined the Achæan League, he defeated the Ætolians. In order to subdue all Greece he made an alliance with Hannibal against the Romans, who occupied Illyria. In the first Macedonian war (214-205) he accomplished nothing and was forced to a humiliating peace. He still aided Hannibal with supplies, however, and in 200, after the conclusion of the second Punic war, Rome, roused by this fact and by the complaints of Attalus, the Rhodians, and the Egyptians, made war upon him again. He was successful until Flaminius took command, and then the allied army of Romans and Ætolians completely defeated him at Cynoscephalæ in 197, the end of the second Macedonian war. Macedonia became an ally of Rome; all Philip's alliances and conquests were renounced, and he had to pay a heavy tribute. Perseus, his natural son, succeeded to the throne. Consult: Droysen, 'Geschichte des Hellenismus' (1877-8); and Mahaffy, 'Alexander's Empire' (1888).

**Philip I.**, king of Spain, surnamed "the Handsome": b. Bruges 22 July 1478; d. Spain 25 Sept. 1506. He was the son of Maximilian I., emperor of Germany, and a grandson of Charles the Bold. He became ruler of the Netherlands in 1482, and by his marriage in 1496 with Joanna, daughter of Ferdinand V., king of Aragon, and Isabella, queen of Castile, he obtained the crown of Castile in 1504. He was the father of the emperors Charles V. and Ferdinand I.

**Philip II.**, king of Spain, son of the emperor Charles V. and Isabella of Portugal: b. Valladolid 21 May 1527; d. palace of the Escorial 13 Sept. 1598. He was married in 1543 to Mary of Portugal, who died in 1545 after the birth of Don Carlos; and early showed himself haughty, cold, and restrained, so that the purpose of his father to procure for him the imperial election was made impossible by his unpopularity, and in 1551 he returned to Spain after a three years' stay in Germany and assumed the royal duties there, to which he had been accustomed since his 16th year, when upon his father's departure for Germany the boy had become regent with a council headed by the Duke of Alba. Philip married Mary of England in 1554, and the queen, who was 11 years his senior, seems to have been deeply in love with him and was certainly greatly influenced by his advice. But the English climate did not agree with him and in 1555 he left the country for Brussels, having been appointed governor of the Netherlands and of the Spanish possessions in Italy; on 16 Jan. 1556 his father abdicated the Spanish throne in his favor. His royal policy was "worldwide power for Spain and the Roman Catholic Church," but this did not prevent war with the Neapolitan Pope Paul IV. and the papal ally, the French king, both of whom were defeated. Yet in general Philip's project was in behalf of the defense of the Church, which he regarded as a means to his own ends. With English help he had defeated the French at St. Quentin 10 Aug. 1557, and at Gravelines 13 July 1558, and had made the peace of Chateau Cambrésis in April 1559. Upon Mary's death

(1558) Philip became one of the many suitors of Elizabeth, her successor, but, learning that her policy was entirely opposed to his, 24 June 1559 married Isabella, daughter of Henry II. of France. In the meantime Alba's stern attempts to carry out the policy of maintaining Catholicism in the Netherlands had roused the province to determined rebellion and had annihilated the king's income from Dutch commerce, so that Alba was recalled and his place taken first by Requesens, then by Philip's brother, Don John, the hero of the wars with the Moors and with the Turks. Don John's want of success was apparently due to the king's refusal of funds as a part of the royal plan to repress this brilliant and popular leader, and he was succeeded by Alexander Farnese. In 1570, after the death of Isabella, Philip married his niece, Anne of Austria, who lived only ten years and left him one son, the future Philip III. Roused by the widespread assistance offered his rebellious Netherlands, Philip undertook a great scheme of European conquest, claimed and won the throne of Portugal, struck a great blow at the Netherlands by the assassination of William of Orange, and, having made France entirely subject to his policy, in 1588 fitted out the great Armada which was to punish Elizabeth for the execution of Mary of Scotland and to make England a Catholic appanage of Spain. The destruction of this fleet was a terrible calamity to Spain. Troubles with France, where it was only with the greatest difficulty that Philip placed on the throne his daughter Isabella and where Henry of Navarre kept the League in disorder, were followed by the death of Alexander Farnese (1592) and by increased boldness on the part of English privateers against Spanish shipping, so that the Spanish kingdom was practically ruined at the death of Philip, and largely by his ambitious schemes, whose only success was in the firm foundation of the counter-Reformation. Consult the biographies of Philip by Prescott, Dumesnil, and San Miguel, and the rehabilitation by Montaña, 'Nueva luz y juicio verdadero sobre Felipe II.' (1882).

**Philip III.**, king of Spain: b. Madrid 14 April 1578; d. there 31 March 1621. He was the son of Philip II. and his fourth wife, Anne of Austria, and succeeded his father in 1598. In the next year he married Princess Margaret of Austria. During his reign the war in the Netherlands continued, his general, Spinola, taking Ostend in 1604 after a three years' siege. Nevertheless Philip was at last obliged to admit the independence of the United Provinces and made a truce with them in 1609. In the same year he expelled the Moors from Spain, a step which accelerated the downfall of Spain's importance. The expelled persons were for the most part valuable citizens,—thrifty traders, and farmers—and their departure left entire provinces half depopulated.

**Philip IV.**, king of Spain: b. Valladolid 8 April 1605; d. 17 Sept. 1665. He was the son of Philip III., whom he succeeded in 1621. His first prime minister was Olivarez, whose maladministration had proved so calamitous in the previous reign. The war with the Netherlands was renewed, lasting until the Peace of Westphalia, when the independence of the Netherlands was conceded by Spain. Other events of



## PHILIP — PHILIP THE BOLD

this melancholy reign were the war with France 1635-59; a formidable revolt in Catalonia, suppressed in 1652; the revolt of Portugal in 1640 with a long war ensuing which terminated in the Portuguese victory of Villaviciosa in June 1665. An equestrian portrait of this monarch by Velasquez hangs in the Royal Museum at Madrid, and is considered the finest portrait by that artist. A second portrait of Philip IV. by Velasquez is in the Louvre at Paris.

**Philip V.**, king of Spain, grandson of Louis XIV. of France: b. Versailles 19 Dec. 1683; d. Madrid 9 July 1746. He was the second son of the Dauphin Louis, who died when the boy was 10; received from Louis XIV. the title of Duke of Anjou; and as a direct descendant of Philip II. of Spain was named successor to Charles II. of Spain in the will of that childless monarch in 1700. To withstand this advance of the Bourbon family and of the personal power of Louis XIV. and to promote the claim of the Archduke Charles of Austria, who was as near the Spanish throne as Philip by ties of blood, England, Holland, and Austria formed the Grand Alliance and precipitated the war of the Spanish Succession. (See SPANISH SUCCESSION, WAR OF.) His realms suffered by the detachment of his domains in Italy and in the Netherlands, and of Minorca and Gibraltar, but he remained king of Spain. The loss of his wife, Maria Louisa of Savoy in 1714 deprived him of a wise counsellor, and put an end to the influence of the Countess of Orsini. He married Elizabeth Farnese of Parma, came under the influence of Alberoni, minister from Parma to Spain, and was hurried into war with France by the scheme to arrange for his children by this second marriage. In 1717 Great Britain and Holland, and in 1718, Austria, joined France. The Duke of Berwick invaded Spain, and Sardinia was lost as soon as won. Alberoni was dismissed and his place taken by Jesuit advisers. Philip in January 1724 for obscure reasons abdicated in favor of his son Luis, who died in August, so that Philip had to return to power. His mind failed during his last years. Consult: Baudrillart, 'Philippe V.' (1890).

**Philip**, often called **King Philip**, chief of the Wampanog or Pokanoket tribe of Indians: b. near the beginning of the 17th century; d. 12 Aug. 1676. He was the youngest son of Massasoit (q.v.). In 1662 he became chief, and renewed the former treaties with the whites. But suspicion seems from the first to have prevailed on both sides. In 1674 John Sausamon, a "praying Indian," or disciple of John Eliot, reported that Philip was stirring up the tribes against the English. An investigation was made which proved practically nothing, but the Colonists were aroused, and the Indians, in turn, put themselves on the defensive. On 30 June 1675 the first attack was made on the Colonists during their return from church. The war was of the most desolating character, the Indians never meeting the enemy in the open field, but rapidly passing from one exposed point to another, burning villages, cutting off by ambuscades detached parties of troops, and shooting down all who strayed outside of the places of protection. Philip also formed an alliance with the powerful tribe of Narragansetts, and in December 1675, 1,000 men under the command of Governor Winslow invaded their territory, stormed a fort

in which there were said to have been 4,000 Indians, and utterly destroyed their village with all its stores. The war raged during the first half of 1676 with unabated fury, but the conquest of the Narragansetts and the complete destruction of his own tribe soon left Philip without resources. Deserted by all, he was hunted from spot to spot, and at last, taking refuge at Mount Hope, was there attacked and in attempting to flee was killed by a renegade Indian. Large numbers of the Indians were sold as slaves in the West Indies and South America. During the war, which had lasted a little more than a year, Brookfield, Northfield, and Springfield in the Connecticut Valley, Lancaster, Weymouth, Marlboro, Groton, and Medfield in Massachusetts, and Providence and Warwick in Rhode Island had been destroyed; and many attacks and massacres had taken place. The character of Philip has been variously represented; but it seems plain that the encroachments of the whites were responsible for his desperate outburst, and that, judged by Indian standards, he was a valiant warrior.

**Philip, John Woodward**, American naval officer: b. New York 26 Aug. 1840; d. Brooklyn, N. Y., 30 June 1900. He entered the United States Naval Academy in 1856, was appointed a midshipman in 1861, served on the Constitution and the Santee and was promoted in that year to be acting commander of the sloop-of-war Marion. In 1862 he received the rank of lieutenant, served on the Chippewa, Pawnee, and the monitor Montauk and took an active part in the siege of Charleston, S. C. In 1868 he was promoted lieutenant-commander and served in the Asiatic and European squadrons until 1874 when he was commissioned commander. He commanded the Tuscarora in a coast survey of Mexico in 1877, was lighthouse inspector in 1884-7, received the rank of captain in 1889 and in 1894-7 was in command of the Boston navy yard. In 1897 he was assigned to the command of the battleship Texas and played a distinguished part in the battle of Santiago in 1898. In that year he was placed in command of the North Atlantic squadron and in 1899 was promoted rear-admiral in charge of the Brooklyn navy yard, in which command he remained until his death.

**Philip the Bold**, duke of Burgundy: b. 15 Jan. 1342; d. 27 April 1404. He was the fourth son of John, king of France. He fought at Poitiers (1356), where, according to Froissart, he acquired the surname of the Bold, shared his father's captivity in England, and on his return his father restored for him the Duchy of Burgundy, which he had united irrevocably to the crown, and made him premier peer of France. Philip married in 1369 Margaret, daughter of Louis, count of Flanders, which gave him on the death of his father-in-law (1384) the counties of Flanders, Artois, Rethel, and Nevers, and made him one of the most powerful sovereigns of Europe. Philip served against the English in campaigns in Beauce and Burgundy (1364), before Calais (1369), in Poitou (1372), and Flanders (1377). On the death of Charles V. (1380) he became regent with his brothers. His administration in Flanders appears to have been wise and conciliatory. In 1388 the king, Charles VI., took upon himself the administra-



## PHILIP THE GOOD — PHILIPPE DE CHAMPAIGNE

tion of the kingdom, but in 1392 showed signs of insanity, and Philip resumed the regency, which he retained till his death in 1404.

**Philip the Good**, duke of Burgundy: b. Dijon 13 June 1396; d. Bruges 15 June 1467. He succeeded his father, John the Fearless, on the assassination of the latter in 1419, and at once entered into the Treaty of Arras, by which he recognized Henry V. of England as successor to the crown of France. Charles VI. concluded with him the Treaty of Troyes (1420), which was accepted by the States-General and the parliament, excluding the Dauphin from the succession and recognizing Henry as administrator of the kingdom and heir to the crown. Both Henry V. and Charles VI. died in 1422, and Henry VI. was then proclaimed king of France. Bedford, who now became regent of France, married Philip's sister. Disputes with the English presently followed and Philip, making his peace with Charles VII., concluded a defensive alliance with him, and declared war on England. He received the Dauphin Louis (see LOUIS XII.) at his court, when he quarreled with his father (1456) and accompanied him to his coronation in 1461. Philip was much beloved by his subjects and under his rule Burgundy was both prosperous and tranquil. He was succeeded by his son Charles the Bold.

**Philip the Magnanimous**, landgrave of Hesse: b. Marburg 13 Nov. 1504; d. Cassel 31 March 1567. He was the son of William II., whom he succeeded under the regency of his mother in 1509. He vanquished Franz von Sickingen in 1523, and joined the princes who went out in 1525 to quell the insurrection of the peasants. The same year he issued an edict on the preaching of the gospel and the morality of the clergy, and to aid the success of the new doctrine, formed the League of Torgau with the Elector of Saxony in 1526. At the Diet of Spires he spoke in behalf of the rights of the Lutheran Church. He then expelled the monks from the monasteries and confiscated their revenues to secular purposes. In 1527 he founded the University of Marburg; subscribed the protestation to the Diet of Spires in 1529, and submitted the Confession of Faith at Augsburg in 1530. He was, with the Elector of Saxony, in 1531, head of the Schmalkaldic League, but was obliged to submit to the Emperor Charles V. after the battle of Mühlberg (1547). In 1552 he obtained his freedom and after his return to his dominions he sent a body of auxiliaries to assist the French Huguenots. With the consent of his wife, Christina, who lived till 1549, and after obtaining the assent of Luther and Melancthon, he in 1540 married Margaret of Saale, usually called the "left landgravine," and had by her six sons and a daughter, an alliance which caused much scandal. Consult: Rommel, 'Philipp der Grossmüthige Landgraf von Hessen, nebst einem Urkundenbuche' (1830); Ranke, 'History of the Reformation in Germany' (English translation 1845-7).

**Philip the Magnanimous, Order of**, an order founded by the Grand-duke Ludwig I. of Hesse, 25 Aug. 1807. There are five classes; the decoration is a cross of white enamel, and the motto, "Si Deus nobiscum, quis contra nos?" (If God be with us, who can be against us?).

**Philip Neri, Saint.** See NERI, SAINT FELLIPPO DE.

**Philip of Swabia**, emperor of the Holy Roman Empire: b. about 1177; d. 21 June 1208. He was the youngest son of Frederick Barbarossa, and was educated for the Church, becoming Bishop of Würzburg in 1191. He resigned his see the next year, and in 1196 succeeded to the dukedom of Swabia. He attempted to obtain the German crown for his infant nephew, Frederick II., but was unsuccessful in this, though himself chosen emperor of the Holy Roman Empire in 1198. He was opposed by the Guelf candidate, who was crowned two months before him. Otho was supported by Pope Innocent III., but Philip at last secured the assistance of the Archbishop of Cologne and other great rulers, and was crowned by the archbishop in 1205. Consult: Winkelmann, 'Philipp von Schwaben und Otto IV. von Braunschweig' (1873-8).

**Philip, The Adventures of**, a novel by W. M. Thackeray, published in 1862. It was a sequel to 'The Shabby Genteel Story' and first appeared serially in the 'Cornhill Magazine' (1861-2).

**Philip and His Wife**, a novel by Margaret Deland, published in 1895. The book might well be called a study in selfishness, although its emphasis seems to bear upon marriage and the marriage laws; concerning which the author propounds certain theories and problems, without offering any direct solution. There are some scenes of great dramatic power, and the background of village life in southern Pennsylvania is pictured with much charm.

**Philipp, fê-lêp, Isidor**, French pianist: b. Pesth, Austria, 1863. He removed to France when very young, was educated in the Conservatory, and became one of the most popular Parisian pianists of the day. His appearances in London and Brussels were also very successful. He has made a specialty of classical chamber music and has published editions of classic studies as well as compositions of his own. He was one of the founders of the Société d'Art, of which he afterward became president.

**Philippa** (fî-lîp'a) **of Hainault**, hâ-nô', English queen, daughter of William the Good of Holland and Hainault: b. Holland 1314; d. Windsor Castle, England, 15 Aug. 1369. She was married to Edward III. of England by a special papal dispensation in 1328 and was crowned at Westminster in 1330. Her marriage was of political importance, inasmuch as it strengthened the friendship between England and Flanders, greatly benefiting the commerce of England. She was very popular among her subjects and some authorities credit her with having summoned and harangued the forces which defeated the Scots at Neville's Cross. She was the mother of seven sons and five daughters, her eldest child being Edward, the Black Prince.

**Philippe de Champaigne**, French painter: b. Brussels 26 May 1602; d. Paris 12 Aug. 1674. He first appears in history as engaged with Duchesne on the decoration of the Luxembourg Palace at Paris, where he was persecuted by the envy and jealousy of his collaborators and



driven back to Brussels (1627), but was recalled by Queen Maria de' Medicis, and appointed court painter. He was elected successively member, professor, and rector of the Academy. His fame at Paris was, however, soon eclipsed by that of Le Brun, and he retired to Port Royal, where the recovery of his daughter, a nun in that monastery, from severe sickness, gave occasion for the lovely picture now in the Louvre, 'Sister Susanne and Mother Agnes in Prayer.' If the conception of this work lacks clearness and intensity, and the composition is not perfect in harmony, there is everything to be found there which study and deftness of handling could supply. The influence of Poussin is plainly discernible in all his works, but he has also all the excellences of the Dutch school, and is perhaps most successful as a portrait painter. His own portrait, engraved by Edelinck, is in the Louvre, where also may be seen his 'Philip the Apostle'; 'The Last Supper'; 'Incidents from the Life of Saint Gervasius and Protasius'; 'Portrait of Richelieu.' His 'Adam and Eve Weeping Over the Death of Abel' (1656) is in the Imperial Gallery at Vienna. Consult: Gazier, 'Philippe et Jean-Baptiste Champaigne' (1893).

**Philippeville**, fê-lêp-vêl, Algeria, a seaport and the capital of an arrondissement in the department of Constantine; on the Gulf of Stora. It has a fine harbor, protected by two moles, one 1,310 feet long and the other 4,590 feet. The town is modern, a large part of it was built since 1838 on the site of the ancient Rusicada. It has manufactories of cork, leather, and also a large distillery. Iron mines and marble quarries are in the vicinity. There is an extensive trade in grain, fruits, tobacco, cotton, cork, and leather. The total annual value of imports and exports is \$17,500,000. Pop. (1901) 21,251.

**Philippi**, fê'lêp-pê, **Felix**, German dramatist: b. Berlin 1851. He entered journalism, and in 1875 removed to Munich, where he wrote for different French and German periodicals, and after 1884 devoted himself to the writing of dramas. His plays are of the realistic type, and he is one of Germany's most successful dramatists, his plays having also been successfully presented before German audiences in New York. Among them are: 'Der Advokat' (1884); 'Dagmar' (1886); 'Das alte Lied' (1889); 'Wohlthäter der Menschheit' (1895); 'Wer Wars?' (1896); etc.

**Philippi**, fî-lîp'î, an ancient city of Macedonia, northeast of Amphipolis, now Filibedjik. Originally a Thracian city named Crenides, "the place of springs," it was conquered by Philip II. of Macedon, named after him, and exploited by him because of valuable gold mines in the neighborhood. Here in 42 B.C. the triumvirs, Antony and Octavian (later Augustus), defeated the republican army led by Brutus and Cassius, after a battle in which Brutus defeated the wing commanded by Octavian. Augustus made the city the Roman colony of Julia Augusta Philippi. Saint Paul seems to have visited Philippi twice, and to have founded there the church to which he wrote the Epistle to the Philippians (q.v.). The city is now in ruins.

**Philippi, Engagement at.** Upon the secession of Virginia Gov. Letcher ordered Col. George A. Porterfield to proceed to Grafton and

organize a command to hold the Baltimore & Ohio railroad and guard the western frontier of the State against invasion from Ohio. The Union sentiment was strong, and Porterfield with difficulty succeeded by 25 May 1861 in raising about 500 infantry and 175 mounted men. Gov. Letcher had ordered him to make a descent on Wheeling and burn the bridges of the railroad, should the Union troops endeavor to pass over it. The descent on Wheeling was impossible, but on the 25th he burned the railroad bridges between Farmington and Mannington. Gen. George B. McClellan, in command of the Union department of Ohio, including West Virginia, when informed of this ordered his troops to move to the Ohio, and four regiments were crossed on the 27th, and advanced from Wheeling and Parkersburg by the branch railroads uniting at Grafton. The bridges were repaired, and the two columns joined at Grafton on the 30th. Porterfield abandoned Grafton on the 28th, retreating 15 miles south to Philippi, in Tygart's River Valley. Gen. T. A. Morris, with a brigade of Indiana troops, arrived at Grafton on 1 June, and was given command of the Union troops in West Virginia. Upon his arrival he found that Col. B. F. Kelley, 1st Virginia (Union) regiment, under instructions from McClellan, had planned an expedition to surprise and capture Porterfield. Morris enlarged it by sending another column, under Col. Dumont, of the 7th Indiana, to co-operate with Kelley. Kelley had about 1,500 men of the 1st Virginia, 9th Indiana, and 16th Ohio, and Dumont, the 7th Indiana, part of the 6th, 14th Ohio and two guns of Barnett's Ohio artillery. Both columns made a night march, Kelley starting from Thornton and Dumont from Webster, on the railroad, and converging on Philippi, which was to be attacked about 4 A.M. of 3 June. Dumont reached the hills overlooking Philippi soon after the appointed time, and without waiting for Kelley opened fire with his artillery upon Porterfield's camp, taking it by surprise; in the midst of which Kelley came in from the other direction, but not soon enough to intercept the Confederate retreat. Porterfield, though surprised, by his coolness, courage, and energy got his men off with but few casualties, and the loss of some public stores and private baggage, and retreated in good order to Beverly, some 30 miles southeast, and the Union troops occupied Philippi. Col. Kelley was the only person wounded on the Union side. Three Confederates were wounded, one, J. E. Hagner, by a cannon-ball, necessitating the amputation of a leg, the first amputation of the war. This was the first passage of arms in West Virginia; it greatly elated the Union men, and gave an impetus to the dismemberment of Virginia and the formation of a new State; the secessionists were much depressed.

E. A. CARMAN.

**Philippians**, fî-lîp'î-anz, **Epistle to the**, the fourth and last of the letters written by the Apostle Paul during the term of his first imprisonment at Rome; its date is most probably of the year 63. The people of Philippi, among whom he had gathered the first fruits of his ministry in Europe, and who, as appears from this letter, had an affectionate attachment to their first Christian teacher, had sent to him by the hands of Epaphroditus a liberal alms of money



## PHILIPPIC — PHILIPPINE ISLANDS

to provide him with some of the necessary comforts which as a prisoner he must lack. The Apostle acquaints the faithful at Philippi with his views and feelings on the subject of his imprisonment and in contemplation of his coming trial. That trial may have for result his condemnation to death. But he rejoices that, just because he is in bonds the brethren at Rome and wherever tidings of his imprisonment are known, are encouraged to confess the faith without fear. For him, "to live is Christ, and to die is gain." He longs to depart this life and to be with Christ; "yet to abide in the flesh is more needful for your sake." The Philippians, he is confident, will stand fast in the faith; but let their manner of life be worthy of the Gospel of Christ. He exhorts them feelingly to concord and warns them against faction and vain glory. He makes an appeal to their proved warm affection toward himself and entreats them, even as they had always faithfully obeyed him whether he was present among them or absent, that so now they would work out their salvation with fear and trembling: this if for no higher reason, then out of affection for him, and that he "might have whereof to glory in the day of Christ, that he did not run in vain, neither labor in vain." Such is the tone of the letter throughout. The Apostle plainly had none but pleasant recollections of his previous labors among the Philippians, and in no other epistle does he give such free expression to his personal kindly regard for his disciples. Nevertheless, in the third chapter he abruptly passes from the tone of affectionate address to that of impassioned denunciation of the wiles of false teachers, Judaizers. The Philippians, who are "his joy and his crown," must not suffer themselves to be misled.

**Philip'pic**, the title applied to the remarkable speeches made by Demosthenes, the greatest of Attic orators, against Philip of Macedon. The invective of these famous orations is so powerful as to render them unique, and the term philippic has since been applied to any damnable and vituperative public address. Thus, Cicero termed philippics those orations of his which drove Mark Antony from Rome, and compelled the Senate to prosecute the war against him after the murder of Julius Cæsar.

**Philippine** (fil'ip-in) **Commission**. See PHILIPPINE ISLANDS.

**Philippine Islands**. These islands are a governmental dependency of the United States and comprise the northeastern group of the great archipelago that lies between Australia and eastern Asia. They lie between lat.  $21^{\circ} 10'$  and  $4^{\circ} 40'$  N., and between lon.  $116^{\circ} 40'$  and  $126^{\circ} 34'$  E. of Greenwich. When it is 12 noon, standard time, at Washington, it is 1:04 A.M. the next day at Manila. The land area is about 128,000 square miles. The larger islands are Mindanao, 45,559; Luzon, 43,075; Samar, 5,198; Negros, 4,839; Panay, 4,752; Palawan, 4,368; Mindoro, 4,050; Leyte, 3,872; Cebu, 1,668; and Bohol, 1,400. These 10 larger islands have an aggregate area of 118,781 square miles, leaving some 10,000 square miles as the aggregate area of the smaller islands. The Philippines are thus nearly twice as large as the five States of New England; larger than New York, New Jersey, Pennsylvania, and Delaware; and

larger than the British Isles. The interior of the larger islands is mountainous. Some of the higher peaks are Pagsan, 7,330 feet; Santa Tomas, 7,418; Mayon, 8,274; Pinalobo, 6,137. These are all in Luzon. Others are Mount Halcón, in Mindoro, 8,865 feet; the summit of Panay, 7,267 feet; and Apo, in Mindanao, 10,312 feet. Among the Philippine mountains, 50 are recognized as volcanoes; 20 of these are more or less active, and 30 are extinct.

**Rivers**.—Luzon has four large rivers. The Rio Grande de Cagayan flows directly northward 163 miles, and empties into the China Sea at Aparri. With its great tributaries, Magat, Bangag, and Siffu, it drains an area of 16,000 square miles. The Agno Grande drains the mountainous province of Benguet and the valleys of Nueva Ecija, Pangasinan, and Tarlac, and flows into the Lingayen Gulf. The Abra receives the waters of the high lands of Lepanto, Bontoc, and Abra, and flows into the China Sea near the town of Vigan. The Rio Grande de la Pampanga flows down from the southern slopes of the mountains of northern Luzon, and passes by a network of delta streams into the Bay of Manila. The Pasig, flowing from Laguna de Bay through Manila to Manila Bay, facilitates trade by small steamers between the city and the rich provinces on the shores of the lake. Mindoro has 60 considerable rivers rising in the central mountains. Twenty-six principal rivers rise in the mountains of Samar, and furnish drainage to a well-watered island. The Panay, the chief river of the island of that name, is comparable in size to the largest rivers of Luzon. The largest river in the archipelago is the Rio Grande de Mindanao. It is about 170 miles long, and in its lowest third is navigable for small steamers. It flows into the Celebes Sea by five mouths. Its principal tributaries are the Sanaga, Malapali, Mararagao, Malita, Tigna, Culamam, and Cabacan. The second great river of Mindanao is the Agusan, flowing northward and draining the valley of Surigao. Besides the great rivers there are innumerable small streams by which the islands are everywhere well watered.

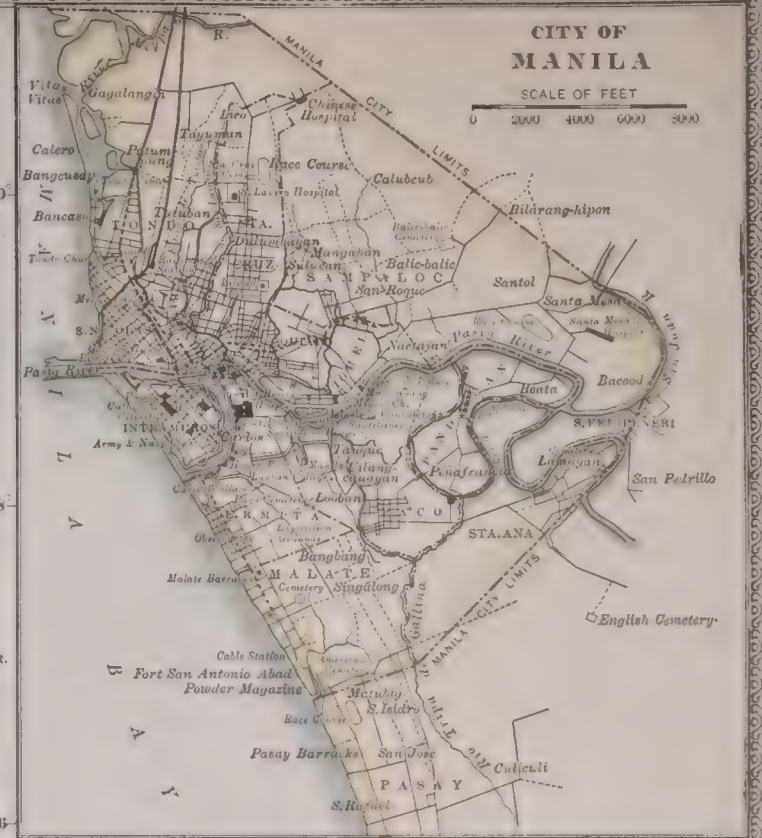
**Winds**.—The archipelago north of lat.  $10^{\circ}$  N. is affected by trade winds. The southwest monsoon, beginning in April or May, blows for about five months. After a short period of variable winds the northeast monsoon appears and lasts the rest of the year. Typhoons are bred east or southeast of the Philippines. They are most frequent about the equinoxes. Their course is westward, sometimes diverging slightly toward the north, and move at the rate of from 12 to 14 miles an hour. The outer circle of the storm varies from 40 to 100 miles in diameter. The inner circle of calm has a diameter of from 8 to 15 miles. Typhoons are always attended by rain.

**Mineral Resources**.—Coal, or black lignite, is found in many places, but the deposits have never been extensively worked. Gold was known to exist in the archipelago before the advent of the Spaniards, and it has been mined on a small scale for several centuries. The three most important gold fields are the interior provinces of northern Luzon, Camarines, and the northeastern part of Mindanao and the adjacent small islands. The placer mines that have been worked are not very rich, and the appliances that have been used to extract gold from quartz are prim-



# PHILIPPINE ISLANDS

SCALE OF MILES  
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## PHILIPPINE ISLANDS

itive and inefficient. Copper ore exists in Luzon, Mindoro, Panay, and Mindanao. The best known deposits are those of the copper region of Lepanto, in northern Luzon. The ore has been smelted here for many centuries, and the natives formerly made rude copper coins which circulated in this region in place of the legal copper coins. Many kettles of various sizes, some  $3\frac{1}{2}$  feet in diameter, are in use among the natives, made from the copper they have extracted, and it is reported that in 1840-55 there were sent out of the province 20 tons of copper utensils annually. Lead and iron are also found in several places, and petroleum has been recently discovered in Panay.

*Forestry and Timber.*—Official reports made by the Spanish authorities in 1876 give the forest area of the islands as 51,577,243 acres. The estimate by Fernando Castro in 1890 was 48,112,920 acres. As only a small part of this is in private ownership, there are probably between 40,000,000 and 50,000,000 acres of forests owned by the government. The forests are managed by the government through a bureau of forestry that issues permits for cutting trees and receives the payments made for the trees taken, the charges varying from about 1 cent to 7 cents per cubic foot, according to the kind of trees cut. It is expected that only the mature trees will be felled, and the government will hold the land and protect the growth of the rest. On Mindanao and other southern islands there is a large number of gutta-percha trees. Although the bamboo may not be classed with the trees that are cut for timber, it is extensively used for building and for numerous other purposes. And scarcely less important is the nipa palm, which furnishes material for the roofs and sides of about 90 per cent of the Filipino houses. Of the 615 varieties of trees in the islands many produce timber equal to the finest woods brought from Central and South America.

*Agriculture.*—All branches of agriculture are characterized by imperfect and careless cultivation. The most important food crop is rice, since it furnishes the principal element in the diet of the people. More care is taken in its production than in raising any other crop, but the methods and appliances are still primitive. Considering the natural resources, the results of this branch of agriculture are less satisfactory in the Philippines than in the neighboring countries of Tonquin, Siam, and Java. The soil and climate are especially favorable for the production of sugar, and more is produced than is consumed in the islands; but this amount is only a small part of what might be raised with more perfect methods of cultivating cane and better mills. Prior to 1882 the raising of tobacco and the manufacture of cigars and cigarettes were a government monopoly. In some districts the Filipinos were required to plant a certain amount of land in tobacco, and to deliver the product

to the public warehouses at a price fixed by the government. The indignation of the people, aroused by the hardships imposed upon them by the government in carrying out this policy, led to the abolition of the monopoly. The production of tobacco is conducted now as freely as other industries. Until a few years ago, raising coffee was one of the most important branches of agriculture. But the ravages of an insect which appeared in 1891 caused most of the large plantations to be abandoned. The small plantations in the provinces of Benguet and Lepanto have escaped the blight, and still produce a limited amount of coffee, which is almost all shipped to Spain. Cacao, now cultivated in many of the islands, is one of the most promising crops of the archipelago. Some attention has already been directed to extracting the oil of ylang-ylang, which sells readily at from \$40 to \$45 a pound. In the production of hemp, or abacá, the islands enjoy a complete monopoly, and this crop is less exposed to destructive accidents than any other. It is found to be so profitable in some provinces that other crops are to a very great extent neglected.

*Fauna.*—In comparison with the neighboring islands of Borneo, the Philippines have few mammals. The pangolin is found in Palawan. Horses were imported from Mexico, China, and Borneo. Wild hogs are abundant, particularly in Tawi-Tawi. Black domestic hogs are found in every village, and they cross more or less freely with the wild hogs. Deer are numerous. Sheep and goats have been imported from China and Mexico. The goats thrive, but not the sheep. There are humped cattle in many parts, but the most important domestic animal is the water buffalo, or carabao. The recent loss of 90 per cent of these animals has greatly interfered with the cultivation of rice. The small island buffalo, called the timarau, is still found in the forests of Mindoro. In the Palawan-Calamianes group there exists a single species of porcupine. Rats, squirrels, wildcats, bats, the so-called flying lemur, the tarsier, and a single species of monkey are found, some widely distributed while others are confined to restricted regions. There are about 600 species of birds, of which 325 are peculiar to the Philippines. Of the numerous varieties of snakes the python is the largest known in the islands. Several have been captured between 22 and 23 feet long and 24 inches in circumference with the stomach empty. Of the non-venomous snakes there are a few species peculiar to the Philippines. There are two species of geckos and an endless variety of lizards. Crocodiles are abundant in some of the fresh waters, and are sometimes seen along the coast, in the sea. The numerous varieties of fish taken in the inter-island waters constitute an important item of food, and fishing for pearls and shells has been a profitable industry.

*Climate.*—Extending from lat.  $4^{\circ} 40'$  to  $21^{\circ}$

1901	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Manila .....	77	77.7	80.4	82.9	83.3	82	80.8	80.8	80.4	80.8	79	77.4
Baquoio .....	63.5	62.1	66.9	70.5	68.3	67.2	66.5	64.6	67	67.6	66	64.3
Dif. ....	13.5	15.6	13.5	12.4	15	14.8	14.3	16.2	13.4	13.2	13	13.1



## PHILIPPINE ISLANDS

10' N., and with a habitable surface rising from the level of the sea to an elevation of 6,000 feet, the islands have a great variety of climatic conditions. The comparison (see table at foot of preceding page) of the mean monthly temperature at Manila with that of Baguio shows the difference of temperature between a town at the sea and an interior position at an elevation of 4,600 feet, in degrees Fahrenheit.

At the level of the sea, speaking with reference to the whole archipelago, the temperature seldom falls below 60° or rises above 90°. It is frequently hotter in New York or Oregon than in the Philippines. The year may be divided into three periods: from the middle of November to the middle of March, in which persons from the temperate zones find the climate agreeable; from the middle of March to the middle of July, the hot and dry season; and the middle of July to the middle of November, the rainy season, in which, owing to the clouds and the rain, the temperature is only a little higher than in the winter.

*The Inhabitants.*—The black people known as Negritos appear to be the earliest inhabitants of the islands. They are smaller than either the Igorrotes or the Christian Filipinos, and stand at the bottom of the social scale. They are true savages, wandering through the forests without permanent abiding places, and living on roots and the products of the chase. There are about 30,000 of them. The Igorrotes are another primitive people, occupying the central provinces of northern Luzon. They are copper-colored and have long, straight black hair, and are physically well developed. The mountainous regions of several of the islands contain wild tribes that may be likened to the Igorrotes, although known by different names. The Tagbanuas of Palawan and the Manguianes of Mindoro seem to be the product of crossing Malayan and Negrito stock. Under the designation Filipino people are usually included only the seven great Christian tribes: the Visayans, occupying the central islands and northern Mindanao; the Bicolis, in the southern provinces of Luzon; the Tagalogs, of central Luzon; the Pampangans and Pangasinanes, of the flat country north of Manila; the Ilocanos, of the northwest coast of Luzon; and the Ybanag, of the Cagayan Valley. The languages of these several tribes are so different as to make it necessary for the people to rely upon some foreign speech as a common medium of communication. Under American rule this is destined to be English. While Christianized Filipinos occupy various points on the coast of Mindanao, the interior of the island, as well as the Jolo archipelago, is inhabited by the Mohammedan Moros. In addition to the wild tribes of the interior, the Christian population that submitted to Spanish rule, and the Moros of the southern islands, there have usually been a few thousand Chinese in the archipelago. It is estimated that they numbered 30,000 in the middle of the 17th century, and 93,000 in 1886. When the fluctuating element of Europeans and Americans is counted in, the rare congeries is complete.

*Population.*—The total population is 6,975,073. The population of the 10 larger islands given severally in the order of their areas, beginning with the largest, is as follows:

Mindanao .....	495,659	Palawan .....	52,350
Luzon .....	3,727,488	Mindoro .....	106,200
Samar .....	195,386	Leyte .....	270,491
Negros .....	372,010	Cebu .....	518,032
Panay .....	801,878	Bohol .....	260,000

*Land Titles.*—In the early period of Spanish colonization, lands were distributed to settlers in America and the Philippines, and the persons to whom the grants were made might obtain an absolute title by living on the land and cultivating it for a period of four years. At the same time many lands were occupied without compliance with any legal forms, and in spite of repeated efforts made by the Spanish government to have all holdings legalized, very few holders of real estate in the Philippines can trace their titles to a governmental origin. In order to systematize land titles and render the legitimate holders secure in their possessions, the American authorities passed (6 Nov. 1902) "an Act to provide for the adjudication and registration of titles to land in the Philippine Islands." Under this act a court of registration was established to hear all applications for registration, and to adjudicate all questions concerning the applications or that may properly come before it under the act. The proceedings had in these cases are proceedings *in rem* against the property, and the decrees operate directly on the land, buildings, and improvements thereon, and vest and establish the title. The court is composed of a judge and an associate judge appointed by the civil governor with the advice and consent of the Commission. A clerk of the court is also appointed by the governor, as well as one or more examiners of titles. Under Act of Congress approved 1 July 1902, the government of the Philippine Islands is required to classify the lands according to their agricultural character and productiveness, and to make rules and regulations for the lease, sale, or other disposition of the public lands other than timber or mineral lands. These rules and regulations shall not have the force of law until approved by the President. When approved they shall be submitted by the President to Congress, and, if not disapproved by Congress, shall have the force and effect of law. Single homestead entries not to exceed 16 hectares in extent may be made. The government of the Philippine Islands may also sell to actual occupants, settlers, and other citizens of the islands tracts not exceeding 16 hectares to one person, and not more than 1,024 hectares to any corporation or association of persons.

*History.*—Magellan landed on the island of Homonhon in March 1521. Here Europeans first became acquainted with the inhabitants of the Philippine Islands. A little later Magellan was killed by the natives on the little island of Mactan, near Cebu. Villalobus, the commander of an expedition that reached the islands in 1543, called the island of Leyte "Filipina," which, in the plural form, was afterward applied to the whole archipelago. Between 1521 and 1565 several attempts were made by the Spaniards to establish themselves in the Philippines, but without success. Finally, in 1565, Legaspi, accompanied by Urdaneta, having four ships and one armed frigate, with 400 soldiers and sailors, landed at Cebu, took the town, and began the conquest of the islands. Three years later Juan de Salcedo, with two galleons bring-





1. Magellan Monument by the Pasag River, Manilla.

2. A street of Nipa Huts in Manilla.







## PHILIPPINE ISLANDS

ing troops, munitions, and arms, arrived at Cebu. Cebu was then declared a city, and Legaspi was made governor-general of all the islands he might conquer. In 1571 he took Manila and proclaimed the sovereignty of Spain over the whole archipelago. Legaspi died in 1572, and was succeeded by Guido de Lavezares. In 1574 the Chinese pirate Li-Ma-Hong attempted to capture Manila, but failing in this he tried to establish himself in Pangasinan, and was driven out by the Spaniards. During the next two decades a number of Franciscan monks and the first party of Jesuits arrived, the bishopric of Manila was founded, the foundations of the Manila cathedral were laid, the audiencia, or supreme court, was established, and the walls of the city were built. Early in the 17th century began a series of conflicts between the Dutch and the Spanish, which lasted for 50 years. In 1662, Ko-Seng, a Chinese pirate, demanded the surrender of the islands. The Chinese in Manila were suspected of being in the plot, and the suspicion led to a general massacre. After this, for 100 years, the islands suffered no serious disturbance from without. Then came the alliance of Spain with France in the war against England, and the taking of Manila by the English in 1762. By the Treaty of Paris the archipelago was restored to Spain 10 Feb. 1763. Only a small part of the tribute of \$4,000,000 levied by the English was ever paid. Between the withdrawal of the English and the advent of the Americans, no foreign power questioned Spain's control. In the Philippines, as in her other dependencies, Spain was especially interested in converting the natives to Christianity, and in order that this work might be more effectively carried on, extensive privileges were granted to the clergy and the monastic orders. During the 324 years between the death of Legaspi and the taking of Manila by the Americans the affairs of the islands were directed by a series of 116 governors, making the average period of the administrations somewhat less than three years.

Before the arrival of the Americans a part of the Filipino people had been in insurrection against the authority of Spain. On 14 Dec. 1897 a treaty was concluded between the Spanish captain-general and the leader of the insurgents. Under this treaty 800,000 pesos were to be paid to the rebel leader, Aguinaldo, in three instalments, the first of 400,000 pesos on his arrival in Hongkong, where he had been sent into exile by the Spanish authorities, the second instalment of 200,000 pesos after a certain number of arms had been turned over by his followers, and the remaining 200,000 pesos after the official proclamation of peace in the Philippines. Only the first and second instalments were paid. Between three and four weeks after the taking of Manila, Aguinaldo, as a pretended friend of the United States, was permitted to return to the islands. Three weeks later he proclaimed the end of the Spanish rule, and inaugurated the so-called republic at Malolos.

On 1 May 1898 the Spanish fleet in Manila Bay was destroyed by an American fleet under Admiral Dewey; and Manila was surrendered to the American forces on the 13th of August of the same year. In the course of the next few days army officers were detailed to take control of the custom-house and certain other civil offices. The treaty of peace with Spain was

concluded at Paris 10 Dec. 1898. About six weeks later (4 Feb. 1899) an armed force of Filipinos attacked the troops of the United States. This led to active hostilities, which ended only after the whole archipelago had been overrun by the American forces. In January 1899 the President appointed a commission to investigate and report on the condition of affairs in the islands. Somewhat more than a year later, when there was a prospect of peace, he appointed a second commission of five persons to establish civil government. Beginning with the 1st of September 1900, this commission was authorized to exercise legislative power in the islands and to appoint certain classes of officers. By an amendment to the army appropriation bill for 1902, approved 2 March 1901, Congress confirmed the action of the President, but restricted the power of the commission in the matter of granting franchises. On 4 July 1901, the president of the commission became civil governor, and on 1 Sept. 1901 the four other members of the commission were appointed heads of the four departments of the interior, of commerce and police, of finance and justice, and of public instruction. At this time three Filipinos were added to the commission.

The members of this commission were: William H. Taft, of Ohio, president; Dean C. Worcester, of Michigan, Luke E. Wright, of Tennessee, Henry C. Ide, of Vermont, Bernard Moses, of California. The three Filipino members were: Trinidad H. Pardo de Tavera, Benito Legarda, José Luzuriaga.

*The Insular Government.*—The legislative power is vested in the Philippine Commission, consisting of the original five members and the three Filipinos subsequently appointed. The power of this legislature is limited only by restrictions imposed by Congress, but it is subject to control by the President through the secretary of war. The executive authority is exercised by the civil governor, who is assisted by the heads of the four executive departments. The civil governor and the heads of the four departments are at the same time members of the commission, or legislative body, the governor being *ex-officio* president. By the Congressional law of 1 July 1902, it was provided that two years after the publication of the census the commission should call a general election for delegates to a general assembly, the assembly to consist of not less than 50 nor more than 100 members. The matters under the general direction of the chiefs of the several departments are conducted by a series of bureaus. The bureaus in the department of the interior deal with public health, quarantine, forestry, mining, agriculture, fisheries, weather, non-Christian tribes, public lands, government laboratories, patents, and copyrights; those in the department of commerce and police, with transportation, post-offices, telegraphs, coast and geodetic survey, public works, insular constabulary, prisons, light-houses, railroad corporations, all corporations except banking; those in the department of finance and justice, with insular treasury, auditor, customs, immigration, internal revenue, cold storage and ice plant, banks, banking, coinage, currency, and justice; those in the department of public instruction, with education, charities, libraries, museums, statistics, records, printing, and architecture and public buildings.



## PHILIPPINE ISLANDS

*Municipal Government.*—The boundaries of the pueblos, or townships, as they existed under Spanish rule, were recognized as determining the territories of the municipalities established under the authority of the United States. The ancient names were retained, and the public property of the old pueblos passed to the new organization. In the municipalities the first steps were taken toward the establishment of local self-government. The president, the vice-president, and the members of the municipal council are elected. But in view of the limited knowledge and experience of the bulk of the inhabitants, it was found to be expedient to confine the privilege of voting to a comparatively few persons; to those who had held some one of the principal municipal offices, those who had property valued at 500 pesos, or who paid taxes to the amount of 30 pesos, and those who could read, write, and speak Spanish or English. Like many of the present townships of New England, the pueblos of the Philippines often contain more than one village; but each of these villages, or barrios, has a certain territory which is recognized as pertaining to it, and the sum of all the tracts of territory pertaining to the several barrios coincides with, or is the same as, the territory of the pueblo. Each barrio is in the immediate charge of a member of the town council, but the municipality and not the barrio is the primary political unit. The municipality is the lowest distinct governmental group.

*Provincial Government.*—Midway between the municipal government and the insular government stands the government of the province. The form of this government was furnished by the provincial government act of 1901. The provincial government consists of five officers: a governor, a supervisor, a treasurer, an attorney, and a secretary. The governor, the supervisor, and the treasurer make up the provincial board. The governor was appointed by the commission in the first instance; later he was elected by a provincial assembly composed of the members of the town councils of the organized municipalities of the province. The supervisor is required to be a civil engineer, and he and the treasurer belong to the classified civil service.

*The Judiciary.*—When the islands fell under the authority of the United States, all Spanish laws not expressly repealed remained in force. The courts then existing were authorized to continue to administer the affairs of justice, but many of the officers declined to act under the new conditions, and prepared to return to Spain. To cover the period of transition military courts were established, or the vacancies in existing courts were filled by military authority. In May, 1899, the supreme court was reorganized with one chief justice and six associate justices. In the existing judicial system there is, besides the supreme court, a series of courts of first instance and certain municipal courts, together with the courts of justices of the peace. The courts of first instance as well as the supreme court are courts of record. A court of first instance is held in each judicial district, and to it is assigned a provincial fiscal who represents the provincial and insular governments. The bureau of justice, under the immediate direction of the attorney-general, is in the department of Finance and Justice.

*Public Instruction.*—The affairs of public in-

struction are managed through a bureau of education, at the head of which is a general superintendent of education. The archipelago is divided into 36 school divisions, in each of which there is a division superintendent, who corresponds with the general superintendent and acts under his general direction. The several divisions, except in a few cases, coincide with the provinces. In the four provinces of Benguet, Lepanto-Bontoc, Nueva Vizcaya, and Paragua, because of their sparse population and the rude condition of the inhabitants, the provincial governor is required to perform the duties of a division superintendent. In addition to the teachers appointed for the municipalities by the division superintendent, whose salaries are paid by the municipalities, the general superintendent is authorized to keep in the service of the insular government a force of one thousand trained teachers for the primary schools and such other additional trained teachers as may be necessary for the provincial schools of secondary instruction.

*Telegraphic Communication.*—The needs of the army in a campaign covering most of the Philippine territory led to the establishment of a more extensive system of telegraph and cable lines than was immediately called for by the business interests of the islands. About 9,000 miles have been laid since the taking of Manila. The temporary wires were removed on the withdrawal of the army, but there remains a permanent system of 1,327 miles of cables and 5,000 miles of telegraph lines. The system was established and during the period of military control was operated by the Signal Corps of the army; but under its management by the civil government many Filipinos will be employed as operators. In order that they may be fitted for this work, schools of telegraphy for their instruction have been established. Shortly after the Filipinos began to be employed as operators, it was reported that "the Ilocano makes the best telegraph operator. He acquires English readily, and has the necessary application and shows a disposition to accept employment in any part of the archipelago." In addition to the lines laid by the American authorities, the islands of Luzon, Panay, Negros, and Cebu are connected by cables of the Eastern Extension Australia and China Telegraph Company, about 610 miles in length, with stations at Manila, Iloilo, Bacolod, and Cebu.

*The Insular Constabulary.*—This body was created by Act No. 175, which provides for an armed force for each province, to be maintained by the insular government. The chief of the constabulary is appointed by the civil governor, and has general charge of the force and directs its operations. He is assisted by a number of assistant chiefs, who are also appointed by the civil governor. The privates and lower officers are Filipinos. In 1903 the force numbered about 6,000 men.

*Brigands.*—After the war many persons who had been engaged in it undertook to continue to live by robbery. In some quarters leaders appeared who pretended to supernatural power, and gathered about themselves considerable bands of fanatical followers. The extermination of these bands was the business of the constabulary. In 1903 it destroyed those led by Rios in Tayabas and Laguna, San Miguel in Bulacan



PHILIPPINE ISLANDS

and Rizal, Modesto Joaquin in Pampanga, Roman Manalang in Zambales and Pangasinan, Protacio Flores in Pangasinan, Timoteo Pasay and the Feliz brothers in Rizal, Dalmacio and Ruto in Western Negros, Flores in Misamis, Anugar in Sámar, Concepcion in Surigao, Colache in Sorsogon, Encarnacion in Tayabas, and others of less note. The following "Popes" were captured: Rios of Tayabas, Faustina Ablena of Sámar, and Fernandez of Laguna. Margarita Pullio and Catalina Furiscal, two women who posed as "saints," and who were interested in the distribution of "anting-antings," were also captured. Rios represented himself to be an inspired prophet and found little difficulty in working on the superstitions of the credulous inhabitants of barrios distant from the centres of population. He organized an "Exterior Municipal Government," as a means of making collections, with an elaborate equipment of officials. He promoted himself and his followers in rapid succession until he had with him one captain-general, one lieutenant-general, 25 major-generals, 50 brigadier-generals, and a large number of officers of lower grade. In appreciation of his own abilities he appointed himself "Generalissimo" and viceroy, and stated his intention of having himself crowned "King of the Philippines." Not satisfied with earthly titles, he announced himself as the "Son of God," and dispensed "anting-antings" which he affirmed would make the wearer invulnerable.

The strange religious sects found in the archipelago invariably manifest a desire and effort to possess arms to reinforce the propaganda of their creeds. Some of these sects which have the ideas of a church militant strongly developed appear under the following names: Dios-Dios, Pulajanes, Colorados, Cruz-Cruz, San Iglesia, Cazadores, Colorum, Santos Ninos, Guardia de Honor, Soldados Militantes de la Iglesia, and Hermanos del Tercer Order.

*The Revenues.*—The insular government derives its revenues chiefly from import and export duties. Under the Spanish government there was a cedula, or graduated poll-tax, that produced between 7,000,000 and 8,000,000 pesos annually. This was, however, abolished by military authority shortly after the occupation of Manila. The civil government, after its establishment, levied a cedula, or poll tax, of one peso on each male person between 18 and 55 years of age. One half of the revenue derived from this source is paid into the treasury of the town in which the persons live who make the payment; the other half is paid into the provincial treasury. The revenue derived from internal taxes is devoted mainly to the support of the provincial and municipal governments. Besides the modification of the cedula tax, the most noteworthy changes in the system of taxation by the authorities of the United States was the addition of a land tax.

*Customs Duties.*—The Custom House at Manila was opened for the reception of goods under American administration on 20 August, seven days after the taking of the city. The tariff and regulations in force under the Spaniards were continued for a time without important modifications, but on 17 Sept. 1901, the Commission enacted a new tariff law, under which customs duties have since been paid.

Although the duties are largely specific, it is intended that they shall amount to an *ad valorem* duty of about 22 per cent.

The following table shows the annual collections expressed in pesos, or the silver currency of the islands, for the last years under Spain and the first years under the United States:

YEAR	Spanish Period	American Period
1890.....	3,140,954.99	.....
1891.....	3,540,603.41	.....
1892.....	4,025,517.12	.....
1893.....	4,238,815.57	.....
1894.....	4,702,952.64	.....
1895.....	4,421,716.47	.....
1896.....	5,040,705.80	.....
1897.....	5,562,139.12	.....
1898-1899 10 mos. 20 days.....	.....	6,212,760.62
1900 (fiscal year).....	.....	11,084,578.30
1901.....	.....	18,249,621.40
1902.....	.....	17,050,432.96

The imports for the four years, 1899 to 1902, inclusive, estimated in the money of the United States, amount to \$110,549,824, paying a duty of \$22,703,754. The exports for the same period amount to \$91,200,206, paying an export duty of \$2,749,451. The customs receipts for the first six months of each of the following years shows a gradual increase:

1899.....	\$2,145,736.66
1900.....	3,311,671.57
1901.....	4,195,737.93
1902.....	4,338,367.11
1903.....	4,449,424.92

The ports of entry are Manila, Iloilo, Cebu, Joló, Siassi, Zamboanga, and Aparri.

*Weights and Measures.*—The metric system of weights and measures is continued in use in the Philippine Islands. The metric terms of measurement in most common use are:

Hectolitre	= { 2.838	United States bushels.
	26.417	United States gallons.
Kilogram	= 2.2046	United States pounds.
Kilometre	= 0.62137	United States miles.
Litre	= 1.0567	United States quarts.
Metre	= 39.37	United States inches.
Metre, square	= 10.764	United States feet.
Metre, Cubic	= { 1.307	United States cubic yards.
	35.3	United States cubic feet.

The Filipinos have certain measures as follows:

1 apatán	= 0.16875 of a pint.
1 chupa	= 0.675 of a pint.
1 ganta	= 2 quarts, 1 2/3 pints.
1 caván	= 16 gallons, 3 quarts, 1 pint.

The relation of these to one another is definitely stated as follows:

4 apatáns	= 1 chupa.
8 chupas	= 1 ganta.
25 gantas	= 1 caván.
1 ganta	= 3 litres or 3.1701 United States quarts.

Rice is sometimes sold by the picul, which is equal to 137.9 United States pounds. The picul has the following subdivisions:

16 taels	= 1 catty.
10 catties	= 1 chinanta.
10 chinantas	= 1 picul.

There are certain other weights and measures of Spanish origin that are more or less extensively used:

Arroba (dry)	= 25 libras = 25.36 pounds.
Arroba (liquid)	= 4,263 gallons.



## PHILIPPINE LANGUAGES

Fardo, a local weight for tobacco = 33 Spanish pounds,  
33.475 United States pounds.  
League, linear measure = 2.634 United States miles.  
Libra = 1.0144 pounds.  
Milla = 1.760 yards, or 1,609.3 meters.  
Pie = 0.9478 foot.  
Quintal (dry) = 4 arrobas = 101.44 pounds.  
Tonelada, space measure 40 cubic feet.  
Vara, linear measure = 0.914117 yards, or 33.384 inches.  
1 hectare, land measure = 2.471 United States acres.  
1 quión, land measure 100 loanes, = 2.79495 acres.

The picul varies in different countries as follows, estimated in pounds of the United States: Borneo and Celebes, 135.64; China, Japan, and Sumatra, 133 $\frac{1}{3}$ ; Java, 135.1; Philippine Islands, 137.9.

The standard unit of the money of the Philippine Islands is a gold peso equal to one half of the gold dollar of the United States. The money of actual circulation is the silver peso and fractional coins, which are token money.

*Commerce.*—The Philippine trade figures for that portion of the calendar year ending 31 October 1903, appearing in the bulletin issued by the Bureau of Insular Affairs of the War Department, show the value of import and export business to have been \$55,421,561 as against \$49,704,609 for the corresponding period of 1902, an increase of approximately \$6,000,000, two-thirds being credited to exports and rice purchases, accounting for the import gain. These amounts do not include gold and silver and United States government supplies, and for the later period imports were \$29,320,156 and exports \$26,101,405, an advance as stated of two and four million dollars, respectively, over 1902 returns. As the new currency is put into circulation the value of Mexican coin exported from the islands becomes larger, withdrawals of silver including the month of October amounting to over \$7,000,000, as compared with half that amount in 1902. Notwithstanding the increased value of transactions, the falling off in duty collected on imports caused a net loss in total customs receipts from \$7,354,337 to \$7,321,602, in addition these amounts include \$300,000 and \$450,000, respectively, which is subject to rebate as export tax on hemp shipped to the United States. Three-fifths of the \$17,146,994 worth of hemp exported in 1903 was sent to this country. Copra shipments advanced in value over the 10 months of 1902 from a million and a half to \$3,214,966, nearly all going to French markets for the manufacture of oil. Sugar at \$3,290,120 shows an increase of approximately \$500,000, due to a better price per ton rather than the quantity exported. Tobacco trade is below the record at the same period of the previous year.

The value of commerce between the United States and the archipelago amounted in round numbers to \$13,600,000 in 10 months of 1903 against \$11,900,000 in 1902. Manila hemp is the only article of commercial importance at present which is marketable in large quantities in this country, nine of the ten million dollars' worth of agricultural products exported to the United States being made up of that commodity. In the early months of 1903 several large cargoes of sugar left Philippine ports for this market, but recent returns indicate a complete cessation of trade, doubtless in the hope that favorable action may be taken on the effort for tariff reductions. The various classes of goods imported from the United States for use in the

islands in 1903 was valued at little over \$3,000,000, being somewhat below the showing made in the previous year. Among shipments received the more important items were wheat flour to the value of \$642,123, cotton goods \$262,517, beer in bottles \$252,366, illuminating oils \$249,133, lumber \$129,791, distilled spirits \$83,029, boots and shoes \$70,474, paper pulp and paper for printing purposes \$48,606, condensed milk \$44,346, and different kinds of small machinery.

Of the \$2,965,334 worth of merchandise and coin from the United States arriving at Manila during 10 months of 1903, only \$350,461 was carried in American bottoms. The shipping movement shows entrance of vessels at that port with cargoes from United States markets to have been 50 steam and 9 sailing with a carrying capacity of 169,947 and 6,140 net tons, respectively, the various flags under which they came are given as 19 American, having a net tonnage of 51,907, 32 British 95,622 net tons, 3 German 8,673 net tons, 2 Japanese 9,622 net tons, and 3 under all other flags with 10,263 net tons. Exports to this country according to Manila returns, aggregated \$7,807,412, all but 13 per cent leaving in foreign vessels. The clearance of 32 steam, 97,002 net tons, and 10 sailing vessels 13,396 net tons includes the following: 13 American 40,620 net tons (5 of these with 4,974 net tons cleared in ballast), 22 British 53,837 net tons, 2 German 5,003 net tons, and 5 at 9,938 net tons under flags of other countries.

During the corresponding ten months of 1902, imports to the value of \$3,308,725 were received at Manila from the United States, but 5 per cent being delivered in American vessels. The entries from the United States show 42 steam with a total of 113,897 net tons and 3 sailing vessels registering 4,553 net tons, of which 9 were flying the American flag with a carrying capacity of 17,481 net tons, 27 British 75,810 net tons, 3 German 9,638 net tons, 2 Japanese 6,837 net tons, and 4 having a net tonnage of 8,684 under all flags. The traffic between Manila and the United States was almost exclusively confined to foreign bottoms, American vessels being credited with less than two per cent of the \$5,923,071 worth of Philippine products shipped to markets in this country. A total of 20 steam and 7 sailing vessels with a net tonnage of 55,671 and 8,271, respectively, are reported at Manila to have cleared for the United States under flags as follows: 8 American 12,255 net tons, including 6 sail at 6,783 net tons in ballast, 15 British 45,077 net tons, 1 German 1,201 net tons, and 3 under flags of other countries with 5,409 net tons.

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**Philippine Languages,** the languages spoken by the native inhabitants of the Philippine Islands; they are variously reckoned, some authors distinguishing as many as 50, others 20 or less, a difference due to the variant definitions of "language" and "dialect." But all these languages or dialects belong to one or other of two classes, those of the Malayan race and those of the aboriginal inhabitants, the Aetas or Negritos. Of these aborigines some remnant is found in nearly every important island of the archipelago, retired in the mountain fastnesses



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in small bands, but their total number is reputed not to exceed 25,000. Their languages or dialects, while perhaps they are one in origin, are almost as diverse as the people's haunts, and they have never been made the subject of linguistic study. The other great division, such languages as are spoken by the races which existed long anterior to the coming of the Spaniards, is made up of a variety of tongues belonging to the Malayan language family. Prominent above all Malayan tongues stands the Tagalog, the language of the people of Middle Luzon, and to a great extent the *lingua franca* of all the provinces of that island; but side by side with it, in Luzon and other isles, are other languages of the same origin, namely the Batan spoken in the islands of Batanes and Babuyanes, to the north of Luzon; the Visayan of the Visayan islands and of some parts of Mindanao; the Sulu of the Mohammedan tribes of the archipelago of the same name; the Ibanag of Northern Luzon, the Ilocan of Northwestern Luzon, the Pampango of Central Luzon, and the Bicol of Southern Luzon. Before the Spanish occupation the Tagalos and the Visayans had an alphabet of their own, and the Tagalos still possess a considerable body of vernacular lyric poetry; like the Tagalog, the Visayan language is highly developed and well adapted for literary use. Their native alphabet was superseded by the Arabic alphabet after the Mohammedan conquest in the 13th century; but since they came under Spanish domination the Tagalos, Visayanos and other christianized or semi-christianized native races have employed the Roman alphabet. In common with most of the Malayan languages the Malayan dialects of the Philippines possess the five vowels, a, e, i, o, and u, with both the long and short sounds, to which are given the same values as in the languages of Continental Europe; their consonants are k, g, ng, ch, jñ, n, t, d, p, b, m, r, l, w, s, and h. The ng represents a peculiar guttural-nasal sound essentially different from that of *ng* in *sing*; and in Tagalog and Visayan there is a peculiar r sound. The root-words in all these languages are nearly all dissyllabic, and the accent is always laid on the penultima, unless that syllable is short. A radical word serves as noun, adjective, or adverb without undergoing any change; thus, the same word may express swift, swiftly, and swiftness; but the unmodified root word is rarely used as a verb. There is nothing in the terminations of words to determine their place among the parts of speech, as nouns, adjectives, verbs, etc., and only in derivative words is the distinction made evident. Derivation is effected by means of a syllable prefixed, or inserted, or subjoined, or by reduplication of the radical word. These modes of derivation or word-formation are very numerous, upward of a hundred, and the idiomatic use of them is an art not easily acquired. As there is no grammatical form to distinguish noun from adjective, adverb, verb, etc., so there is none to distinguish gender, number, person, or case, save that some of the pronouns have a case inflexion. Nor is plurality expressed in any way, save where otherwise the sense would be ambiguous; to avoid ambiguity as to number, sometimes the noun is duplicated, or a word signifying "all" or "many" is added to it. Verbs acquire a causative, iterative, intensive, etc., sig-

nification by the employment of particles differing slightly in form to make the verbs active or passive; there are no inflexions for mood or tense, number, or person; when mood or tense must be noted to avoid ambiguity, that end is attained by the use of auxiliary verbs or particles. In speech the relative position of noun and adjective is, noun first, followed by the adjective; the order of the principal words of a sentence is, first the subject, then the verb, last the object.

**Philippines, Products of.** In these days of expanding Americanism a study of the products of our various over-seas possessions opens up a wide and fascinating field. Prominent among these territories stand the Philippine Islands with their wealth of timber, hemp, tobacco, sugar, copra, and many other developed and undeveloped products.

It is the purpose of this article to consider those products in detail, keeping in view, not so much their present commercial value, as what their value will likely be in the future to the United States, and to the islands.

While the figures of exports from the Philippines since American occupation began on 12 Aug. 1898 are not by any means a fair indication of what the islands will be able to export, under normal conditions, yet they will serve to give us an idea of the possible and probable future exporting value of this branch establishment of ours in the Orient.

Starting with \$12,000,000 in 1899, the first fiscal year of American occupation, we have the following record of merchandise exports:

1901.....	\$23,214,948
1902.....	23,927,679
1903.....	33,121,780

Considering the 1902 and 1903 exports by classes we have:

PRODUCTS OF	1902	1903
Agriculture .....	\$20,659,573	\$31,332,483
Manufactures .....	2,088,114	1,327,704
Forest .....	222,849	226,601
Mining .....	3,657	1,171
Miscellaneous .....	953,486	253,821
Totals .....	\$23,927,679	\$33,121,780

Comparing the main items of the same years, the result is:

	1902	1903
Hemp fibre .....	\$15,841,316	\$21,701,575
Other fibres .....	178,120	173,776
Manufactured fibres .....	17,870	26,931
Copra .....	1,001,656	4,473,029
Straw manufactures .....	181,162	137,369
Sugar .....	2,761,432	3,955,568
Tobacco, unmanufactured .....	784,523	902,870
Cigars .....	1,666,722	947,498
Cigarettes .....	9,995	20,699
Other tobacco manufactures....	40,127	10,945
Sapan wood .....	30,934	29,782
Coffee .....	2,879	1,378
Indigo .....	8,806	11,078
Copper .....	18,935	12,070
Fish .....	15,201	19,504
Almaciga gum .....	1,693	7,302
Copal .....	73,010	41,186
Glue .....	10,111	12,618
Other gums and resins.....	64,808	111,872
Hides of cattle.....	22,119	46,483
Other hides and skins.....	54,633	29,622
Metal compositions .....	25,991	5,716
Ilang Ilang oil .....	70,553	103,789
Seeds .....	3,054	11,366
Shells .....	101,444	121,226
Distilled spirits .....	577	20,162

As a matter of fact the export records contain over 100 items, all products and manufactures of the Philippines, of which the foregoing list is fairly representative.



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That the products of the islands have already been materially developed under American rule is evidenced by the figures of exports for the 15 years, 1880-94, prior to the Spanish insurrection:

Average yearly exports — 1880-1884.....\$20,838,325  
Average yearly exports — 1885-1889..... 20,991,265  
Average yearly exports — 1890-1894..... 19,751,293

The increase from \$20,000,000 — the average yearly export from 1880 to 1894 — to \$33,000,000 — the figure, in round numbers, for 1903 — is striking; but the difference is still greater, because the 1880-94 figures include coin and lottery tickets. Coin exported in those years must have amounted to at least \$5,000,000 yearly. Under American occupation neither gold coin nor silver coin is included in the export figures, while for 1901-3 the coin exports were:

	Gold	Silver
1901 .....	\$ 305,251	\$ 2,911,063
1902 .....	806,208	2,423,200
1903 .....	180,480	6,366,106
Total, each .....	\$1,291,939	\$11,700,369
		1,291,939
Grand total .....		\$13,002,308

or an average of \$4,334,102 yearly. Inasmuch as it is clearly shown above that exports have largely increased under American occupation, it stands to reason that more coin must have been sent away in Spanish days to pay for imports and other debts.

### VEGETABLE PRODUCTS.

*Hemp Fibre*, known as manila hemp.—At present that is the staple product of the islands, and one of which the United States can use all, or nearly all, the total production by discontinuing the use of Mexican henequen, or sisal grass. Next to the United States, the United Kingdom is the best customer for manila hemp. The comparative consumption of it by the two countries, and the total quantities exported in 1901-3, was as follows:

	1901 tons	1902 tons	1903 tons
Total export .....	109,231	108,265	130,159
of which			
	1901 tons	1902 tons	1903 tons
United States .....	17,872	44,810	70,526
United Kingdom .....	74,635	55,023	50,968

The largely increased takings by the United States in 1902 and 1903 over 1901, show our need and appreciation of this valuable product. The native name of this product is abacà. Its cultivation is best in a moist climate. The Philippine Islands have a monopoly on manila hemp, as it cannot be produced in any other part of the world. It grows wild throughout a large part of the archipelago, and affords the best return for the effort expended of any industry of the islands. Manila hemp readily responds to cultivation, doubling the profit. It can be produced at a profit at one-third of present prices, or for less than one-half the cost of cheaper and unsatisfactory substitutes. The market for manila hemp is inexhaustible as the world uses \$100,000,000 worth annually of substitutes. Manila hemp is immune from insect pests or damage by weather conditions. It is grown and harvested without the use of machinery, consequently little or no capital is

necessary. It forms 65 per cent of the present total exports of the islands, and over 75 per cent of the agricultural exports. The Filipino hemp producer is the most independent farmer of the world, delivering his specialty on the wharf, with the markets of the world at his feet. The demand for manila hemp is so great that the Philippine export tax for revenue on the commodity does not in any way retard production or sale. Ex-Gov. Taft so testified — see report of Senate Philippine Committee, page 150. The governor further said, in answer to the same question, that tariff changes would have a far different effect on the cultivation and export of sugar and tobacco. Gen. Luke Wright, governor of the Philippines, also testified that the hemp industry of the islands is the most profitable of the various industries. There are forests of wild hemp that have not yet been touched. Mr. J. G. Livingston, governor of the province of Sorsogan, testified (page 459 Senate Hearings), "The existing price of hemp in this province is so high that an industrious man can earn \$4 to \$5 Mexican per day."

The islands also produce sisal grass and other cheaper substitutes for hemp, and exported \$173,776 worth of them in 1903. In the same year we paid Mexico \$13,073,633 for sisal grass, and \$215,811 to other countries. Why not also cultivate more of this under our own flag, and keep the money in the family? We also paid the East Indies \$3,205,524 for jute and jute butts, which ought to grow in the Philippines. The climate is about the same.

All signs indicate that the possibilities for profitable culture of fibres in the Philippines are unlimited.

*Copra*.—This is dried cocoanut, and is used largely in the manufacture of soaps. The islands exported:

1901.....	\$2,648,305
1902.....	1,001,656
1903.....	4,473,029

Nearly all of it went to the continent of Europe, chiefly to France, and to Great Britain. Our share was but trifling. The figures of division are, mainly:

	1901	1902	1903
France .....	\$1,759,577	\$772,250	\$3,259,659
Great Britain .....	126,580	888	444,439
Germany .....	480	4,882	263,780
British East Indies....	39,970	78,934	197,529
Spain .....	547,529	125,317	187,398
United States .....	4,450	7	9,173

Copra is a good steady product in any of the southern islands. A small cluster of cocoanut trees is enough to keep a Filipino family in the lap of luxury. After four or five years' care, nature and the Chinese trader do the rest. The life of a tree is a century, and 200 trees are grown to the acre. All the Filipino has to do is to sit in the shade and watch his copra grow. Two hundred trees yield an annual income of \$100 gold. The 1903 crop was worth about \$9,000,000 silver. As a paying business that beats bonanza farming in the American Northwest. Only \$63 worth of fresh cocoanuts was exported in 1903. The 1902 crop of copra, like all other crops in the islands, suffered severely from the series of agricultural misfortunes which overspread the islands in that year, but the 1903 crop redeemed the situation, being over four times the 1902 crop, and nearly double that of 1902.



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*Sugar.*—Here is a great field for product development in the Philippines. The United States is the greatest sugar consuming market in the world. In the past three years American importations of raw sugar have been:

YEAR	Pounds	Value
1901 .....	3,975,005,840	\$90,487,800
1902 .....	3,031,915,875	55,061,097
1903 .....	4,216,108,106	72,114,291

Our consumption is so enormous, about 5,000,000,000 pounds a year, that we can easily absorb all the sugar which Cuba, Hawaii, and the East Indies can produce, plus the limited product of our own beet sugar factories, and still have room for all the sugar which the Philippines could, for many years, produce. Our takings of Philippine sugar are growing, however. Still, Japan is taking nearly as much as we are. The three years' figures of distribution of the sugar of the Philippines follow:

COUNTRY	1901	1902	1903
United States .....	\$ 93,472	\$ 293,352	\$1,335,826
Japan .....	1,071,612	711,743	1,269,485
Hongkong .....	942,374	1,360,861	886,282
China .....		312,225	309,990
United Kingdom ....	185,593		153,982

Before the insurrection against Spain, the Philippines produced sugar much more extensively than since. For instance, the 1893 production was 261,519 tons, but that of 1901 was only 55,399 tons. Constant revolution, death of the island's carriers (the water-buffaloes) by rinderpest, and other misfortunes were the cause of this four fifths reduction in 1901. Fortunately 1902 and 1903 put things in a somewhat better shape. Still, the sugar industry in the Philippines is practically again in its infancy. The sugar producing capacity of the islands is almost boundless. Much of the 65,000,000 acres of arable land is eminently adapted to sugar culture. The islands have a population of 8,000,000, of whom 6,500,000 are accustomed to working for 8 to 10 cents a day. With all this land, and all this cheap labor (and the Filipino is now being forced by circumstances to realize the necessity of working) there is hardly any limit to the possible extension of the sugar industry. As it is now, we are paying \$61,000,000 to \$91,000,000 yearly to foreigners for this commodity, while we own millions upon millions of as good, or better, sugar lands than are owned by those foreigners, with sufficient of as cheap, or cheaper, labor in sight. The day is very far distant when American beet sugar factories will be able to fill our increasing yearly sugar demand, already, as before stated, 5,000,000,000 pounds. Ex-Gov. Taft testified, "We have enough suitable land to produce the sugar of the world." Yet Mr. Edward Atkinson's coterie of "Anti-Imperialists" say the Philippines cannot be made to pay. If the islands can—as they did—export from 122,925 to 261,519 tons yearly in the years from 1880 to 1898, with admittedly crude plants and disheartened working people, whose wages were not paid in coin—as they now are—with only a few thousand acres under indifferent cultivation—at a cost of 62½ to 90 cents per hundred pounds—without agricultural implements—and with a loss of 45 per cent of the sugar, what may we not expect as to quantity and cost of sugar production, under modern equipment, labor-saving im-

plements, cheap labor, American capital, American energy, and American executive ability?

*Tobacco.*—Fairly good cigars are exported at one cent each. The total exportations of tobacco, cigars, and cigarettes, during the past three years were as follows:

1901.....	\$2,217,728
1902.....	2,501,367
1903.....	1,882,012

These exportations were mainly to European countries. The United States tariff, even with the 25 per cent reduction in favor of the Philippines, practically precludes the sale here of Manila cigars. Moreover, 43 of our States are now producing tobacco. The wages paid American tobacco-workers average \$1.364-5 a day, against 35½ cents a day in Manila. Tobacco is a well established and profitable industry in the Philippines—even irrespective of the United States home market. What it would grow to, with that great and increasing market open to it, is impossible of prediction. Manila has 31 cigar and cigarette factories, employing 12,168 persons.

*Coffee.*—The United States consumes from \$60,000,000 to \$70,000,000 worth of coffee each year, and does not produce a pound of it. Porto Rico's coffee is slowly recovering from the terrible cyclone of 1899, and her coffee is working its way, though far too slowly, into American favor. Hawaii is also doing a little in coffee growing, but the two sources are not furnishing a tithe of the 1,000,000,000 pounds the home market annually consumes. Instead of \$60,000,000 to \$70,000,000 of American coffee money going out of the American family, all ought to be distributed between the Philippines, Porto Rico, and Hawaii.

American expert investigation has shown that the entire central islands of the Philippine Archipelago are adapted to the production of a superior article of coffee, only equaled by the best Mocha. In the past the Philippines exported large quantities of it. In the years 1885-90 the average yearly export was 12,708,524 pounds. Then the borer insects (and revolutions against Spain) invaded the coffee plantations, and as the people were devoid of the necessary agricultural science to deal with this pest, coffee growing practically ceased. Things are, or easily can be, different now. American science can protect American capital in this direction. In adjoining Java, millions of capital earn good profits in producing an inferior grade of coffee, much of which is consumed in the United States. Experts say that the use of suitable apparatus for shelling and polishing will enable Philippine coffee to compete in the markets of the world. Brazil is reported as figuring to destroy part of its coffee crop to enhance the price.

*Cocoa or Cacao.*—This is another product of which we cannot produce a pound in the United States proper. In the raw state we imported in

	Pounds	Value
1901 .....	50,433,562	\$6,720,814
1902 .....	56,744,545	7,262,100
1903 .....	63,351,294	7,820,087

Mr. Lyon, the expert tropical agriculturist of the Philippine Commission, says that in no other country has he seen soil and climate so favorable to growing cacao, as in the Philippine



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island of Mandanao; that the cacao now produced there is of superior quality, and is nearly all bought up for shipment to Spain, where it brings a high price; that there are numerous other regions in the Philippines where cacao can be raised to great advantage,—to-day, there is not a proper cacao plantation, as the Filipinos just planted a few scattering bushes, which they left practically without care to be swamped by brush and preyed upon by insects; that proper harvesting and curing methods are not employed; that the fruits are torn from the bushes, injuring the bark. American thoroughness could easily protect American capital in that industry. The 1903 export of cacao only amounted to \$11.

*Dyewoods.*—Of dyewoods there are 17 varieties in the Philippines. The United States import dyewoods from foreign countries, to the following extent:

1901.....	\$864,986
1902.....	744,380
1903.....	748,550

This seems to be a virgin field for development.

*Gums and Resins.*—Already this is quite an industry in the Philippines. Of copal the islands exported,

1901.....	\$109,936
1902.....	73,010
1903.....	41,186

but none of it came to the United States, except \$906 worth in 1902, though American imports of copal were:

1901.....	\$1,193,251
1902.....	2,261,206
1903.....	2,938,771

Why not produce our own copal in the Philippines?

Of camphor, arabic, chicle, copal, gambier, shellac, and other gums our imports were:

1901.....	\$6,639,139
1902.....	7,744,183
1903.....	10,594,647

As these are all tropical products, and as the Philippine Islands are essentially tropical, there is an opportunity here to keep another \$10,000,000 yearly in the family cash-box. As copal is produced and also almaciga gum, why not camphor, arabic, and the rest of this list of tropical gums?

*Rubber and Gutta-percha.*—As to growing rubber and gutta-percha in the Philippines, experts tell us that the giant rubber vine and several other indigenous varieties have been found in large quantities in several of the islands; that during 1900, the islands exported 36 piculs (133⅓ pounds) of “Borneo” rubber (from vines) which establishes the existence of the plant. A Ceara rubber tree was planted in Manila, and in one year reached a height of 21 feet. The rubber-planter’s return is quoted at from \$150, to \$300 per acre. At present we are buying all our immense consumption of rubber and gutta-percha from foreign countries. Gutta-percha is now being shipped from Manila to Singapore and Borneo. Several species of trees produce the sap. Our import for three years past was:

	Rubber	Gutta-percha
1901 .....	\$28,586,340	\$130,957
1902 .....	25,151,559	252,329
1903 .....	30,997,232	222,400

## SUBSIDIARY VEGETABLE PRODUCTS.

In addition to the products already described, namely, coffee, cocoa, sugar, hemp and other fibres, dyewoods, gums and resins, copra, and cocoanuts, tobacco, rubber and gutta-percha, the Philippines also produce, or are able to produce, tea, rice, spices (\$78,604 worth exported in 1900–2), bananas in abundance, ground fruits of several kinds, grapes, strawberries, blackberries, figs, walnuts, citrons in abundance, mangas (one of the most exquisite fruits in the world, and the queen fruit of the Philippines), papaya (two sexes, of which the male produces tubes filled with white aromatic flowers, and the female yields fruit), pineapples of fine flavor, cantaloupes, lemons of seven varieties, oranges of various indigenous species, and many other edible fruits, indigo, marine and fresh water fish valuable and abundant. There are other minor saleable vegetable products of species natural to a tropical climate.

## MINERAL PRODUCTS.

The mineral resources of the Philippine Archipelago are sufficiently known to indicate their value as commercial products, but to what extent scientific exploration and exploitation alone will determine. “From a mineralogical standpoint, the best authorities,” says the geographical dictionary of the Philippine Islands, published in 1902 by the Bureau of Insular Affairs, War Department, “are the Spanish mining bureau, the researches of Ashburner, and the technical publications of Semper, Santos, Roth, Drasche, Abella, and others; also the travels of Comyns, Jägor, Worcester, and others.”

The use of gold in exchange and adornment, and copper for utensils was common among the natives upon the first landing of their Spanish conquerors 400 years ago, but the Spaniards never encouraged the systematic mining of metals. Placer washings, and the most primitive methods of mining and working quartz were, and still are, in use by the natives. Revolutions, burdensome laws, and the scarcity of skilled labor discouraged foreign mining enterprise in the long line of Spanish days.

Since American occupation miners and prospectors have often preceded the troops. The American mining bureau at Manila, now has reports from almost every one of the very many islands in the archipelago. In many cases samples and specimens have been furnished to the bureau. Through these sources the fact has been established that gold, copper, lead, iron, coal, sulphur, granite, marble, petroleum, and other metallic and non-metallic minerals exist in paying quantities. The influence of the miner and prospector is making itself felt, repeating the experiences of the pioneer days of the mineral-producing American States of the West. More than that, mining operations in the Philippines, when once they really begin, will have all the present-day advantages of the latest devised electrical and other mining apparatus. Following is a brief summary of some of the mining opportunities in the Philippines:

*Coal.*—This is of the Tertiary Age, and a



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highly carbonized lignite, analogous to Japanese and Washington coal, but not to the Welsh or Pennsylvania coals. Philippine coal might supplant English or Australian coal for most purposes. The seams found vary from 2 feet 6 inches to 14 feet 8 inches in thickness. Want of transportation is the present drawback.

*Copper.*—This is reported from many localities. Copper ore was smelted by the natives before Magellan discovered the Philippines. Mean assays show over 16 per cent of copper.

*Gold.*—This is found in a vast number of localities. As recently as 14 May 1904, the *New York Sun* reports a rich gold strike—128 ounces in a short time under primitive methods—by an American prospector, in the provinces of the Camerines. The capital is Neuva Caceres, a city of 12,000 inhabitants, about 207 miles from Manila. Silver, iron, copper, and lead are also known to exist in the same mountains. Specimens of quartz from another point—Paracale—assay 38 ounces of gold to the ton. In Benquet (the highlands of the Philippines) where the summer government station is to be erected, the gravels of the river Agno carry gold. In another district, years ago, natives produced 150 ounces of gold per month, using only cocoanut shells as dishes.

*Iron.*—Iron is abundant in Luzon, Cebu, Panay and doubtless in other islands. The finest deposits are in the province of Bulacan, island of Luzon, the principal island of the archipelago.

*Petroleum.*—This valuable mineral is reported from several points.

*Sulphur.*—Deposits of sulphur abound about the numerous active and extinct volcanoes in the Philippines. The finest sulphur deposits are on the little island of Biliran.

In addition, mention may be made of antimony, asphalt, clays (equal to the best Chinese and Japanese kaolins), natural gas, gypsum (very plentiful in central Luzon), lead and silver, lithographic stone, marbles (of fine quality), mercury, nitre, ochres, opals, platinum, pearls, salt, serpentine, and zinc.

### FORESTS OF THE PHILIPPINES.

The forest wealth of the islands of the Philippine Archipelago is enormous in variety, quality, and quantity. The Chief of the Bureau of Forestry of the Insular Government estimates (22 July 1904) that there are about 40,000,000 acres of forest lands in the public domain of the islands. All of this, the value of which is beyond computation, is, by the generosity of the people and Congress of the United States, set apart solely for the benefit of the Filipinos, plus the incalculable further benefit of American methods and energy of development. That is an imperial gift to a dependent people, and constitutes all the "Imperialism" that can be found in connection with American occupation of the Philippines.

These magnificent forests have been found to contain 665 varieties of timber, indigenous to the archipelago, and include, approximately, the most valuable woods of economic or commercial value. The forest products, besides the woods useful for house and ship-building, cabinetwork, and other economic and artistic purposes, comprise a large variety of gum-producing trees and medicinal and dye-plants, already

indicated under the head of Vegetable Products. The hardwoods of the Philippines will come into considerable use in the United States. It is quoted in technical journals that Philippine mahogany can be delivered at American ports at about one half the cost of the South American wood now imported. In this connection it is well to note the past three years American import of foreign mahogany. The figures are:

	Feet	Value
1901 .....	32,281,000	\$1,752,612
1902 .....	44,795,000	2,361,483
1903 .....	48,387,000	2,783,679

All of which is admitted duty-free, to the benefit of foreign countries, while thousands of millions feet of our own Philippine mahogany lie idle waiting for railroads, American ships, and American capital and energy to cut, transport, and land it upon the wharves of New York and Boston, Seattle and San Francisco.

At present the demand for Philippine timber in the archipelago and China is much greater than the supply that is being taken out.

Besides the large areas of mahogany, the Philippine forests contain the finest varieties of other hardwoods for cabinet and furniture work. Of such woods, the United States bought from foreign countries, in the past three years, as follows:

1901.....	\$1,240,737
1902.....	999,792
1903.....	1,251,621

Thus we see that a present market of at least \$4,000,000 yearly awaits Philippine mahogany and hardwoods, in the United States. That money can be kept in the family. The beauty of these valuable Philippine woods was fully made known and appreciated at the Louisiana Purchase Exposition, held at St. Louis, Missouri, from May to November, 1904, and also at the Pan-American Exposition, held at Buffalo, New York, in 1901. Over 100 varieties were polished, labeled, and exhibited. Though 665 varieties comprised the first classification of Philippine woods (1900), others have since ascertained, and it is expected that fully 1,000 varieties will finally be listed. A brief description of the principal woods abundantly existing in this imperial domain follows.

Eleven different oaks, mahogany, and cedar in abundance, ebony, teak, and many other fine species of which the value has yet to be ascertained. Fine furniture makers will be attracted by the following:

Ebano (ebony) — Intense and uniform black color.  
 Camagon — Black with brown streaks.  
 Bolongita — Dark red with spots of black.  
 Tindalo — Light red, gradually turns black with age.  
 Narria (mahogany) — Scarlet to blood red.  
 Malapatay — Yellow spotted with brown and black.  
 Alintatao — Dark, hard like ebony.  
 Camuning — Bright ochre yellow, uniform streaks of brown.

There are also six good varieties for common furniture. Ship-builders can find every variety necessary for keels and stern-posts; for outside planking, futtock timbers, stems, crooks, or framework; for beams, masts, and yards; for keelsons and clamps; for waterways and deck timbers; for upper works and partitions. For canoes there are many suitable species. House builders can find every variety they need, many of them impervious to the white ants. Several especially adapted for all parts exposed to the



PHILIPPITE — PHILIPPOTEAUX

action of moisture. Varieties suitable for all the finer forms of interior work, and decoration. Calantas, or Philippine cedar in great abundance for cigar boxes, fine boxes, and jewel caskets. Then Molave, called by the natives the "queen of woods," logs 35 feet by 24 inches square, yellow, yellowish green, or ashy; resists sea worms, white ants, and the action of the tropical climate; extremely strong and durable, lasts well under ground; very highly valued for building purposes. And palms for structural purposes, resisting moisture; trunks are converted into tubes for conducting water, used for rafters in house building, for piles, and for telegraph poles; from the hard, outer wood handsome canes and bows are made. Besides these, there is lanite, ashy white with white spots, for cabinetwork, carved objects, or musical instruments.

PINE TIMBER.

William H. Brown, governor of the province of Abra, reported (see page 463 Senate Hearings): "On these mountains I found fortunes for many men; not in gold, not in silver, nor in any other metal, but in pine! pine! pine! Lumbermen from Maine — and I have spent many a day in the pine woods of Maine — would stand with open mouths gazing in admiration at the splendid trees that towered scores of feet above our heads; trees that took three men to encircle, thousands and hundreds of thousands of them." Nine tenths of the timber standing in many of the forests might be removed with profit to the government and actual improvement to the forests, as it would give opportunity for rapid growth to the trees left standing. The forests of the Philippines are more extensive and more valuable than those, so far counted as unapproachable, of India. During the fiscal year of 1902, all that was taken from the forests of the Philippines was 3,637,392 cubic feet of timber, 3,808,870 cubic feet of firewood, 247,947 cubic feet of charcoal, 20,685 pounds of rattan, 2,256,458 pounds of dyewoods, 312,154 pounds of tan bark, 1,082,235 pounds of gum mastic, 282,996 pounds of rubber (of superior quality), 373,331 pounds of gutta-percha (of low grade), 9,181 gallons of vegetable oils, 113,905 pounds of pitch, and 20,685 pounds of cinnamon. Imagination fails to conceive of the vast quantities of forest products still available (and growing day by day) for the benefit of the people of the Philippines, and of the American nation as a whole.

OUR NEED OF PHILIPPINE PRODUCTS.

The future commercial value to the United States of the Philippine Islands turns upon the use we can make of their products, so that American products and manufactures can be sent in exchange, instead of, as is now the case, our good, hard money going to foreigners for what we are obliged to import of like tropical products. That annual loss can easily be ascertained by reference to the import records published by the Department of Commerce and Labor, through its Bureau of Statistics. The record as indicated, for 1903, is mainly:

Coffee .....	\$ 59,200,479
Sugar .....	72,114,291
Cocoa .....	7,820,087

Fibres (not Manila hemp).....	\$20,559,843
Mahogany .....	2,783,679
Other cabinet woods.....	1,251,621
Bananas .....	8,541,156
Gums .....	10,594,647
Indigo .....	1,202,451
Spices .....	4,815,125
Rubber and gutta-percha.....	30,997,232
Cocoanuts .....	908,242
Dyewoods .....	748,550
Total .....	\$221,537,400

Though it is not to be assumed that development of the Philippines would turn all this vast sum towards the islands, yet a share of it would go that way. Moreover, development of the islands would render many millions in other products available for American use. It must be remembered that every dollar paid by one member of the American family to another member, stays in the family, and increases the forceful front which we offer to the world. Great Britain with her colonies is a leading world power; Great Britain without her colonies would be only an island. Though the latter statement cannot be made of the United States by reason of its illimitable natural resources, yet it is true, that the United States with the advantageously placed and valuable colonies which it now possesses, is a far stronger world power than it would be without the Philippines, Porto Rico, Hawaii, Alaska, Guam, Tutuila, and the Panama Canal strip. WALTER J. BALLARD.

**Philippite**, a mineral belonging to the group of Zeolites, formerly regarded as orthorhombic, but now ascertained to be monoclinic in crystallization. Crystals always twinned. Hardness, 4-4.5; specific gravity, 2.2; luster, vitreous; color, white; translucent to opaque. Composition: Silica, 47.9; alumina, 20.5; lime, 7.4; potash, 6.3; water, 17.9 = 100, corresponding to the formula, 4SiO<sub>2</sub>.Al<sub>2</sub>O<sub>3</sub>.(<sup>2</sup>/<sub>3</sub>CaO + <sup>1</sup>/<sub>3</sub>KO), 5HO. Occurs in vesicular cavities in old igneous rocks, and also of recent formation in the walls of the hot baths of Plombières, France. **Philippium**, in chemistry, an element closely allied to cerium. Though described by Delafontain in 1888 as a newly discovered element, it was not until 1897 that it was acknowledged to be such by English chemists. Philippium has been found in gadolinite, samarskite and fergusonite. It appears in two sets of compounds, the philippous and the philippic, corresponding to a white acid and an orange oxide. The salts of the first series are colorless, quite stable, crystallize well, and correspond to the lanthenum and yttrium salts. Philippic oxide has a deep orange-red color. The constitution of philippium compounds remains to be established.

**Philippoteaux**, fê-lê-pō-tō. **Henri Emmanuel Félix**, French painter: b. Paris 3 April 1815; d. there 9 Nov. 1884. After studying his art under Cogniet he applied himself to the painting of battle scenes, and his canvases give a vivid and almost complete panorama of 19th century wars. His mastery of details and lively delineation of the clash and movement of combat are remarkable. Among his principal pictures are: 'The Evacuation of Moscow' (1835); 'The Capture of Ypres'; 'The Siege of Antwerp in 1792' (1838); 'Louis XV. Visiting the Battlefield of Fontenoy' (1840), in the Luxem-



## PHILIPSBURG—PHILISTINES

bourg; 'The Battle of Rivoli' (1845); 'Charge of the Chasseurs d'Afrique at Balaclava' (1859); 'The Siege of Puebla' (1865); 'The Meeting of Henry IV. and Sully after the Battle of Ivry 1590' (1875), now in the Museum at Versailles; 'Bayard on the Bridge of Garigliano 1503'; 'The Battle of Alma' (1875); 'A Panorama of the Siege of Paris 1870-1'; and several other war panoramas.

**Philipsburg**, Germany, a town on the right bank of the Rhine, 16 miles north of Carlsruhe, formerly a celebrated imperial fortress. In 1734 it was captured by the French under the Duke of Berwick (who lost his life here), and its fortifications were razed in 1800. Pop. (1900) 5,000.

**Philippson**, fē'lēp-zōn, **Martin**, German historian: b. Magdeburg, Germany, 27 June 1846. He was educated at Bonn and at Berlin, became docent at Bonn in 1871, and in 1878 was appointed to the chair of history in the University of Brussels. A bitter controversy arose with the anti-German student body in 1890, and Philippson resigned his professorship. He wrote: 'Geschichte Heinrichs des Löwen' (1868); 'Geschichte des preussischen Staatswesens vom Tode Friedrichs des Grossen bis zu den Freiheitskriegen' (1880-2); 'Das Leben Kaiser Friedrichs III.' (1900); 'Kurfürst Friedrich Wilhelm von Brandenburg' 1879-1901); etc.

**Philips**, fil'ips, **Ambrose**, English poet: b. Shropshire 1675; d. London 18 June 1749. He was graduated from Cambridge in 1696, and removed to London, where he became intimate with Addison and Steele. His 'Winter-piece,' published in the 'Tattler,' first gained him recognition; his six 'Pastorals,' which appeared in Tonson's 'Miscellany' (1709), gained the praise of Tickell, but roused a bitter satirical attack from Pope. Some of his odes written to children, contain really his best work, but their simplicity of diction earned for him the nickname "Namby-Pamby," since become an adjective in general use. He established the 'Free-thinker' in 1718, and supported the Government in its columns, later sat in the Irish Parliament for Armagh, was secretary to the lord-chancellor of Ireland in 1726, and judge of the prerogative court in 1733. His play, 'The Distrest Mother' (1712), adapted from Racine's 'Andromaque,' received high praise from the 'Spectator,' but 'The Briton' (1722) and 'Humphrey, duke of Gloucester' (1723) attracted little attention. Consult Johnson, 'Lives of the Poets.'

**Philips**, **Edward**, English author: b. London August 1630; d. there about 1696. He was educated under the care of his uncle, John Milton, and studied for a time at Oxford. Later, with his brother, John (1631-1706), who had been Milton's assistant as Latin secretary to Cromwell's government, he joined the Cavalier party, which proceeding resulted in an estrangement from his uncle. He engaged in literary work, edited a volume of poems by William Drummond, and supported himself by literary hack work and tutoring in noble families. Subsequently he became reconciled to his uncle and was a warm admirer of his work. He wrote: 'New World of English Words' (1658); 'Theatrum Poetarum' (1675); 'Life of Milton' (1694); etc.

**Philips**, **Francis Charles**, English novelist and dramatist: b. Brighton, Sussex, 3 Feb. 1849. He was educated at Brighton College, entered the army, where he served three years, became a barrister in 1884, and began writing novels and plays. His novel, 'As in a Looking Glass' (1885), was dramatized and played by both Sarah Bernhardt and Mrs. Beere. He collaborated in writing the plays: 'A Woman's Reason'; 'The Fortune of War'; 'Papa's Wife'; etc., and among his novels are: 'The Dean and His Daughter,' dramatized (1887); 'Mrs. Bouverie' (1894); 'The Luckiest of Three' (1896); 'Men, Women, and Things' (1898); etc.

**Philips**, **George Morris**, American educator: b. Atglen, Pa., 28 Oct. 1851. He was graduated from Bucknell University, Lewisburg, Pa., in 1871, and has been principal of the Pennsylvania State Normal School, Westchester, Pa., from 1881. He has published: 'Astronomy' (1882); 'Natural Philosophy' (1884); 'Civil Government of Pennsylvania' (1893); 'Geography of Pennsylvania' (1895).

**Philips**, or **Phillips**, **John**, English poet: b. Bampton, Oxfordshire, 30 Dec. 1676; d. Hereford, England, 15 Feb. 1709. He was educated at Winchester and Oxford, and won his first literary success on the publication of his 'Splendid Shilling,' written in blank verse in imitation of Milton. His 'Cyder' was also an imitation, after Virgil's Georgics, and 'Blenheim,' which was a Tory celebration of Marlborough's victory, was written in reply to Addison's 'Campaign.' He is the only notable writer in blank verse between Milton and Thomson.

**Philips**, **Katherine Fowler**, English poet: b. London 1 Jan. 1631; d. there 22 June 1664. She was married to Hector Philips in 1647 and afterward accompanied the Viscountess Dunganon to Ireland. On her return to London she became a member of the famous literary circle which included Jeremy Taylor and Sir Charles Cotterel and was known among them as "the matchless Orinda." Her translation of Corneille's 'Pompée' was very successful and was acted in 1663-4. An unauthorized edition of her poems was printed in 1663 and her letters to 'Poliarchus' (Sir Charles Cotterel) were published in 1705. Consult Gosse, 'Seventeenth Century Studies' (1883).

**Philipson**, fil'ip-sōn, **David**, American rabbi: b. Wabash, Ind., 9 Aug. 1862. He was graduated from the University of Cincinnati and from the Hebrew Union College there in 1883. In 1884-8 he was rabbi of the Har Sinai Congregation in Baltimore, and has since been in charge of the B'ne Israel Congregation, Cincinnati, and professor of homiletics in the Hebrew Union College there. He is prominently connected with various charitable and other associations and has published: 'The Jew in English Fiction' (1889); 'Old European Jewries' (1894); 'The Oldest Jewish Congregation in the West' (1894); 'Reminiscences by Isaac M. Wise' (1901); etc.

**Philistines**, fī-līs'tīnz (Hebrew, Philisthīm), a people who appear to have settled in the coast plain of Canaan shortly before the arrival of the Israelites; whence they migrated is a question which historical and archæological research has as yet failed to resolve. Some his-



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torians trace their origin to the island of Crete, others hold that they came from the borders of Egypt, the land of Gerar. Their territory, called Philistia or land of the Philisthiim, gave, in after times, to the whole country at any period occupied by Israel the name it still bears, Palestine. They occupied four principal cities from the neighborhood of Joppa on the north, southward to the Egyptian border, namely, Azotus (Ashdod), Gaza, Ascalon (Ashkelon)—these on the Mediterranean coast; and Gath and Ekron inland. These five cities, under as many lords, were always confederated for war, offensive or defensive, against foreign enemies. Throughout the period of the Judges in Israel this confederacy was at almost continual war with the Israelites, and despite the consolidation of the military resources of the Hebrew people under the kingship, the ascendancy of Philistia seemed assured before the close of Saul's reign. But David carried the war into the Philistine country and with notable success; his son Solomon completely subdued Philisthiim, and made the country tributary to Israel. Even after the division of Israel into two kingdoms the Philistines, though they were a serious menace to the northern kingdom, for some time did not dare to attack the kingdom of Judah; but in the reign of Ahaz, the eleventh of the Judaite kings, they reconquered some of their ancient possessions. In the time of the Maccabees the Jews once more asserted mastery over their ancient rivals; afterward Philistia was annexed by Pompey to the Roman province of Syria. The origin of the Philistines is a much vexed question. That they were of Semitic race or that they were at least a semitized people has been with strong probability inferred from such remains of their language as are extant. First, the names of their cities, which are unquestionably semitic; but are the names we have the very names given to the cities themselves, or are they names given them by their Semitic neighbors? If the question had to be resolved by means solely of the names given in the Hebrew sacred books, the solution would be open to doubt; but the modern study of the Assyrian monuments has discovered a great many other proper names of persons and places—to say nothing of analogies in religious beliefs; and these give abundant proof that the Philistines were, at least in language, Semitic.

**Philis'tinism**, a term of contempts to designate the manners, habits of thought, and views of life held by persons of inferior culture. The word Philistine (Philister) was first employed in some such sense as this, by German university students; for them all classes outside of university circles are *Philister*. Matthew Arnold attributes Philistinism to the whole middle class of the English people who are, he says, ignorant, strenuously obstructive, and narrow-minded. But Leslie Stephen recognizes in the use of the word the very note of Philistinism: "Philistine," he says, "is a term of contempt applied by prigs to the rest of their species."

**Philis'tus**, a Greek historian who resided at the court of Dionysius the Elder, tyrant of Syracuse (430–367 B.C.), and wrote a history of his life. The work has not come down to our time; it is quoted by Pausanias.

**Philleo**, fīl-ē'ō, **Prudence Crandall**, American philanthropist: b. Hopkinton, R. I., 3 Sept. 1803; d. Elk Falls, Kan., 28 Jan. 1889. In 1831, with the aid of several residents, she opened at Canterbury, Windham County, Conn., a school for young ladies. She received a colored pupil, and thereby aroused the disapproval of her Canterbury neighbors, who declined to help sustain the school if the objectionable member were retained. Upon her refusal to dismiss the colored pupil, the white scholars left, and she then determined to teach blacks only. In April 1833 her new enterprise was begun. Upon petition of the townspeople, an act was passed by the Legislature making unlawful the establishment of young ladies' schools for colored pupils not resident in the State, and in the succeeding autumn she was twice tried, and convicted. In 1834 the judgment was reversed by the supreme court of errors. During the two years' struggle with the town of Canterbury, she was subjected to ostracism and spiteful persecution, and her house was even set on fire. Soon afterward she was married to Rev. Calvin Philleo, and with him removed from Connecticut. Consult May, 'Recollections of the Anti-Slavery Conflict' (1869).

**Phillimore**, fīl'i-mōr, **John George**, English jurist: b. Oxfordshire 1809; d. Shiplake House, Oxfordshire, 27 April 1865. He was educated at Westminster and Oxford, was called to the bar of Lincoln's Inn in 1832, became eminent in his profession and member of Parliament in 1852. He published: 'Introduction to the Study and History of Roman Law' (1848); 'Private Law Among the Romans: Principles and Maxims of Jurisprudence'; etc.

**Phillimore**, SIR **Robert Joseph**, English jurist, brother of J. G. Phillimore (q.v.): b. London 5 Nov. 1810; d. Henley-on-Thames 4 Feb. 1885. He was educated at Oxford, was called to the bar in 1841, and rapidly came to the front in his profession. He sat in Parliament for Tavistock 1852–7; in 1867 was appointed judge of the high court of admiralty, and in 1871–2 was judge-advocate-general. He was knighted in 1862 and created a baronet in 1881, and two years later resigned his judgeship. His works include: 'Commentaries on International Law' (1854–61); 'The Ecclesiastical Law of the Church of England' (1873); and a translation, with notes, etc., of Lessing's 'Laocöon' (1874).

**Phillimore**, SIR **Walter George Frank**, English jurist: b. London 21 Nov. 1845. He was educated at Oxford, became a barrister of the Middle Temple in 1868, and received the patent of precedence in 1883. In the Admiralty Court he has taken high rank, and is vice-president of the English Church Union. He edited Robert Phillimore's 'Ecclesiastical Law of the Church of England' and wrote 'Book of Church Law.'

**Phillip**, fīl'ip, **John**, Scotch artist painter: b. Aberdeen, Scotland, 19 April 1817; d. London 27 Feb. 1887. While a boy in distressing poverty, he cultivated his natural taste for painting, and at the age of 13 received instruction from a local portraitist. Before his 15th year he produced portraits which won for him the patronage of Lord Panmure and the means of pursuing his art studies in London, as a student at the Royal



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Academy. His subjects were at first all Scotch, — 'A Scotch Fair,' 'A Scotch Washing,' etc., or in individual portraits. A visit to Spain for his health's sake in 1851 resulted in a distinct change both of style and subject, and thenceforth his standing among the foremost British artists was assured; he subsequently made two further visits to Spain, and also spent three months at Rome. Among his works are: 'The Letter-writer of Seville'; 'The Spanish Contrabandista'; 'The Early Career of Murillo'; 'The Marriage of the Princess Royal'; 'The House of Commons.'

**Phillip'ium**, in chemistry, a rare element belonging to the yttrium group. Discovered by Delafontain (1878) in a sample of the mineral samarskite obtained from North Carolina, it appears to form two series of compounds, the phillipous and the phillipic, but the chemistry of these substances and even the elementary nature of the so-called phillipium itself needs further confirmation.

**Phillipps**, fil'ips, **SIR THOMAS**, English book-collector: b. Manchester, England, 2 July 1792; d. Cheltenham, England, 6 Feb. 1872. He studied at Rugby and Oxford, early evinced a taste for collecting valuable books and manuscripts, and devoted his entire life to his collections, which exceeded 60,000 books and manuscripts and a large number of old coins and pictures. In 1821 he was created a baronet, and in 1822 established a printing-press on his estate, from which he issued publications important to collectors. His eldest daughter was married to James Orchard Halliwell, the Shakespearean scholar, who upon succeeding to Sir Thomas' estates changed his name to Halliwell-Phillipps (q.v.). The vast collection was bequeathed to the youngest daughter, but much of it is now scattered.

**Phillips**, fil'ips, **Adelaide**, American singer: b. Stratford-on-Avon, England, 26 Oct. 1833; d. Carlsbad 20 Oct. 1882. At seven she removed with her family to Boston, and at the Boston Museum, 25 Sept. 1843, made her début as Little Pickle in 'The Spoiled Child.' She afterward appeared as a juvenile danseuse at Barnum's Museum in New York, under the name of "the Child of Avon." At the Boston Museum she subsequently played soubrette parts, and in 1846 appeared at the Walnut Street Theatre, Philadelphia, as Rosa in 'John of Paris.' In 1852, having developed a contralto voice of rare qualities, on the advice and with the practical assistance of Jenny Lind, she went to Italy for study. After two years she returned to the United States, having meanwhile (1853) made a successful début in 'Semiramide' in Brescia. She appeared in concert in Boston (1854), and made her first American appearance in opera 17 March 1856, at the Academy of Music, New York, as Azucena in 'Il Trovatore.' She sang in the Italian Opera House, Paris, in 1861, and afterward in all the chief cities of the world. For many years she was the foremost of American contralto singers, and equally in concert, opera, and oratorio gave pleasure to thousands.

**Phillips**, **George Searle** ("JANUARY SEARLE"), American author: b. Peterborough, England, January 1818; d. Morristown, N. J., 14

Jan. 1889. He was graduated from Cambridge, came to New York, and engaged in journalism, but returned to England in 1845. He was editor of the Leeds *Times*, principal of the People's College, Huddersfield, Yorkshire, England, in 1846, and later came back to the United States, where he settled permanently. He edited the Chicago 'Republican,' in conjunction with Charles A. Dana (q.v.), and afterward was literary editor of the New York *Sun*. In 1873 he became insane, and the remainder of his life was spent in an asylum. He wrote: 'Life of Ebenezer Elliott' (1850); 'Memoirs of Wordsworth'; 'Life at Home and Abroad'; 'The Gypsies of the Dane's Dyke'; etc.

**Phillips**, **Henry**, American archæologist: b. Philadelphia 6 Sept. 1838; d. there 6 June 1895. He studied law and was admitted to the bar in 1859, but practised little, devoting his attention chiefly to numismatics, archæology, etc. He published: 'History of American Colonial Paper Currency' (1865); 'History of American Paper Money' (1866); 'Pleasures of Numismatic Science' (1867); 'Poems from the Spanish and German' (1878); a translation of Chamisso's 'Faust' (1881); and four volumes of translations from the Spanish, Hungarian, and German (1884-7).

**Phillips**, **Henry Myer**, American lawyer and politician: b. Philadelphia 30 June 1811; d. 28 April 1884. He was admitted to the bar in his native city in 1832, turning his attention with much success to criminal and civil practice. In 1856 he was elected as a Democrat from the fourth district of his State, to the 35th Congress. After the expiration of his term, he accepted many positions in educational, charitable, and financial institutions, became a commissioner of the Board of City Trusts, having control of the Stephen Girard estate, and was made president of that board and president as well of the board of directors of the Academy of Music, Fairmount Park Commission, and director of numerous corporations. He served also as Grand Master of Freemasons of the State.

**Phillips**, **John**, American educational benefactor: b. Andover, Mass., 6 Dec. 1719; d. Exeter, N. H., 21 April 1795. He was a son of Samuel Phillips (1690-1771), was graduated from Harvard in 1735, and after studying theology preached for a time. He was afterward a merchant at Exeter, and for several years one of the New Hampshire council. In 1778 he assisted in founding Phillips Academy at Andover, and in 1781 he founded Phillips Academy at Exeter. He was also a benefactor to Dartmouth College.

**Phillips**, **John**, English geologist: b. Marden, Wiltshire, 25 Dec. 1800; d. Oxford, England, 24 April 1874. He was educated under the supervision of his uncle, William Smith, the geologist, with whom he engaged in geological investigations in England. In 1834 he accepted the chair of geology at King's College, London, receiving an appointment to the same position at the University of Dublin in 1844 and at Oxford in 1856. He was keeper of the Ashmolean Museum, and in 1859-60 president of the Geological Society. He wrote: 'Guide to Geology' (1834); 'Memoirs of William



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Smith' (1844); 'Vesuvius' (1869); 'The Geology of Oxford and the Valley of the Thames' (1871); etc.

**Phillips, John Arthur**, English geologist: b. Polgooth, Cornwall, 18 Feb. 1822; d. London 4 Jan. 1887. He was graduated from the Ecole des Mines, Paris, in 1846. In 1848-68 he was a mining engineer and metallurgist in London, acted as chemist to the Admiralty Commission, and in 1848-50 was professor of metallurgy at the college for civil engineers at Putney. He inspected the California gold mines in 1853 and later years, and wrote: 'The Mining and Metallurgy of Gold and Silver' (1867); 'Elements of Metallurgy' (1874); 'A Treatise on Ore Deposits' (1884); etc.

**Phillips, Morris**, American journalist: b. London, England, 9 May 1834; d. Huntington, N. Y., 30 Aug. 1904. His elementary education was obtained at Cleveland and also in New York, where he settled in 1853. He rose in the 'Home Journal' establishment from office boy to proprietor, was associated for 13 years with N. P. Willis (q.v.) in its management, and was identified with that weekly until it changed its name in 1902. He published 'Abroad and at Home' (1893).

**Phillips, Philip**, American jurist: b. Charleston, S. C., 17 Dec. 1807; d. Washington 14 Jan. 1884. He studied law in Charleston; was admitted to the bar at 21; and was a member of the State constitutional convention of 1832, known as the Nullification convention. Elected to the State legislature in 1834, he resigned in 1835 and removed to Mobile, Ala., where he practised his profession. He was president of the Alabama State convention in 1837; in 1844 was elected to the State legislature, and re-elected in 1852; was member of Congress from Alabama from 1853-5, and declining re-election he removed to Washington, D. C., and practised law until the Civil War, when he went to New Orleans, La. After the war he returned to Washington, where he resided until his death. In 1840 he prepared a 'Digest of Decisions of the Supreme Court of Alabama,' and was the author of 'Phillips' Practice of the Supreme Court of the United States.' As one of the eminent lawyers of his time, he was connected with some of the most noted law cases of the country.

**Phillips, Philip**, American Methodist evangelist and singer: b. Chautauqua County, N. Y., 13 Aug. 1834; d. Delaware, Ohio, 25 June 1895. In 1861 he opened a music store in Cincinnati, and during the Civil War held song services in many northern cities to aid the Christian Commission, and in 1866 was musical editor of the Methodist Book Concern. In 1868 he visited England, where he sang 200 nights for the Sunday School Union, and prepared for them 'The American Sacred Songster,' of which 1,100,000 copies were sold. He traveled with D. L. Moody (q.v.), and in 1872 made a singing tour of the world. He published: 'Spring Blossoms' (1865); 'Hallowed Songs' (1871); 'Our New Hymnal' (1894); etc.

**Phillips, Samuel**, American colonial clergyman: b. Salem, Mass., 17 Feb. 1690; d. Andover, Mass., 5 June 1771. He was graduated at Harvard in 1708, studied theology and was

ordained pastor of the Second or South Parish Church of Andover, in 1711, a pastorate which he held till his death. He was a notably strict Calvinist in his theology. His brother, John, was the great-grandfather of Wendell Phillips (q.v.), and his grandson, Samuel Phillips, was the founder of Phillips Academy at Andover.

**Phillips, Samuel**, American lawyer and legislator: b. North Andover, Mass., 7 Feb. 1752; d. Andover, Mass., 10 Feb. 1802. He was a grandson of Samuel Phillips (1690-1771) (q.v.), and was the fifth of the name. He was graduated at Harvard in 1771. He succeeded his father as town clerk of Andover in 1773, was a member of the provincial congress 1775-80, and of the Massachusetts constitutional convention, 1779-80. He sat in the State senate 1780-1801 (excepting in 1787-8), was lieutenant-governor 1801-2, and justice of the court of common pleas for Essex County, 1781-98. He is best known as the founder of Phillips Academy, a project conceived by him soon after leaving college and to the furtherance of which he induced his uncle, John Phillips (q.v.), the founder of Phillips Academy at Exeter, to contribute. (See PHILLIPS (ANDOVER) ACADEMY.) His daughter, Mary, was the mother of Bishop Phillips Brooks (q.v.). After his death his wife assisted in the founding of Andover Theological Seminary.

**Phillips, Stephen**, English poet: b. Somerton, near Oxford, 28 July 1868. He abandoned an Oxford career to go on the stage in Frank Benson's company, in which he played in his time many parts and gained the experience which later was so greatly to aid him in the dramaturgic construction of his works. His first serious effort, 'Eremus' (1894), though praised by Stopford Brooke, and Addington Symonds, attracted little general notice. It was later withdrawn by the author. 'Christ in Hades and Other Poems' (1896) found generous eulogists, but it was not until his 'Poems' (1897), a small collection, was crowned by the 'Academy' as the best work of the year with the first prize of 100 guineas, that Phillips achieved a reputation. In his later works he successfully revived the English poetic drama. Some discerning critics have regarded certain of the 'Poems' as his finest attainment, but the dearth of poetry in the English drama gave to 'Paolo and Francesca' (1899), 'Herod' (1900), and 'Ulysses' (1902), a greater interest. The last was presented in the United States in 1903.

**Phillips, Thomas**, English painter: b. Dudley, Worcestershire, 18 Oct. 1770; d. London 20 April 1845. He was an early pupil of Edington, the glass-painter at Birmingham, and worked as his assistant until 1790, when he went to London and was employed by West in executing a design for the windows in Saint George's Chapel, Windsor. Soon afterward he began to devote his time to portraits and became one of the most fashionable portrait painters of his day, in spite of the competition of Sir Thomas Lawrence, as well as of Hoffner, Shee, Owen, and Beechey. His 'Venus and Adonis' (1808) secured his election as a Royal Academician, and in 1824 he was appointed Fuseli's successor as professor of painting at the Royal Academy. His lectures were published in 1833. He was very successful in catching a likeness,



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and his portrait of Napoleon, painted by stealth with the connivance of the Empress Josephine, is now at Petworth, and has been frequently engraved; that of David Wilkie by him is in the National Gallery. He also painted well-known likenesses of Lord Byron and Sir Walter Scott, as well as of Crabbe, Chantrey, Southey, Coleridge, Campbell, Rogers, and Sir Humphry Davy.

**Phillips, Wendell**, American orator and reformer: b. Boston 29 Nov. 1811; d. there 2 Feb. 1884. He was graduated from Harvard in 1831, a classmate of J. L. Motley (q.v.). After three years' study at the Harvard Law School he was admitted to the bar in 1834; but he took slight interest in the legal profession. On 21 Oct. 1835 he saw Garrison (q.v.) dragged through the streets of Boston by those "gentlemen of property and standing," as the press styled them, who had been disappointed in their original purpose of bringing George Thompson (q.v.) to the tar-kettle. From that time he was an Abolitionist, with which interest he identified himself in 1836. He came at once into prominence by his great Faneuil Hall speech of 8 Dec. 1837. Through the efforts of W. E. Channing a meeting had there been assembled suitably to protest against the murder of E. P. Lovejoy (q.v.) at Alton, Ill., while defending the freedom of the press against a pro-slavery mob. But the entire purpose of the gathering seemed likely to be defeated by James T. Austin, a parishioner of Channing and attorney-general of Massachusetts, who, in a singularly absurd outburst likened the Alton rabble to the patriots of the Revolution and declared that Lovejoy had perished "as the fool dieth." It appeared not improbable that these most ill-considered remarks might divide the audience, when Phillips, by invitation, took the platform and made answer. "When," he said, as he began that stinging rebuke, "I heard the gentleman lay down principles which placed the rioters, incendiaries, and murderers of Alton side by side with Otis and Hancock, with Quincy and Adams, I thought those pictured lips (here indicating the portraits in the hall) would have broken into voice to rebuke the recreant American, the slanderer of the dead." Phillips became forthwith the chief of American orators and the apostle of the Garrisonian school of abolition. He accepted the creed of Garrison almost without condition, though he became but gradually a disunionist and was never a non-resistant. In 1839 he withdrew from professional practice, being unwilling to bind himself by the advocate's oath of fealty to the Constitution. Later, for a similar reason, he declined a congressional candidacy. With Garrison he opposed in 1839-40 the attempt to debar any from the anti-slavery platform on the ground of differences in religious faith, and the organization of the Abolitionists into a political party. He disagreed, however, with Garrison, in 1864, in regard to Lincoln's re-election, which he did not favor; and in 1865, respecting the discontinuance of the Anti-Slavery Society, which Garrison held then to have concluded its mission. Phillips believed that the education and enfranchisement of the negro ought to be accomplished, and was elected in Garrison's place to the presidency of the society, a post which

he held until the disbandment 9 April 1870, consequent upon the passage of the 15th amendment. But his activities did not now pause here. He thought the task of reform was never done, and on this idea placed a most valuable emphasis. So he spoke for the Indian, for the Irish, for improvements in the criminal law and prison administration, for legislative control of the sale of liquor; and against accumulations of corporate wealth dangerous to the State. In all these causes Phillips was never even remotely the demagogue, though at times his associates may have been such. He received in 1870 about 20,000 votes as labor-reform and temperance candidate for the governorship of Massachusetts. He was known, also, for years as one of the kings of the American lyceum, among his most famous addresses being 'The Lost Arts,' 'Toussaint l'Ouverture,' and 'Daniel O'Connell.' Among his occasional orations may be mentioned that in memory of Theodore Parker (q.v.), and that on 'The Scholar in a Republic,' given in 1881 at the centennial of the Harvard Phi Beta Kappa. A scholar himself, in the narrower acceptance, Phillips was not. The course of his activities did not allow this; but he was a considerable reader, appropriated to his own uses all that he studied, and found ample supply of needful illustration in the history of the English Revolution of 1630, on which subject he had once read every work obtainable. Contemporary evidence as to his oratory is unanimous, and places him with Webster and Everett. His method was far different from theirs; he replaced their rounded sonority by the easy, limpid, and colloquial style which since his time has remained the type of the best American public speech. He spoke with much repose, did not lack for appropriate wit, and was superb in sarcasm, epigram, or invective. He surrendered worldly preferment to identify himself with a despised propaganda; he gained his fame and saw his victory against heavy odds, opposed to the inertia of a general prejudice. Many of his speeches were, as reports show, sword-play with a hostile audience. Of course, under existing conditions, he made mistakes; but his fine attainments were always finely used. He contributed to 'Anti-Slavery Standard' and 'The Liberator,' and wrote several pamphlets. A collection of his 'Speeches, Lectures, and Letters,' edited by J. Ridpath, was published in 1864; a second series, by T. C. Pease in 1892. The biographies by Austin (1888) and Martyn (1890) cannot be called worthy of their subject. Consult further works treating of the anti-slavery period and its leaders.

**Phillips, William**, American merchant, son of Samuel Phillips (1690-1771): b. 1722; d. 1804. He was a wealthy merchant of Boston, and becoming interested in the project of an academy at Andover as outlined by his nephew, Samuel Phillips (1751-1802), gave to it an amount equal to that contributed by his brother Samuel. He was a member of the Massachusetts Legislature and held various political offices of importance.

**Phillips, William**, American educational benefactor, son of William Phillips (1722-1804): b. Boston, Mass., 10 April 1750; d. there 26 May 1827. He engaged in business with his father, became wealthy, and was 12 times chosen lieu-



## PHILLIPS ACADEMY—PHILO JUDÆUS

tenant-governor of Massachusetts (1812-23). At his death he bequeathed large sums to Phillips (Andover) Academy and to Andover Theological Seminary.

**Phillips (Andover) Academy**, a celebrated college preparatory school for boys at Andover, Mass., founded 25 April 1778, opened 30 April 1778, and incorporated 4 Oct. 1780. It owes its existence to the initiative of Samuel Phillips (1751-1802), who, soon after his graduation from Harvard, conceived the project of an academy in his native town and persuaded his father to divert to this end estates of which he was to be the heir, and induced his uncles, John and William Phillips, to co-operate. The property originally conveyed to the Academy trustees by Samuel Phillips (the elder) and his brother John, consisted of 141 acres with several buildings upon it, in Andover, 200 acres in Jaffrey, N. H., and some \$8,000 in cash. In 1785 a new academy building was erected, the gift of the three brothers, Samuel, John, and William Phillips. The trustees of the Academy were vested in 1807 with authority to receive and hold funds for a theological school, and what is now known as the Andover Theological Seminary (q.v.) was founded the next year. The Academy has grown to be one of the foremost institutions of its kind in this country, and in recent years its equipment has been very materially increased, the archæological department with ample endowment and costly building, being one of the most notable of recent gifts. The larger number of the students go to Harvard and Yale on leaving the academy, and the institution is therefore based on the requirements of those universities. In 1902 the academy had 400 pupils and 24 instructors. Its endowment now amounts to about \$400,000 with an income of \$70,000, and outside of invested funds the academy property amounts in value to \$500,000. There are 60,000 volumes in the several libraries of the institution. Consult Adams, 'Some Famous American Schools' (1903).

**Phillips (Exeter) Academy**, a noted American college preparatory school at Exeter, N. H., incorporated 3 April 1781, endowed by John Phillips 9 Jan. 1782, opened 7 May 1783. The institution was the earliest of an educational character incorporated by the New Hampshire legislature, and was named in honor of its founder, John Phillips (q.v.), whose gifts to it amounted in all to some \$65,000. In 1903 it had over 300 students and 16 instructors. Like the sister institution at Andover, it has prospered greatly in recent years, and many new and commodious buildings have been erected within the past decade, the most notable of these being the great dining hall, built in 1903. It has an endowment of some \$400,000, and an annual income of \$100,000. In 1903 its alumni numbered over 7,000 and like the alumni of Phillips Andover included many names famous in American annals. A marked characteristic of the school is its thorough carrying out of the principle of self-government. Consult: Adams, 'Some Famous American Schools' (1903).

**Phillipsburg**, fil'ips-bërg, N. J., town in Warren County; on the Delaware River, and on the Central of N. J., the Pennsylvania, and the Lehigh V. R.R.'s.; opposite Easton, Pa., and about 60 miles in direct line west of Newark.

It was settled in 1749, and in 1861 was incorporated. It has good water power, and excellent facilities for transportation. The chief manufacturing establishments are foundries and furnaces, railroad shops for the three railroads, horseshoe works, boiler and drill works, machine shops, stove works, sheet iron works, silk mills, and large coal yards. Its prominent public buildings are its municipal buildings, several business edifices, the churches, and schools. It has several private business schools, public and parish schools, and a public library. The government is administered under a revised charter of 1875, and is vested in a mayor, who holds office one year, and a council. Pop. (1890) 8,644; (1900) 10,052.

**Phillpotts**, fil'pöts, **Eden**, English novelist: b. Mount Aboo, India, 4 Nov. 1862. After serving as clerk in a fire insurance office at Plymouth in 1880-90, he studied in London for the stage, but found "his ability did not justify perseverance." His earlier works are of inferior value. Among his representative books are: 'Down Dartmoor Way' (1895); 'Lying Prophets' (1897); 'Children of the Mist' (1898); 'Sons of the Morning' (1900); 'The Good Red Earth' (1901); 'The Striking Hours' (1901); and 'The River' (1902). He is the recognized interpreter of Dartmoor folk and scenery, and received high praise from R. D. Blackmore (q.v.).

**Philo Byblius**, fi'lō bib'li-ūs, **Herennius**, Phœnician grammarian: b. Byblos, Phœnicia; flourished between 64 and 141 A.D. He is the author of a famous historical work, 'Concerning Cities and Their Renowned Citizens.' It is in 30 books and has proved the thesaurus of later grammarians. He also executed a translation of the alleged work of Sanchoniathon (q.v.), of which some fragments have survived, and have been published in the third volume of Müller's 'Fragmenta Historicorum Græcorum,' Vol. III. The alleged complete text of Sanchoniathon, which was discovered in a Portuguese monastery and published by Wagenfeld (1837), proved to be a forgery.

**Philo Judæus**, joo-dē'ūs, Jewish philosopher: b. about 20 B.C.; d. not later than 54 A.D. He went to Rome in 42 A.D. as one of a deputation from Alexandria to the Emperor Caligula, to persuade him to release the Jews from the obligation of adorning the imperial statue. He was the oldest of five deputies. This and the fact that he visited Jerusalem and belonged to a wealthy family, is nearly all that is known of his life.

Before the time of Philo the hellenized Jews (see HELLENISTS), particularly those of Alexandria, had begun to blend the ideas of the Greek philosophers with the teaching of their own sacred books; but as they generally held that the Pentateuch itself was the source of inspiration from which the Greeks derived what was true in their philosophy, they endeavored by allegorical interpretations of their own books, to find "indications of the profoundest doctrines of philosophy in the simplest stories of the Pentateuch." It was in this school that Philo was brought up. His philosophy was thus strictly a theosophy. It rested, as its direct foundation, on the Jewish Scriptures as an inspired revelation, and with these it incorporated the specu-





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## PHILOBIBLON — PHILOMELA

lations of the writer, founded on the systems of Greek philosophy, which best harmonized with the teaching of the Hebrew Scriptures, and especially on the philosophy of Plato.

Philo's idea of God was partly religious, partly philosophical. From his faith as a Jew he derived the principle that God is to be worshipped as a personal being, but in developing his conception of God he is indebted chiefly to philosophical speculations. He held that God is incorporeal and only cognizable by reason. He is the most universal of beings, and higher than knowledge, goodness, or beauty, *per se*. He has, strictly speaking, no attributes, being pure, unqualified being; he is therefore incomprehensible. The attributes ascribed to God in Scripture are to be understood only figuratively. God is present everywhere in the material universe by his operations; nowhere in his essence. God is the only free being. All others are subject to necessity. Philo's notions of matter are not remarkably consistent. He held God to be too perfect to have any association with it, yet he holds him to be the Creator of the universe. Between God and the world there is an intermediate being, the Logos. He wavers in his account of the Logos also. The Logos is the most universal of all beings except God. The Logos contains in itself the sum of ideas — powers or spiritual forms which pervade the universe, and which are creative, governing, foreseeing, law-giving, etc. These forms are also regarded as either qualities of the deity or distinct persons. Sophia, wisdom, is sometimes considered as the first of the potencies of the Logos, sometimes as the mother of the Logos. God created the world as already indicated, by the agencies of these potencies, or of the Logos in whom they reside, out of unqualified matter. He gives the Logos the titles of Son of God, Paraclete, and Mediator between God and Man.

Man is a dual being, having a soul that came from God, tied to a body that naturally tends to the things of sense; by the aid of God the soul may be lifted above the body and ultimately regain its original source.

In interpreting Scripture Philo recognizes a double sense, the allegorical, which is the more important, and the literal, which is not to be neglected. The anthropomorphic representations of God in Scripture he regarded as an accommodation to the sensual nature of man. It is a fundamental principle with him that the law, which emanates from the being who is both the creator and the father of the universe, is in harmony with nature, and that he who violates it is punished by natural events. Consult: Drummond, 'Philo Judæus' (1888); Conybeare, 'Philo About the Contemplative Life' (1895); Freudenthal, 'Die Erkenntnislehre Philons von Alexandria' (1891).

**Philobiblon**, fī-lō-bīb'lōn, a prose eulogy of books and learning written in Latin by Richard Aungervyle, called Richard de Bury from his birthplace (1287). He was bishop of Durham and lord high chancellor and treasurer under Edward III. The work was finished in 1300, and first printed at Cologne in 1473. An American edition was printed at Albany, N. Y., in 1861, by Samuel Hand, and the Latin text, with translation by Andrew F. West, was issued by the Grolier Club of New York in 1889.

**Philochorus**, fīl-ōk'ō-rūs, Greek historian: flourished in Athens between 306 B.C. and 206 B.C. Suidas states him to have been a contemporary of Eratosthenes, an adherent of Ptolemy Philadelphus, and a bitter opponent of Demetrius Poliorcetes and his son, the latter of whom had him put to death when he took possession of Athens. His best known work, 'Atthis,' a history of Athens dating from the remotest period of their history down to the death of the author, is the most valuable and authentic of the special histories of Attica. Fragments of it are preserved in Müller's 'Fragmenta Historicorum Græcorum' (1841).

**Philoctetes**, fīl-ōk-tē'tēz, Greek archer. He was a friend and armor bearer of Heracles, who bequeathed to him his bow and arrows. As one of the suitors of Helen he started with seven ships for the Trojan war, but becoming ill from the bite of a serpent was left by the Greeks on the island of Lemnos. An oracle declared that Troy could not be taken without the arrows of Heracles, and Ulysses and Diomedes journeyed to Lemnos, whence Philoctetes accompanied them to Troy and fought bravely until the city was taken, slaying Paris with one of his poisoned arrows. The legend was dramatized by Sophocles, Æschylus, and Euripides, the play by Sophocles still surviving.

**Philodemus**, fīl-ō-dē'mūs, Greek Epicurean philosopher and epigrammatic poet, a contemporary of Cicero. He was a resident of Gadara in Palestine, and a leading Epicurean of his time. The 'Greek Anthology' contains 34 of his epigrams.

**Philolaus**, fīl-ō-lā'ūs, Pythagorean philosopher; according to Plato he was a contemporary of Socrates, and was born in Magna Græcia. He left Metapontum on account of political disturbances and entered Lucania. Later on he visited Thebes. The teachings of Pythagoras were for the first time committed to writing by him. The only fragments of this work which are extant Böckh declares to be genuine (1819). Their genuineness has, however, been denied by Bonn, 'Die angebliche Schriftstellerei des Philolaus' (1864). Some of them are undoubtedly authentic, others spurious.

**Philolog'ical Association, American.** See AMERICAN PHILOLOGICAL ASSOCIATION.

**Philological Society, British**, a society founded in London, 1842, for the study of language according to its scientific analysis. It publishes annually its 'Transactions,' a volume of papers read at its meetings, which are held monthly from November to June. The offices of the society are at University College. The most important work of the British Philological Society has been the publication of the 'New English Dictionary,' which was begun under the editorship of James A. H. Murray in 1857, and has not yet been completed.

**Philol'ogy.** See SCIENCE OF LANGUAGE.

**Phil'omel**, a poetic name for the nightingale (q.v.), especially the large Asiatic species (*Daulias philomela*) or the Persian form (*D. hafizi*).

**Philomela**, fīl-ō-mē'la, in Greek mythology, daughter of Pandion, king of Athens, was by fraud won by Tereus, a Thracian king, to be his bride, Tereus pretending that his wife



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Procne, her sister, was dead. Lest Philomela should reveal her wrongs, Tereus cut out her tongue. But she contrived to acquaint Procne with her story. The sisters in revenge slew Itys, son of Tereus, and served him to his father at table. The gods transformed Philomela into a nightingale and Tereus and Procne, Itys and Pandion into other birds.

**Philomela, The Lady Fitzwater's Nightingale**, title of a romance by Robert Greene, probably founded on the story of Tito and Gisippo in the Decameron, or the 'novela del curioso impertinente' related in Don Quixote, Book I., chap. 34 sq.

**Philopœmen**, fil-ō-pē'měn, Greek general and statesman: b. Megalopolis, Greece, 252 B.C.; d. Messene, Greece, 183 B.C. He came of a noble Arcadian family, was orphaned at an early age and brought up by Cleander, an influential citizen of Mantinea, received his education under the philosophers Ecdemus and Demophanes, and gained his first military experience in the border raids between the Arcadians and Laconians. In 222 he aided in the defense of Megalopolis against Cleomenes, king of Sparta, and in 221, at the head of a company of horsemen, fought under the Macedonian king, Antigonos, who came to the aid of the Achæans against the Spartans. In 210 he was appointed general of the Achæan horse, and in 209 accompanied Philip in his expedition against Elis, conducted himself with his usual bravery, and slew in battle the Elean commander Demophantus. In 208 he was elected strategus or commander-in-chief of the Achæan League, an office to which he was seven times re-elected. He introduced reforms in military arms and discipline, and brought the army to the highest state of efficiency it had attained since the decline of Greece. In 208 he utterly routed the Spartans under Machanidas at Mantinea and was proclaimed the "liberator of Greece" at the Nemean festival. In 194, he was reappointed strategus, defeated Nabis in 192, forced Sparta to enter the Achæan League, and upon her revolt in 188 defeated her forces and compelled her to adopt Achæan laws. In 183 when Philopœmen lay ill at Argos the Messenians revolted and he arose from his sick-bed to lead the army against them, though now a man of 70. He was captured and given a cup of poison by Deinocrates, the Messenian leader. He is the last of the great Greek commanders. Consult: Plutarch, 'Life of Philopœmen'; Mahaffy, 'Alexander's Empire' (1888).

**Philosopher of Ferney, The**, a title by which Voltaire was known on account of his residence from 1758 to 1788 at Ferney, five miles northwest of Geneva.

**Philosopher of Malmesbury, The**, a title given to Thomas Hobbes (q.v.), who was born at Malmesbury in Wiltshire.

**Philosopher of Sans-Souci, The**, a name which Frederick the Great applied to himself on account of his residence at the palace of Sans Souci which he built at Potsdam.

**Philosopher of Wimbledon, The**, a name bestowed upon John Horne Tooke (q.v.), the political writer and grammarian, whose later years were passed at Wimbledon, Surrey.

**Philosopher's Stone**. See ALCHEMY.

**Philosophical Society, American**. See AMERICAN PHILOSOPHICAL SOCIETY.

**Philosophy**. It is not the purpose of this article to sketch the history of philosophy, or to discuss in detail the problems which have divided its schools; but, rather, to describe the sphere which philosophy aims to cover, its relation to the particular sciences, and its principal divisions; and, as far as possible within the limits of space allowed, to indicate the solutions that have been proposed for the problems upon which the divisions of the subject have been based.

*Definition of Philosophy*.—No satisfactory answer to the question, What is philosophy? can be derived either from the meaning of the word, or from the consensus of opinion expressed by the various writers on philosophy, unless these opinions are themselves subjected to comparison and criticism from the philosophic point of view. Such difficulty is not, however, peculiar to philosophy; it belongs, indeed, to all the greater disciplines which have engaged the mind of man through the centuries of his mental development. For the conception which defines the task, and describes the method of philosophy is itself subject to change and growth; and accurate and harmonious definitions are themselves among the latest products of any pursuit conducted by a truly scientific method. It is, nevertheless, entirely possible to understand what philosophy is, and what it undertakes to do and has already accomplished, by following the indications given by its own process of development. For this process, like every other development, has certain permanent features; it follows, more or less closely, certain clearly discernible lines of movement.

Man everywhere, from the prehistoric time when he first began to think reflectively upon the problems offered by the phenomena of external nature and of his own being and life, has been inclined to philosophy. The savage or primitive man (the *Naturmensch*, as the Germans call him), instead of being, as is sometimes supposed, untroubled by metaphysics, is much more, if this were possible, naïvely and necessarily metaphysical than is his civilized descendant. Indeed, to be a human being is to be naturally inclined to understand, by reflective thinking, the causes and the meaning of experience. Hence arises in the race the necessity of a philosophical development. But that particular line of this development which chiefly concerns us in the attempt to define philosophy, is traced back to the Greeks. This statement is true for two reasons: (1) The Greeks first separated philosophical speculation from its dependent connection with religious myth and theological conceptions; and (2) they are, in fact, the ancestors of that branch of the universal family of philosophers to which we belong.

*History of Opinion*.—Originally, a loose and wide meaning was given to the term "philosopher" (*φιλόσοφος*). At first, it stood for any man who, whether by travel or reading or interest in art, had the spirit and acquisitions of intellectual culture. Solon was said to have "traveled through many lands philosophizing" (Herodotus i. 30); and Thucydides, in his funeral oration over Pericles, claims for all the



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Greeks that they love the beautiful with true simplicity, and "philosophize without effeminacy." But the earliest more systematic attempts at philosophy among the Greeks displaced the theogonies of the poets, or their explanations of the universe as due to the actions of the gods, with cosmogonies, or speculations as to the origin of things and the causes of experience, by means of known physical elements or mental principles. It is customary to say that Socrates was the first "to lead mankind from the study of the universe to the study of man"; but this is only relatively true.

With Plato and Aristotle the more definite conception of the sphere of philosophy, and the use of the more scientific method for its pursuit, began—not only among the Greeks but among all mankind. In spite of those many and important differences, which the latter seems to have taken pains rather to emphasize and to exaggerate than to lessen or to harmonize, these two great thinkers are in substantial agreement as to the essential nature of philosophy. With them both, the word does not stand for any one particular science or even for the aggregate of all the sciences; on the contrary, philosophy is held by Plato and Aristotle to be the supreme and only true science. It should be remembered, however, that the word "science" had then no such meaning as now belongs to it; nor were there in existence bodies of sciences corresponding to those of the modern world.

Plato taught that philosophy imparts to the mind something more than merely "correct opinion"; that it deals with being, and not with seeming; with the truly real; it, therefore, implies the acquisition of what is knowable, in the highest meaning of the word. But the essential and immutable being of everything is its idea; and of all the ideas, the supreme one is the idea of the good. Philosophy is, therefore, the knowledge of the ideal and absolute elements of things; but all of these elements may be considered as constituting a harmonious system under the supremacy of the true and the beautiful, which are at one in the good. Aristotle, on the other hand, regarded philosophy as science, or knowledge, in general; in his scheme, it comprised the speculative, the practical, and the artistic sciences. But there was also a "first philosophy," or supreme science; and in his conception of this, Aristotle agrees in the main with Plato. For "first philosophy" investigates being as being; it inquires into the first principles and ultimate causes of things; and thus it renders possible the knowledge of that absolute principle which presupposes nothing more ultimate than itself. The peculiar characteristics of philosophy are thus held to be its certainty, universality, independence, supremacy, and a kind of divine character. This last characteristic makes it worthy of honor even by Deity itself.

Although the later Greek philosophy, under the conduct of the Stoics and the Epicureans, took a more practical turn, and although philosophy during the Middle Ages, being employed by Christian theologians in the defense of dogma, lost much of its characteristics of independence and supremacy, the conceptions of the greater Greek thinkers remained substantially unchanged down to modern times. The Greeks

did not, indeed, strictly define philosophy. But they conceived of its mission and its method in a way to influence, if not to dominate, all subsequent reflective thinking. For when the Renaissance gave back to philosophy its independence, both Bacon and Descartes regarded philosophy as a universal science. The former held that all human cognitive endeavors are summed up in history, poetry, and philosophy, which correspond to the three faculties of memory, imagination, and reason. Thus everything which is an object of knowledge by human reason falls within the sphere of philosophy. Bacon, too, like Aristotle gives a special place to first philosophy. Descartes regarded philosophy as a universal science; but first philosophy is the science of principles,—that is, of the highest generalizations of all the positive sciences. Descartes did in a way for modern philosophy what Socrates is said to have done for Greek philosophy; he made its point of starting a critical examination of the mind of man.

With Locke and his successors, but especially with the critical philosophy of the "astounding Kant" (first edition of his 'Critique of Pure Reason,' 1781), philosophy became chiefly an analysis and criticism of the cognitive powers of the human mind. Thus one branch of the subject—namely, the philosophy of knowledge, or epistemology—occupies the chief place in, if it does not usurp the whole of, the field properly covered by the term. Such is in a peculiar way the position of Kant, who holds that the primary and chief task of philosophy is to ascertain the *a priori* elements and principles of the human mind, and to arrange these together into a system. As to a science of reality—meaning by this, the knowledge of the world of beings that exist independently of human mental representations—this great thinker comes to a skeptical conclusion. But with the successors of Kant philosophy began again to be considered more as of old,—an absolute, universal, and independent science, whose authority within its own proper domain must be considered as supreme. In one way or another, this was the position of Fichte, Schelling, and Hegel. And while the Scottish school, consisting of Reid and his followers, have reduced philosophy to a kind of theoretical psychology, and Positivism has denied the possibility of philosophy with anything like its traditional meaning and claims; still the conception of its aim and its scope, which is honored by time and is essentially the same as the ancient notion, continues to maintain itself.

The prevalent conception of philosophy now obtaining among its students and promoters is, indeed, in many of the most important features, essentially unchanged. And yet there are to be noted significant changes in the points of view, in the use of method, in the factors chiefly emphasized; and, especially, in the notion of the relation which philosophy properly sustains to the particular sciences. These changes must, then, be briefly noticed, if one would arrive at a defensible, comprehensive and satisfactory answer to the question: What is philosophy?

*Analysis of the Factors.*—The modern conception of philosophy can now, in its more complete and scientific form, be best understood by stating what are the principal problems, or groups of problems, which it attempts to solve.



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These may be conveniently arranged under the following four heads: (1) Especially since the time of Kant, the question of the nature, limits, and validity of human reason itself has occupied a prominent place in the discussions of philosophy. With Kant himself—as we have already seen—this self-criticism of reason was the principal part of philosophical discipline. To quote the words of Fichte: "This science can be nothing but the universal knowledge, which has come to know of itself, and has entered a state of light, consciousness, and independence, in regard to itself." Or, according to the more extreme statement of another advocate of a similar view: "Philosophy calls itself knowledge of the Universe (*Weltweisheit*)"; but "we call it self-knowledge."

From this point of view, the outcome of philosophical discipline may be either one of two conclusions. The criticism of reason may end in what is known as positivism, or some form of phenomenalism. In this case reason, by self-criticism, would have discovered and proved that reason itself is limited to appearances or phenomena; that human knowledge cannot reach the world of reality; that man cannot mentally reproduce, or recognize, the beings and events of the world as they really are and actually occur, "outside of" (as it is figuratively expressed) his own consciousness. In a word, philosophy as a reasoned and systematic ontology, or a valid doctrine of real being, is found to be impossible.

But the opposite conclusion—namely, that all human knowledge somehow envisages, or implicates, reality—necessarily leads the thinker who holds it to lay emphasis on another main branch of philosophical discipline.

(2) The second form of the modern conception of philosophy continues to emphasize the factors rendered prominent by Plato and Aristotle, and which, indeed, have been prominent in the entire history of reflective thinking. As Matthew Arnold tersely puts the question: "We want to know what Being is." The skeptical conclusion to the self-criticism of reason has never proved satisfactory to reason itself. And in its revolt, which is unceasing, from this conclusion, the mind of man continues to inquire after the nature of ultimate reality; it continues to believe that the forms of man's own mental life of cognition do somehow faithfully and truly represent the beings and events of a world which lies outside of that mental life, and which has, so to say, an existence and a value of its own. Thus the conception of philosophy as a growth of assured knowledge of reality, and as a speculative activity of the human reason toward the transcendent ground of all existence, holds its place firmly in the field of modern thought. This view of the task of philosophy is that of Hegel and of all his followers, however dissenting from the details of the Hegelian system. It is also the view of those who, like Schopenhauer and Hartmann, cultivate systematic philosophy as a so-called metaphysics of the unconscious. It is even substantially the view of Herbert Spencer who, in spite of his doctrine of the Unknowable, has built up upon the basis of facts supposed to accord with his peculiar view of evolution, one of the most complete and stupendous theories of reality which the history

of speculative thinking has ever produced. In a word, according to this view, "philosophy is the rational science of reality." Or, as another modern writer declares: It is "the science of the most supreme and important realities."

(3) It has always been felt that the more speculative conception of philosophy leaves the problems of human life too much out of its account. In order to merit appreciation for its real value, reflective and speculative thinking ought to result in practical truths, or conclusions which may serve to enrich and guide the moral and social interests of mankind. This conception of the philosopher's task has always been prominent in the Orient. And in Oriental countries to-day the true philosopher is he who has wisdom; and so can counsel men as to what they ought to do, and as to what, in the world of reality itself, ought to be. In modern times Kant himself wrote (preface to Jachmann's 'Examination of the Kantian Philosophy of Religion') that, while philosophy, as a scientific theory, has only a relative value, "philosophy, in the literal meaning of the word, as a doctrine of wisdom, has an absolute value; for it is the doctrine of the final purpose of human reason." From this point of view the principal task of the philosopher is to deal with the value-judgments of mankind, with the ideas and ideals of humanity as to what ought to be,—in conduct, in art, in society, and in religion. From this point of view, too, the philosopher is challenged and required to bring forth so-called practical fruits; to teach men to think more truly, act more wisely, and live better, or more nearly up to the rising and rational ideals of humanity. In his effort to do this, the thinker must, of course, justify reason in respect of her ideals, and not simply discover and describe what those ideals happen to be at any particular point of time, or at any particular place, in man's historical development. It appears, therefore, that philosophic wisdom in this meaning of the term implies knowledge of the reasonable and of the universal.

(4) The great advances of the particular sciences in modern times have forced into a conspicuous position another and somewhat different conception of philosophy. This conception is by no means wholly new. For it has never been supposed that speculative thinking, whether in the form of a self-criticism of reason, or of a reasoned theory of reality, or of a rational system of practical principles, could dispense with all knowledge of facts, their uniform sequences, and the laws of the forces operative in their realization. But the modern scientific development has certainly made imperative a new adjustment of the relations between philosophy and the particular sciences. Each one of these sciences is fast discovering its relations of reciprocal dependence, and mutual good-will, toward all of the other sciences. Each one when pressed to give an account of itself is discovered to have its own body of uncriticised presuppositions, its own naïve theory of knowledge and theory of reality, so to say. And, indeed, it is not difficult to show that even the most purely physical and positive of the sciences have to include certain value-judgments, and conceptions of what ought to be, in their methods of research and in their discovered principles. And thus the conception



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of philosophy as a science of sciences is, as it were, born anew, but with increased duties and increased liabilities to make mistakes, although also, with increased promises of success and reward. It is from this point of view that Professor Wundt has described philosophy as "the universal science which has to unite the cognitions, obtained by the particular sciences, into a consistent system." It is most encouraging to all parties of note how, under this conception a renewal of friendship between philosophy and the particular sciences is taking place.

*Synthesis of the Factors.*—Both a study of the history of philosophy and a reflective consideration of these four groups of problems, lead to the same conclusion. No one of the four can be left out of the proper conception of the field of philosophy. Indeed, so intimately and even necessarily are they all related that, in fact, no one of them is left out of the account of itself which is given by any of the principal attempts to treat the subject in a comprehensive and systematic way. The theory of knowledge and the theory of reality, the self-criticism of reason and the unceasing and undaunted endeavors of reason to reach a worthy knowledge of the world of reality, are like the two sides of the one shield; or rather, they are twin ways of the functioning of man's rational powers, neither of which can exist without the other, and both of which are destined to live because belonging to the very life and growth of reason itself. Moreover, what man knows, or thinks he knows, about his own rational life and about the ultimate reality, can never fail to be regarded by him as a basis for conduct, for art, and for religion. Man cannot manage his life wisely, without regard to his views upon so-called epistemological and ontological problems. His doing cannot be wholly divorced from his thinking. For as one of the great modern philosophers (Fichte) has said: "A philosophical system is not a dead bit of furniture which one can take to one's self or dispose of, at pleasure; but it is endowed with a soul by the soul of the man who has it." And they who have no metaphysical system are none the less, whether savage or civilized, naively metaphysical. Especially is it true that religion is always, and essentially, not merely a matter of feeling and cult, but also a certain theory of reality. He, finally, who attempts to philosophize, whether in a systematic or unsystematic fashion, without due regard for the facts and laws which constitute the body of the particular sciences, is not simply trying to put together bricks without mortar; he is, the rather, trying to construct a building for his soul to dwell safely in, without any substantial material whatever.

Hence the effort arises to summarize these groups of factors and unite them in some one conception. This attempt leads us to the following preliminary definition of what modern philosophy is attempting to accomplish. Thus defined:—

Philosophy aims to establish, by the valid use of human reason, a harmonizing and unitary view of the world and of human life, based upon the principles presupposed and ascertained by the particular sciences. More briefly said: philosophy is a critical and rational system of

man's judgments and beliefs that have reference to reality.

*Relations of Philosophy to the Particular Sciences.*—The definition of philosophy suggests that its relations to the particular sciences may be considered from two somewhat diverse points of view; and when considered from these points of view, the relations themselves divide into two classes. For in the first place, philosophy is skeptical with respect to the presuppositions, or assumptions of each of the particular sciences; and it aims, by friendly and yet trenchant and skilful criticism, to harmonize and unite the conclusions of all the sciences. Philosophy is, therefore, when regarded from this point of view, superior to the particular sciences; it is their critic, judge, and arbiter, or referee, so to say. But, on the other hand, philosophy is dependent upon the particular sciences. It cannot, without committing itself to an absurd and irrational attempt and to a course of reasoning doomed to failure, refuse to take its points of starting, its material of facts, laws, and subordinate principles, from these same sciences. For philosophy does not propose to construct a world that shall accord with the fancy and sentiment, however animated and exalted, of the individual, speculative reason. It aims, the rather, to discover upon what universal or most general principles the world is, in fact, constructed. It learns, then, with due modesty, and yet with critical freedom, what the particular sciences have to say about the world of things and of minds, as these sciences find this world in actual existence.

With reference to the critical attitude of philosophy toward the particular sciences it is to be noted that all these sciences have their common presuppositions, or opinions and judgments taken for granted. It is not their business, as such, to discuss the nature, limits, and validity of man's cognitive faculties, or the grounds upon which reposes his belief in his power to transcend the particular in his own experience and to know the extra-mentally real; or to settle other problems of a theory of knowledge. Moreover, each one of these sciences has its own convenient and appropriate assumptions. For example, the mathematical and physical sciences assume some sort of reality for space and time; they also assume that these forms of man's apprehension are valid for the actually existing physical bodies, molecules, and atoms, for the luminiferous ether, and for the emanations from radio-active substances, etc. Physics and chemistry also take it for granted that all these physical beings actually move, combine, separate, and enter into an indefinite variety of actual relations to one another. They also assume that forces have some kind of real existence; that these forces are actually conserved and correlated; and that this takes place in some uniform and regular way; that is, they assume the existence and reign of so-called laws. The biological sciences make all these and still other assumptions; for, under any of the numerous current theories of evolution, they claim to be able mentally to represent the order and casual connection of organic forms with one another, their reactions upon the changes in their environment, and the laws of their relations, as the actual history of real beings must have taken place, or probably did take place,



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extending over wide areas of space, during enormous stretches of time.

And now the relations of two of the principal branches of philosophical discipline to the assumptions of the particular sciences are at once apparent. As a critical theory of knowledge, philosophy examines the right of the human reason to this claim that it can faithfully reproduce in the form of mental pictures and connected conceptions, the facts and procedure of real beings. The claim to know, in general, is an assumption of all the particular sciences. And since the claim is an assumption of all the particular sciences, philosophy becomes in this way the critic of them all.

But philosophy also undertakes the task of giving a critical examination to each one of those fundamental conceptions, or universal and necessary ways of construing the being of the world, which all the particular sciences, more or less uncritically, employ. Thus it inquires: What is the real nature of space; and what is it really to be in space? What is the real nature of time; and what is it really to exist, or to continue, in time, etc.? Again, all real beings—both things and minds—are regarded as occupying time; and things, at least, are said to occupy space. What, then, is it to occupy space and time; as the beings of the world of our experience must do, in order to be known as real? And still, further: What sort of reality attaches itself to the conception of force (or its modern substitute in physics—namely, energy)? and—more puzzling question still: What takes place in actuality when force is said to be stored, or set free; or when the energy is called that of position or that of motion? Motion itself, when considered as really taking place, and as anything more than a subjective change in relations of apparent position, offers many puzzling problems to our philosophical inquiries. But, perhaps, most complicated of all is the question: What is it to be a cause, to cause and to be caused, etc.?

Moreover, the particular sciences, in dependence on their assumptions, are constantly increasing and modifying the stock of their conclusions regarding the real nature of the beings of the world, and regarding the actual character of the relations between these beings, and of their transactions in the time of the world's history. All these principal conclusions are of interest to philosophy. It accepts them gratefully, so far as they may be regarded as proved or highly probable, from the hands of the workers in the particular sciences.

But we have seen that philosophy seeks a harmonizing and unitary conception of the being of the world, and of the relations existing between the particular beings, and of their evolution in the time of the world's history. The assumptions and conclusions of the particular sciences certainly need this harmonizing and unifying work to be done upon them. This need becomes the more clear, when we consider another side of human experience, with which another group of the particular sciences attempts to deal. This group of sciences is especially connected with that branch of philosophy which deals with the problems of human life. But the solution of these problems requires the consideration of certain facts of a quite different order from those with which the physico-chemical, or

even the biological sciences, as such, are competent to deal. For example, it is a fact of experience that all normal human beings develop feelings of obligation, of approbation and disapprobation, toward certain kinds of conduct and certain types of character; that they also show feelings of æsthetical admiration, or its opposite; and that they form certain ideals of the beautiful, as well as of the morally good.

Thus, what are called value-judgments—or judgments which express not merely the mental apprehension of the truth of fact and law, but the mental appreciation of the worth of certain facts, ideas, emotions, and ideals—offer many interesting problems for the student of human life. Most of these problems concern the genesis, development, grounds, and ultimate nature, of what men believe and think "ought to be," rather than what they conjecture or know, "actually is." But several of the particular sciences, attempt, of course, to deal with this class of problems—namely, those which arise in the field of man's moral and artistic feeling and "value-judgments"; and of his ethical and æsthetical ideals. These particular sciences, too, although they are generally, in themselves, more philosophical than are the physico-chemical sciences, have their own assumptions, and arrive at a more or less defensible system of conclusions respecting matters of fact. For the feelings, and judgments, and ideals of what ought to be, are themselves facts of human experience.

The need of the harmonizing and unifying, but critical work of philosophy becomes manifest and emphatic the moment we carefully compare the assumptions and conclusions of these two groups of the particular sciences. Especially is this so when the phenomena of the religious consciousness and religious development of the race are subjected to study by the historical and psychological method. Anthropology and comparative history are making it more and more evident that man is essentially a religious being; while psychology is just beginning to show how deeply seated in all his various conscious functions, as well as in what is figuratively called his subliminal self, is the religious experience of man. The three allied sciences of psychology, anthropology, and comparative history, are, therefore, all exceedingly busy just now in the collection and discussion of the data necessary to frame a so-called science of religion.

Numerous instances, to illustrate and enforce this function of philosophy in its relations to all the particular sciences, might be brought forward. But one or two are sufficient for the present purpose. The chemico-physical sciences, and the sciences of biology, psychology and anthropology, as influenced by the chemico-physical sciences, have been forming a more and more complete conception of man as, himself a piece of intricate mechanism, set in the totality of a vast natural system, a natural universe, mechanically conceived. Thus placed, the individual and the whole race are regarded as strictly determined in all their actions and development, after the analogy of a chemico-physical system or organism. But such a mechanical conception of human nature, of its functioning and its development, has never seemed satisfactory to morals, to art, or to



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religion. Hence there has been, and still is, a contention between the two—"a long-standing and unsettled strife"—as to the right conception of man and of his place in the universe. Philosophy must mediate in this strife. In its work of mediation, it investigates critically the conception of causation, and the so-called law which attempts to give a universal validity to this conception. It inquires as to the genesis and value of the conception itself. It asks: What is it to be a cause; and are things and minds causally related in the same way? It strives to harmonize the demands of the physico-chemical sciences with the feelings, value-judgments, and ideals, of the moral, æsthetical, and religious consciousness of man.

Or again: the physico-chemical sciences think it right to insist upon such a conception of the Being of the World as shall represent it in terms of impersonal forces, and of a universal but unconscious and purposeless ordering of its own affairs. It (or Nature) behaves thus and so; and it develops as it does, in accordance with its own inherent forces and immutable laws. These sciences are naturally and properly shy of what they call anthropomorphism. They think that the being of the world is not scientifically conceived of, when the conception is anthropomorphic. But morals, and art, and religion, are naturally and properly careful to conserve the interests of the feelings, judgments of worth, and ideals, in which, so to say, their most valuable assets chiefly consist. They are, therefore, more indulgent to the imagination and intellect in their combined effort to construct a picture of the Being of the World, which shall not violate, but shall on the contrary, satisfy, these ethical, æsthetical, and religious interests. Such an effort is necessarily anthropomorphic in a different way from that in which the chemico-physical sciences think it altogether safe to indulge themselves. Thus morals, art, and religion, make the Being of the World, good, and beautiful, and worshipful,—in brief, an ideal personal Being. That which the former sciences conceive of as an impersonal system of forces and laws, the ideals of the mind prefer to conceive of as perfect ethical spirit, to be admired, worshipped, and obeyed, as God. But philosophy must exercise, in a supremely important way, its harmonizing offices in the attempt at a solution of this great problem.

The number of subordinate problems, in the consideration of which the reconciling office of philosophy is helpful and indeed indispensable, is not small. But the end which philosophy diligently and unswervingly pursues has already been described; it is the forming of a harmonizing and unitary view of the world and of human life.

*Philosophy and Psychology.*—Among the particular sciences there is one which stands in a peculiarly intimate relation to every branch of philosophical discipline. This science is psychology. Indeed, so intimately related are psychology and philosophy that some writers have insisted upon the impossibility of distinguishing between the two. But this is an exaggeration of the real state of the case. The modern science of psychology aims to treat by scientific methods the phenomena of human consciousness in such manner as to form a valid conception of the nature, genesis, and laws of

the development of man's mental life. It, therefore, admits of many subordinate and yet cognate divisions. It concerns itself downward, so to say, with the psychical life of the lower animals, with the facts and laws of human physiology, and especially with the science of nervous phenomena; and outward and backward in history, with anthropological and antiquarian researches. In its method it does not neglect the study, from the psychological point of view, of the products of the human mind, in the other sciences, in literature, in art, and in philosophy. It even regards history itself as man's will and intellect, written in the large. But psychology also leads onward and upward into philosophy, in a very imperative way.

The relations between psychology and philosophy are so intimate that, in many cases, the two have been—as has already been said—largely, or almost wholly, identified. This has especially been true of English philosophy. For example, Locke's 'Essay Concerning Human Understanding' has been called—although improperly—"the most important offspring of modern philosophy." But its author describes his purpose to be an inquiry "into the original, certainty, and extent of human knowledge, together with the grounds of belief, opinion, and assent." This inquiry necessarily raises problems which we should now say belong to psychology, and also to that branch of philosophy which is called epistemology; but it does not completely cover the field of either psychology or philosophy. A modern English writer (Ward) has maintained that we cannot define psychology at all, because we cannot distinguish, at the outset, "what takes place in the mind" from "what takes place without"; and a distinguished German psychologist (Wundt) affirms that the partition of sovereignty between psychology and philosophy is an abstract scheme which, in the presence of the real facts, always appears unsatisfactory.

The modern view, however, is distinctly favorable to separating, as far as possible, between the spheres of psychology and philosophy, and to treating psychology as one of the particular sciences. Thus understood, this science will collect, compare, analyze and discuss, the phenomena of man's mental life, with a view to a tenable theory of the nature and development of the so-called human soul, or mind. And the philosophy of mind will further apply the method of reflective thinking and of speculation to the results obtained by the science of psychology. It becomes at once apparent, however, that the scientific study of every principal problem of man's mental life leads directly to some important problem, or group of problems, in philosophy. For example, the problem of sense-perception, or our knowledge of things by the senses, is primarily a problem for psychology. But the study of sense-perception soon compels the recognition of a certain belief in the reality, both of the objects perceived and of the perceiving self, and in the actuality of relations of interaction between the two. From the beginning the different schools of philosophy have divided sharply over the nature, grounds, and validity of this belief; and over the nature, grounds, and validity of the distinctions implied, between the perceiving self and the object which is perceived. Moreover, the moment we begin



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to inquire as to the reality of either the mind or things, and as to the actuality of the relations between them, that moment we begin to discuss problems in metaphysics.

Once more, psychology, since it is the science of mental phenomena and mental life, must deal with the mind's judgments of worth, and with the ethical, æsthetical, and religious conceptions and ideals. But the attempt to do this at all thoroughly leads at once to the raising of problems which belong to the philosophy of morals, of art, and of religion. We seem obliged, then, to recognize a peculiarly close relation between this particular science and another important group of philosophical problems.

In this connection it should also be said that psychology, like all the other particular sciences, has its own assumptions, or points of view and conception, which have not yet been critically examined. For example, the study of the science of psychology assumes that the mind is real, and that the things it perceives by the senses are real; that knowledge of the mind and of things is possible; and also, that the common-sense conceptions of space, time, force, relation, and all the other so-called categories, are sufficiently accurate for beginning its scientific pursuits. But philosophy challenges and criticises all these assumptions.

It would appear reasonable, then, to respect this intimate and necessary relation between psychology and philosophy, in the following way. The former, when pursued as a science, should be allowed the same rights in making its preliminary assumptions, and in arriving at its conclusions, as those which belong to all the particular sciences. But psychology should,

realities to be considered do not follow any strictly logical order; nor do they observe definitely fixed bounds to their relations, in a way to favor only one method of division. For these reasons different writers on the subject have advocated different ways of dividing the general field of philosophy.

We proceed, then, without further discussion to propose that division of philosophy which seems to us most appropriate and convenient for the discussion of its several chief problems. For it should be remembered that there ought to be, and there are, as many principal divisions of the subject treated by philosophy, as there are problems of this character to be discussed. Two other considerations should also be borne in mind: (1) These problems are all interdependently related to one another; and they all sustain the relations which have already been described, to certain of the particular sciences. They all, also, of course, are problems, to the philosophical consideration of which the attempt at a complete scientific system of mental phenomena leads the way. But, at the same time, (2) these various problems require treatment in a manner to contribute toward the attainment of the final purpose of philosophy. This we have seen to be a reconciling and uniting view of nature and of human life. This treatment implies some conception of the Being of the World which shall be adequate to perform such a reconciling and uniting office. Therefore, all the other departments of philosophy look forward to that one which summarizes the conclusions of all the others.

The following table expresses, according to our views, the truth of philosophy in the division of its different chief problems:—

<p>I. Philosophy of the Real [Metaphysics, in the wider meaning of the word]</p>	<p>{ 1. Theory of Knowledge [Or Epistemology, Noëtics] 2. Theory of Reality [Ontology, or Metaphysics in the narrower meaning of the word]: { A. Philosophy of Mind B. Philosophy of Nature (or of physics, etc.) with its two branches</p>
<p>II. Philosophy of the Ideal [Or of that which ought to be: Idealology, or Rational Teleology]</p>	<p>{ 1. Ethics, or the Ideal of Conduct [Metaphysics of Ethics, Moral Philosophy, or Practical Philosophy] 2. Æsthetics, or the Ideal of Art [Philosophy of the Beautiful]</p>
<p>III. Philosophy of the Absolute [or the Supreme Ideal-Real]</p>	<p>{ This endeavors so to conceive of the Being of the World, or the Ultimate Reality, as to unite the conclusions of the other branches of philosophy with the demands of the religious consciousness. Thus this Reality may be conceived of as Perfect Ethical Spirit</p>

as far as possible, recognize the fact that in the more speculative solution of the problems to which its pursuit inevitably leads, it is itself dependent upon philosophy; and, finally, that philosophy is something much more than a higher stage of psychology; for philosophy aims at a rational system of the conceptions and principles, presupposed or ascertained by *all* the particular sciences.

*Divisions of Philosophy.*—Like every other vast field of human research, philosophy needs to have made some specific allotment of its different aspects, if not of its wholly separable portions. The problem of making this allotment is the problem of division. Its inquiry is: How many, and what, are the different main branches of the general subject? But like every other similar problem in scientific division, the

*Different Main Branches of Philosophy.*—It now remains only to describe, in the briefest manner possible, the different groups of problems which correspond to the divisions of philosophy indicated in the table given above. Among these we have to notice:—

*The Theory of Knowledge, or Epistemology.*—In the second edition of his 'Critique of Pure Reason' Kant affirms that "philosophy requires a science to determine *a priori* the possibility, the principles, and the extent of all cognitions." Modifying this statement somewhat, we may say that epistemology investigates the universal and permanent factors of our experience in a way to answer these three questions: (1) What really is knowledge? (2) What are the limits of human knowledge? and (3) What is the nature and guaranty of the certainty of know-



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ledge? The position of philosophy toward all these questions is that of critical inquiry. In taking this position the mind makes the effort to strip itself of all prejudices and even of all presuppositions; and, by a process of patient and thorough reflective thinking, to probe to the bottom its own cognitive powers. Thus we have before us the somewhat strange and intensely interesting spectacle of the knowing mind striving to know itself as knower;—to understand its own doubts and beliefs, the principles upon which its life of knowledge bases its existence and growth, and the nature and direction of the barriers to its knowing powers which are set by its own constitution, or by the fixed relations in which its activities stand to its own objects.

The limits of this article do not permit even a sketch of the processes of reflection and argument by which different thinkers have attempted to solve the problems involved in a theory of knowledge. Even less are we able to discuss at length the problems themselves and the answers arrived at by the different schools of philosophy, in this branch of its manifold investigations. It must suffice to say that the one most important point of difference concerns the relation in which those mental states which we call cognitive—or states of knowledge—stand to extramental realities. Upon this point we find the extreme so-called idealistic school, or school of phenomenalism, holding that, for every individual mind, only its own states can be known; or, in a word, all knowledge is of phenomena; and all known phenomena must be subjective, or modifications of consciousness that can be relied on only to tell the truth about themselves. On the other hand we find those who claim that knowledge is, always and essentially, some sort of an envisagement, or immediate apprehension, of reality; that this claim is as true for things as for our own selves; and, in fine, that the extreme skeptical position misrepresents human experience totally, and is indeed so absurd that it cannot even be put into other than self-contradictory terms. And between these two views on the epistemological problem lie many others of a mediating sort.

*Theory of Reality, or Ontology.*—This same branch of philosophy is also properly called metaphysics, in the narrower and more appropriate meaning of the word. In its most general form its attention is directed upon the problem, What is reality? In this form it is seen closely to correspond with the epistemological problem which investigates the nature of knowledge. More elaborately expressed we may say that metaphysics is the critical and systematic exposition of those necessary conceptions and presuppositions which enter into man's cognition of what he considers to be real. Popularly said, this branch of philosophy strives to answer the question: What is it to be real?

Now even a superficial and preliminary examination is enough to show that there are certain conceptions which the mind, always and of the strictest necessity, applies to every kind of a real object. For example, all realities exist for us under conditions of space and time; they stand in relations to one another; they undergo change, either in the form of motion, or change of state or quality; they act dynamically upon one another; they are said to obey law, etc. But

this branch of philosophy wants to know, What it is really to exist in space and time, actually to stand in relations of one sort or another; really to change position or state; and actually to influence something else, or to obey law, etc. For this reason, a doctrine of ontology has sometimes, not inaptly, been spoken of as a criticism of the categories,—meaning by this word, the conceptions which are always and necessarily applied to all beings considered to be real, and to all events considered to be actual (as distinguished from non-existent or imaginary).

But it is at once obvious that any theory of reality, for its more detailed consideration, must be divided into two subordinate branches. For there are two different classes of real beings—namely, minds or selves, and things or non-self-like existences. And these two do not really exist under precisely the same conditions, or display precisely the same essential qualities, or enter into precisely the same relations, whether among themselves or between each other. Thus certain forms of conscious activity are necessary to the real existence of minds; but the same forms do not appear to be necessary to the existence of things. Things and minds are, then, essentially unlike in respect of some qualities which they must have, respectively, in order to exist at all. Moreover, the kind of energy which things and minds display, and the actual dynamical relations into which they can enter with other beings, are markedly different. Even the so-called law of the conservation and correlation of energy, confessedly, cannot apply to the relations of minds to things, or minds to minds, in the same way in which it applies to things; even supposing it to have any valid application whatever to psychical energy. General metaphysical philosophy is divided, then, into the Philosophy of Mind, and the Philosophy of Nature.

*The Philosophy of Mind.*—The primary object of this branch of philosophy is to determine what claim to reality, and to a place in the system of real things, can be established for the ego, or subject of mental states. The skeptical and phenomenalistic view regards the mind as merely a succession of states. The now old-fashioned theory of mental substance regarded man's soul as some sort of an entity that might be conceived of as existing, in reality, without, however, doing anything or showing its peculiar forms of active life in any way. The modern theory of the nature of mind is more dynamical, as it were. It finds the essential core of the being of mind in activity; and it tries to determine the nature of this being by studying the mental life as a development of more and more complex combinations of permanent forms of activity. This form of examination it applies to the critical inquiry after an answer to such problems as follows: What is it really to be as all minds are? What is the character of that unity which belongs to the mind?—at least, in its normal and developed condition, however such unitary being may be disturbed by double (or triple) consciousness, and other similar phenomena. Thus the inquiries of this branch of philosophy have a very important bearing on the questions which religion raises with regard to the nature, origin, and probable destiny of the human soul, and of the race.



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Just now, however, the other branch of metaphysical philosophy is creating much interest, and is being diligently and skilfully cultivated by many of the foremost thinkers of the age. This branch is called the Philosophy of Nature.

*The Philosophy of Nature.*—It is not sufficiently recognized that a very large proportion of the entire body of the modern natural and physical sciences is really metaphysical, in the strictest meaning of the latter term. Moreover, the metaphysics of the chemico-physical and biological sciences is of the most subtle, elaborate, and difficult character. No one can doubt this who has attempted even partially to understand the modern conceptions of atoms, electricity, ether, physical energy, the constitution of matter, and the nature of the relations sustained to one another by different material existences. And, indeed, the new discoveries as to the existence and behavior of radio-active substances, and their emanations, of germ-cells and their developments, are complicating enormously the metaphysics of these sciences. The truth is that the metaphysics of things (or the philosophy of nature) is much more obscure, complex, and at present purely tentative, than is the metaphysics of mind. On the other hand, the amount of patient research and the order of talent given to this branch of philosophy at present are such as to encourage the most hopeful attitude toward its future developments. What are the essential qualities, what the universal and permanent relations, what the laws and final purposes, of material things, are philosophical questions which physics, chemistry, and biology, are now investigating in a most productive manner. But the attempts at the solution of the problems of all the foregoing branches of philosophy, only make the mind the more eager to have light thrown upon the ideals of conduct, art, and religion. And hence the next branch of our discipline is Ethics.

*Ethics, as the Philosophy of Conduct.*—The opinions of men as to the right and wrong of conduct may profitably be studied from the historical point of view. A study, by the methods of psychology, of the nature of man as fitted for conduct and for the development of moral character, furnishes further material for an attempt at a science of ethics. But all such empirical methods of examining the problems of morality only raise, but do not solve, the more ultimate and profoundly interesting problems. Among these are such as the following: What is the essential nature of the morally right? What is the origin and guaranty of the feeling of obligation to do the right? (As Kant would propose the question: How can there be a categorical imperative?) But, finally, what ground, that is universal and unchanging, can be found for the morally right, in the real being of the world? Such questions as these define the sphere of the metaphysics of ethics. History and psychology, as we have already said, can only point to these questions and ask them, with endless repetition and no decrease of emphasis, of speculative philosophy. And these are the very questions which are, not only of the most undying interest but also of the greatest practical moment to the inquiring mind of man.

Closely akin to these are the questions propounded to æsthetics.

*Æsthetics, as the Philosophy of the Beautiful.*—Here again the historical study of art and of the development of opinion and feeling respecting beautiful objects, as well as the analysis of so-called æsthetical consciousness, only raises, but does not answer, the questions of chief interest to philosophy. Such study shows that man has always regarded the characteristics of beauty as not merely subjective, but as really belonging to the object. The beautiful is distinguished from the sensuously agreeable by the possession of two characteristics in a special way: these are objective validity and ideal worth. Hence the inquiry arises for a ground of that which seems to human consciousness to be possessed of these characteristics; and that ground philosophy aims to place in the Being of the World. But this is equivalent to regarding this being as an ideal life, conceived of after the analogy of the human spirit. It is this feeling of kinship for the beautiful in nature, of which even the rudest and most savage of mankind show manifest signs, that led the poet (Byron) to exclaim:

Are not the mountains, waves, and skies a part  
Of me and of my soul, as I of them?

It is obvious, however, that such personifying of that system of things which science calls nature, must provoke much skeptical criticism; whether the personifying take the form of constructing this system in terms of the ideal of ethics or of the ideal of æsthetics. In this way the mind is challenged and directed in its renewed effort to perform the supreme task of systematic philosophy. For this has already been repeatedly described as the attainment of such a harmonizing and unitary view of nature and of human life as shall take due account of all the knowledge conveyed by the particular sciences in its construction of a satisfactory conception of the whole. All these other branches, therefore, lead up toward and are auxiliary to the philosophy of the absolute.

*The Philosophy of the Absolute (or Supreme Ideal-Real.)*—Of course, for the thinker who, after a severe and intelligent criticism of man's cognitive powers, reaches the conclusion of a complete phenomenalism, or agnosticism, there can be no such branch of metaphysical philosophy as this. But then, equally of course, such a skeptic cannot consistently have any views as to the reality of the concrete things and minds that constitute his physical and social environment. In a word, consistent and logical agnosticism not only destroys all philosophy, but also undermines and renders merely subjective all the conclusions of the physical and natural sciences.

Now besides the phenomena of man's ethical and artistic life and development, we have to notice those of his religious life and development. For some sort of religious belief and worship is as old and as universal as is historical man. Even prehistoric man, so far as we know anything about him, seems to have been religious. The conception of the Being of the World to which the highest religious development of humanity has attained is that of a perfect ethical spirit, into moral and spiritual relations with whom man may come by voluntary acts of communion and service. Philosophy, therefore, has before it the final problem of striving to satisfy



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all the various demands of man's many-sided nature and development in the conception which it presents of the Ultimate Reality, or the World-Ground; that is, the being of the world which science regards as a system of forces and laws, which ethics and æsthetics regard as the source and realization of their ideals, and which religion regards as perfect ethical spirit and worships as God. The appropriate name which philosophy bestows upon its conception of this unitary being is the Absolute.

The most profound and important questions reflected upon, and debated by, the different schools of philosophy, from the beginning of its existence in any systematic form up to the present time have, therefore, concerned the nature of, and relation of mankind to, this so-called Absolute. But the differences of opinion existing between these different schools may be best summarized by saying that they concern the character and the amount of personality which may properly be attributed to "the Absolute." On this point we find one extreme claiming that the two conceptions—namely, of absoluteness and personality—are not only incompatible, but antagonistic. On the other hand, the conclusions of psychology, philosophy of mind, epistemology, and even a theory of reality based upon the conceptions of science, are being summoned to show that all human thinking and living is conditioned upon the essential personality of the Absolute, or likeness of the environing world to the human self. And perhaps it is no exaggeration to say that some such form of an ideal-realism is just now the kind of philosophy which divides the field of reflective thinking with those who still cling to the skeptical position of phenomenalism.

*The Benefits of Philosophy.*—It is customary to bring the ceaseless discussion of the ultimate problems of philosophy, and the alleged fruitlessness of this discussion, as a serious and even conclusive charge against the usefulness of philosophy. To answer this charge fully it would be necessary to pass in review the entire history of man's development in reflective thinking. This history would show conclusively that every great movement in science, art, morals, religion, and even in politics and social affairs, has been profoundly influenced by the pre-existing and current philosophical opinions. And if this influence has ever been injurious to, or restrictive of, human welfare, its only counter-acting influence has arisen out of the same source,—namely, the renewed and better use of human reason in the discovery of the complete and final truth touching the nature of reality. As Aristotle long ago said: Even if we forbid men to philosophize, they will none the less philosophize. And the very skepticism which complains of philosophy in the past, and asserts its essential uselessness, is itself a challenge to a better and more hopeful form of reflective thinking.

But it is not true that the discussion of philosophical problems has been fruitless or, on the whole, harmful to the best interests of mankind. On the contrary, it may be successfully maintained that no other form of man's higher life has made more essential progress, or has contributed more to other forms of progress, than has philosophy;—when the term is understood in the broad and generous way in which

we have tried to interpret it. For in philosophy, man's reason reaches its supreme expression of the striving after what is ideally best; and this is to know one's self and one's fellows, the world and God, in a more profound manner, and so as to satisfy the entire intellectual, ethical, æsthetical, and religious needs of the soul.

*Bibliography.*—(This brief list of books includes only those most easily accessible, and most likely to be profitable to the general reader; and, doubtless, only a small proportion of even such books.) *General Philosophy*: Külpe, 'Introduction to Philosophy'; Ladd, 'Introduction to Philosophy'; Lotze, 'Microcosmus'; Janet and Séailles, 'A History of the Problems of Philosophy'; Paulsen, 'Introduction to Philosophy'; Robertson, 'Elements of General Philosophy'; Stuckenberg, 'Introduction to the Study of Philosophy'; Watson, 'An Outline of Philosophy.' *The Theory of Knowledge*: Hobhouse, 'The Theory of Knowledge'; Ladd, 'Philosophy of Knowledge'; Ormond, 'The Foundations of Knowledge.' *Metaphysics*: Bowne, 'Metaphysics'; Ladd, 'A Theory of Reality'; Mackenzie, 'Outlines of Metaphysics'; Royce, 'The World and the Individual'; A. E. Taylor, 'Elements of Metaphysics.' *Philosophy of Mind and Matter*: Holman, 'Matter, Energy, Force, and Work'; Ladd, 'Philosophy of Mind'; Pearson, 'The Grammar of Science'; Snyder, 'New Conceptions in Science'; Stallo, 'The Concepts and Theories of Modern Physics.' *Ethics*: Bowne, 'Principles of Ethics'; Ladd, 'Philosophy of Conduct'; Seth, 'A Study of Ethical Principles'; Mezes, 'Ethics, Descriptive and Explanatory'; Paulsen, 'A System of Ethics'; Sidgwick, 'Methods of Ethics'; Wundt, 'Ethics.' *Æsthetics*: Day, 'Science of Æsthetics'; Marshall, 'Pain, Pleasure, and Æsthetics'; Raymond, 'Genesis of Art Form'; Santayana, 'Sense of Beauty'; Van Dyke, 'Principles of Art.' *Philosophy of Religion*: Bowne, 'Philosophy of Theism'; Fairbairn, 'Philosophy of Christian Religion'; Pfeiderer, 'Philosophy and Development of Religion'; Tiele, 'Elements of the Science of Religion.'

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**Philosophy, History of.** The history of philosophy has a peculiarly close and vital relation to philosophy itself. It may even be said to form an essential and integral part of philosophical discipline. While a knowledge of the history of every science is of great service in aiding one to comprehend its standpoint and fundamental hypotheses, insight into the genesis and historical development of philosophical problems and conceptions is in philosophy a primary and essential requirement. For, in the first place, these conceptions are not the work of any single mind, or the possession of any particular school. They are the outcome of a long line of development to which many ages have contributed, and in which many individuals have borne a part. Even where different systems seem to be directly opposed as they successively make their appearance in history, the new is never a mere denial or displacement of the old, but is connected with it by positive lines of relation. And ultimately nothing which is of value is ever lost, but is taken up and preserved in the later systems. In short, the history of philosophy presents an account of the evolution



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of human thinking in one of its most universal aspects. It deals with the development of the process in which the race has attempted to express in scientific form its views regarding the nature of the world and its interpretation of life. These are problems to which the human mind must in every age seek to find an answer. The form of these inquiries, however, can never remain unchanged. For the object that every philosophical thinker seeks to understand is the world as it is known to him and to his generation. As new material is brought to light by the advances of the special sciences, or as the changing interests of practical life bring now this and now that aspect of reality into prominence, and thus leading to a modification of the standards of value, the problems of philosophy get new formulations, and the old systems show their inadequacy and need of revision. We may therefore say that the history of philosophy gives an account of the process in which the human spirit becomes constantly more clearly and definitely conscious of itself and its relation to the world. The task of philosophy, which accordingly consists in defining more clearly at once the nature of the self and of the world, must be undertaken anew by the thinkers of each generation. No age can rest in the definitions of the past. But, on the other hand, it is only in the light of the past that the thinkers of any particular age can understand their own problems. It is only by building upon the foundations already laid, by continuing the work of their predecessors, that they are able to accomplish anything of value. A philosopher's best originality consists in developing, and thus rendering more exact and definite, the thoughts of those who have gone before him. It is true that he must work in the light of the science and practical insight of his day; but, in order to produce valuable results, it is necessary that his reason should be illumined by the philosophical conceptions and principles which have proved their fruitfulness in the great systems of the past.

There is, of course, a fundamental difference between this conception of the history of philosophy and that formerly prevailing which looked on it as a record of the opinions of individual thinkers whose theories had no positive or essential relation to one another. From this standpoint, the history of philosophy possesses merely an antiquarian interest. It leads us through a road strewn with the wreckage of discarded theories and broken down systems. Oftentimes the diversity of opinion which it presents is taken as a proof that the goal which philosophy seeks to reach is unattainable, and its problems insoluble. In spite of the prevalence of the notion of development, this view of the history of philosophy still persists in some quarters. The conception of the history of philosophy as a process of development was, however, clearly formulated by Hegel (q.v.) a century ago. This conception gave a new significance to the historical facts, and aided in arousing a new interest in their investigation. By Hegel himself, however, the development was conceived in a wholly logical sense. That is, he conceived the progress from age to age as determined wholly by the inner necessity with which inconsistent and inadequate thoughts lead on in a regular and absolutely necessary order to their

own refutation and correction. As a result of this logical interpretation, Hegel was led to force the facts of the history of philosophy into an artificial scheme of thesis, antithesis and synthesis, corresponding to the universal thought movement as laid down in his 'Logic.' Moreover, in the light of this logical interpretation, the history of philosophy appears as an impersonal process of development characterized by inner necessity, where the individual thinkers seem to determine nothing through their free personality, but merely to represent a certain inevitable stage in the evolution of the thought of the race. In spite, therefore, of the great service which it has rendered, Hegel's conception has serious defects. For while fully admitting the importance of the logical factor, it is impossible to forget that the development of philosophy is the work of individual thinkers, whose conceptions spring from their own personal life, and that its progress is also modified by the general culture and prevalent interests of the times in which it makes its appearance. In investigating the history of philosophy, then, these various factors must be given due place. The task which investigation in this field has to perform has been stated under the following three headings by Windelband ('History of Philosophy,' § 2, 6): (1) "To establish with precision what may be derived from the available sources as to the circumstances in life, the mental development, and the doctrines of individual philosophers; (2) from these facts to reconstruct the genetic process in such a way that in the case of every philosopher we may understand how his doctrines depend in part upon those of his predecessors, in part upon the general ideas of his time, and in part upon his own nature and the course of his education; (3) from the consideration of the whole to estimate what value for the total result of the history of philosophy belongs to the theories thus established and explained with respect to their origin."

Philosophy, so far at least as it forms a part of the culture of the western nations, took its rise in Greece in the 6th century B.C., and was developed by the independent thinking of the people of the Western world. Whether there existed anything that may properly be called philosophy among any of the Oriental peoples, particularly among those of India and China, or whether the so-called Oriental philosophy does not rather belong to the history of religion, are questions that may here be left undecided. Philosophy, as it is known to the Western world, may conveniently be divided into an ancient, a mediæval, and a modern period. Ancient philosophy is almost entirely the product of Greek thought, and was first developed in the Greek colonies of Asia Minor in the East, and in Sicily and Italy in the West. It reached its culmination in Athens, and was finally cultivated at Alexandria, and at various points throughout the Greco-Roman world. Greek philosophy falls naturally into the Pre-Socratic period, the Socratic School, including Socrates, Plato, and Aristotle (qq.v.) and the Post-Aristotelian Systems. In this classification the Sophists may perhaps be regarded as a transition link between the first and second periods. Pre-Socratic philosophy was occupied



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mainly with attempts to explain the nature of the external world and the character of those physical phenomena that most readily attracted attention. According to the generally received account, philosophy had its origin in the 6th century with Thales of Miletus, in Asia Minor, who was followed in the same city by Anaximander and Anaximenes. We say that philosophy, which in its beginnings included all the sciences, had its origin with these men, because, so far as we know, they were the first to advance beyond mythologies, and definitely to raise and seek to answer the problem regarding the natural causes and principles of the world. A little later Pythagoras (q.v.) and his school, who flourished in lower Italy, did good service in developing the mathematical sciences, and also proposed a universal explanation of things couched in terms of numbers. Lower Italy was also the home of the Eleatics, whose greatest representative, Parmenides, taught the unchanging and unitary character of that which truly is. About the same time Heraclitus was maintaining at Ephesus, in Asia Minor, that everything is in process of change and becoming, and that nowhere is there to be found any permanent static being. To reconcile the opposition between the views of Parmenides and Heraclitus, both of which seemed to be justified by experience, later thinkers, Empedocles, Anaxagoras, and the Atomists, while differing in important respects from each other, agreed in adopting a plurality of fixed, unchanging elements which are constantly forming new combinations by their union and being dissolved in turn. Thus while elements remain unchanged, what we call things are in constant process of transition.

The work of the Sophists was almost entirely critical and destructive. They are significant, however, as first calling attention to the subjective side of experience. This took the form of an assertion that knowledge exists only as sensations and feelings in individual minds, and that therefore there is no standard beyond the individual of truth or of moral values. The Sophistic skepticism was met and refuted by Socrates and his pupil Plato (q.v.), who showed, by a more thorough-going analysis of the nature of conscious experience, that in reason, as opposed to sense-perception, man possesses a standard both of theoretical and of practical truth. Aristotle organized the special sciences on the basis provided by his predecessors, and defined their field of inquiry, while at the same time applying and making more concrete in the field of philosophy the idealistic principles of Plato. During the post-Aristotelian period, the philosophical interest was mainly ethical and practical. The reasons for this are to be found in the political conditions of the time. The Greek states had lost their independence, and when the social and political institutions, which embodied the laws of life and conduct for the Greek in objective form, had thus collapsed, it became necessary for the individual to seek to find in his own nature the principles of practical guidance that life demands. At the same time, theoretical problems were not entirely abandoned, though in general they were subordinated to practice. Both the Stoics and Epicureans made philosophy include logic and physics as well as ethics, but both alike regard

the two former disciplines merely as means, and the last alone as the true end. These two schools were founded at Athens at very nearly the same time (about 300 B.C.), the former by Zeno (q.v.), and the latter by Epicurus (q.v.). The Stoics taught a system of materialistic pantheism, which they drew largely from Heraclitus. In ethics, where their teachings are of the greatest importance, they emphasize the necessity of self-restraint and of independence of external goods and outward circumstances. They maintained that the highest good consisted in the attainment of virtue, and that this was entirely different in character from personal happiness or satisfaction. The school of Epicurus, on the other hand, based their account of the physical world upon Atomism, and in ethics they regard the rational pursuit of pleasure as the end of life. Skepticism made its appearance in Greek philosophy with Pyrrho (q.v.) (360-270 B.C.), in the school of the Academy with Arcesilaus about the time of Alexander the Great, and among a group of later thinkers in the 3d century of the Christian era. We find the skeptical arguments and difficulties which are familiar in modern times elaborated in great detail and urged with remarkable acuteness by these writers, particularly by Sextus Empiricus. Eclecticism (q.v.) flourished especially at Alexandria, where Philo (q.v.) sought to unite Hebrew theology and Greek philosophy, and among the Romans, where writers like Cicero (q.v.) selected freely whatever doctrines commended themselves in the various systems of Greek thought. Greek philosophy ends in Neo-Platonism (q.v.), which is a species of mystical theosophy. It abandons the attempt to discover ultimate truth by means of logical thought, and seeks to comprehend all things in their immediate relation to God by inducing, from time to time, a state of ecstasy in which the limitations of ordinary consciousness are transcended, and the highest truths are apprehended in direct intuitive vision.

The ideas and conceptions introduced by Christianity gave a new impulse and direction to philosophical inquiry during the Middle Ages. During this period there was developed the consciousness of a fundamental opposition between God and the world, and in general between the spiritual and the natural. This shows itself in sharp divisions between church and state, this life and the future life, priests and laity, etc. Along with this, there went also a sense of man's natural helplessness and lack of freedom, and the futility of all his attempts to save himself without divine grace. Mediæval philosophy may be divided into two main periods, a Patristic and a Scholastic period. These may be described in the words of Ueberweg: "In the patristic period, philosophic thought stands in the closest relation with theological speculation, and co-operates in the development of Christian dogma. In the scholastic period, it passes into the service of theology, being employed merely to reduce to scientific form a body of dogmatic teaching for the most part already at hand, by introducing a logical arrangement, and bringing to its support philosophical doctrines from ante-Christian antiquity." The work of the Fathers of the Church reached its culmination in Saint Augustine (q.v.) (354-430 A.D.), who, after his conversion to Christianity, employed his pro-



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found philosophical genius in explaining and justifying the theological dogmas of the trinity, of predestination, and of the origin and nature of the human soul, etc. Scholasticism (q.v.), as Hegel has remarked, is modern science in embryo. It is the form under which the thought of the Western nations was molded and schooled for long centuries. Ostensibly, at least, philosophy during this period was entirely subordinated to the accepted theological doctrines. *Credo ut intelligam* was its professed motto. This subordination, however, was never absolute, and in every generation there were thinkers who modified, and to a greater or less extent rationalized, the teachings of the Church. In spite of the subjection of thought to authority, the history of the whole period shows a gradual though slow awakening on the part of European peoples to the rights of reason, a growing consciousness that thinking, to exist at all, must be free and independent. Early scholastic philosophy was mainly under the influence of Plato and the Neo-Platonic writers. Of Aristotle only the logical writings in the Latin translation of Boethius (q.v.) were known. The most noted names of this period are John Scotus Erigena, Anselm of Canterbury, and Abelard (qq.v.). About the beginning of the 13th century, the Catholic scholars became acquainted, through the Arabians, with the other writings of Aristotle; and the great Dominican teacher, Albert Magnus (q.v.), was quick to see how the system of the "heathen" philosopher might be made the support and bulwark of the Church. This led to a revival and transformation of scholasticism. The doctrines of the Church found a new and broader philosophical basis in the profound system of Albert's pupil, Thomas Aquinas (q.v.) (1225-74), which was, however, sharply opposed on some points by the subtle dialectician, John Duns Scotus (q.v.). During the 11th century, and during the first part of the 12th, and again in the last period of scholasticism, philosophical discussion centred round the question of the universal and its relation to the particular object. Realism (q.v.) maintained that the universal is the primary and fundamental reality in which and through which alone particular objects can exist (*universalia ante rem*). Nominalism, on the other hand, contended that the universal was nothing more than a name given to a number of particular objects, and that therefore only these have any real existence. It is at once evident that this controversy is only a particular form of the most fundamental problem of all philosophy, the relation of the one and the many. It is also interesting to note that the reappearance of nominalism in the later scholastic period was coincident with, and indeed an expression of the same spirit as, the new interest in natural science and in the observation and study of particular objects by empirical methods.

At the time of the Renaissance (q.v.), philosophy felt the same quickening influence which manifested itself in other fields. This renewed interest was first directed toward a study of other ancient systems besides that of Aristotle, who, as the official philosopher of scholasticism, was in many quarters condemned and decried. Plato and the Neo-Platonists were especially prized, and a Platonic Academy was founded at Florence by Cosmo de' Medici. This revival

of the ancient learning was quickly followed by independent investigations in the field of physical phenomena, and to some extent also in that of the phenomena of mind. Here belong the names of Nicolaus Cusanus, Copernicus, Kepler, and, though later, that of Galileo (qq.v.). The results gained by the new science were combined into a monistic and pantheistic view of the world in the philosophical system of Giordano Bruno (q.v.). One of the most important steps taken by these early investigators of nature was the development of the concept of mechanical explanation, and the formulation of its principles in the laws of motion. Descartes (q.v.) applied the conception of mechanism to all the phenomena of the physical universe, reducing them to terms of motion and extension. Descartes was no materialist, however, but maintained the existence of spiritual substances, operating according to their own laws, alongside, and largely independent of, the world of physical bodies. Thomas Hobbes (q.v.), whose theories in ethical and political philosophy are of great historical importance, was the first thinker to be led by the principles of modern science to reduce all classes of phenomena, physical and mental alike, to mechanical terms.

One of the most striking characteristics of early modern thought is found in its consciousness of new problems, and in the resulting sense of a complete break with the past. It was felt that up to this time little or nothing had been discovered, with the exception of mathematics, which could pass as real knowledge. The first demand was for a right method of discovering truth. It was confidently assumed that when this fundamental need was supplied, diligence and co-operation on the part of scientific workers would in a short time reveal all of the important laws of nature. The search for a method of scientific procedure gave rise to Rationalism and Empiricism (qq.v.), the two distinctive philosophical schools in the 17th and 18th centuries. Rationalism endeavors to imitate the procedure of mathematics, which it regarded as furnishing the one species of certain knowledge. It seeks to start, as mathematics does, with a number of axiomatic principles; and by analyzing these, and showing the necessary results to which they lead, it will exhibit its conclusions as a system of demonstrable truth. In this theory of knowledge, observation of particular facts is not emphasized: the organ of knowledge is reason, which proceeds by the road of analysis and deduction. This method, first formulated and employed by Descartes, was most consistently applied by Spinoza (q.v.), and continued with some modifications and additions in the systems of Leibnitz and Wolff (qq.v.). The empirical method, with its inductive procedure, was emphasized and stated in eloquent terms by Francis Bacon (q.v.) in his 'Novum Organum.' Locke's 'Essay Concerning Human Understanding,' however, must be regarded as the starting point of philosophical empiricism. For it refutes in detail the doctrine of innate ideas, and maintains, as its fundamental thesis, that all knowledge is derived from experience, and that experience is given as definite and particular contents which are known to the mind through external sense perception or through internal observation.



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Thus the starting point and the essential character of knowledge are found in particular facts passively perceived by the mind, while the activities of mind and the processes and principles of reasoning are proportionately minimized and given a subordinate place. In the development of this doctrine, Bishop Berkeley (q.v.) transformed Locke's "plain historical account" of mind into a system of empirical idealism. A little later, David Hume (q.v.), developing the empirical principles with the consistency and thoroughness of genius, arrived at utter theoretical skepticism regarding any rational basis of experience. Empiricism was also adopted and developed in France, notably by Condillac and Helvétius (qq.v.), but soon passed into naturalism and materialism, which finds its most pronounced expression in von Holbach's 'System of Nature.' Although usually taking an agnostic position on ultimate philosophical questions, empiricism has continued to have its representatives, among whom we may mention the names of David Hartley, Joseph Priestly, James Mill, and his son, John Stuart Mill, and Alexander Bain (qq.v.). These writers have dealt mainly, though not exclusively, with psychology, where they have emphasized various forms of the principle of association as a connecting law of mental phenomena.

The skeptical conclusions of Hume were opposed in the name of Common Sense by Thomas Reid (q.v.), the founder of the Scottish School, and by his followers, of whom the most noted are Dugald Stewart (q.v.) and Sir William Hamilton (q.v.), in Scotland, and in America, President James McCosh (q.v.) of Princeton, and President Noah Porter (q.v.) of Yale University. Reid's method, which was somewhat refined and developed by his later followers, consisted in an appeal to the common sense of the plain man in order to establish the existence of certain fundamental principles that were perceived intuitively and immediately both in the realm of theoretical and of practical experience. This method serves to emphasize the fact that there is much in experience which is overlooked by the empirical account; but it was necessary that philosophy should define and exhibit this by a more systematic and scientific method of analysis. This Kant accomplished mainly in his epoch-making work, the 'Kritik of Pure Reason.' Kant showed that experience was not constituted simply by a given content, but that, in order that it should exist, there was also necessary a system of interpretative forms or functions on the part of the mind, and that these find their unity and complete expression in the nature of self-consciousness. He thus at once reconciled and completed the partial views of Empiricism and Rationalism, and, at the same time, furnished philosophy with a new principle and a new method. Nevertheless, Kant himself failed to perceive the full scope of his own principles, and maintained that knowledge can only deal with phenomena or appearances, while the world of things in themselves remains beyond the reach of man's knowing faculties. In the 'Kritik of Practical Reason,' however, he showed that it is admissible and necessary in the light of our moral experience to make certain postulates regarding the nature of the ultimate realities, though these postulates never attain

the rank of knowledge, but must always remain matters of faith. In the 'Kritik of Judgment,' Kant attempted to unite the standpoints of the other two critiques, but the result, though very suggestive and historically important, was left in a somewhat indefinite and unsatisfactory state. Kant's philosophy was at once taken up and made the starting point of a notable line of development by three great thinkers, Fichte, Schelling, and Hegel (qq.v.). These men all abandoned the absolute distinction between phenomena and things in themselves, and proceeded boldly in somewhat different ways to construct systems of Idealism (q.v.). To describe these briefly, we may say that Fichte's system is Ethical Idealism, finding in the moral life the ultimate explanation and *raison d'être* of the world; that Schelling's main interest is in external nature, which he interprets in terms of Evolutionary Idealism; while Hegel's system is more universal in its scope, and attempts to embrace in a vast logical scheme the complete process of the Absolute Thought, including all the facts of man's life in their historical evolution, as well as the laws and forms of the physical universe. Hegel's philosophy of nature cannot be regarded as successful; and his system contains formal paradoxes and artificialities that have prevented its real value from being generally appreciated. But, with all its defects, it can scarcely be doubted that it furnishes the most complete and satisfactory synthesis of experience that has yet been formulated, and that the progress of modern thought is constantly developing and rendering more concrete its principles. It was Hegel's great achievement to grasp clearly for the first time the conception of history as a rational organic process, and thus to rise to the notion of a dynamic and concrete universal. His ideas have therefore proved exceedingly fruitful in the development of social and political philosophy, as well as in the more usual fields of metaphysical speculation.

In Hegel's postulate that the real is the rational and must disclose its nature to thought, we have the culmination of Rationalism. Schopenhauer, on the other hand, maintains in his 'The World as Will and Idea' the doctrine of Irrationalism,—that the world in all its various parts is not the expression of reason at all, but is the manifestation of a blind, purposeless principle, which he calls Will (q.v.). This insistence on Will as opposed to Reason (q.v.) does not, however, result in emphasizing more strongly the ethical life, as with Fichte. For Schopenhauer, Will is a blind impulse which manifests itself in the processes of nature which are usually regarded as purely physical, as well as in the phenomena of life and mind, while its coming to consciousness in man must be regarded as an unessential moment in its nature, and a misfortune. Its very nature is blind, purposeless striving that must forever remain unsatisfied. This is the basis of the Pessimism which Schopenhauer (q.v.) so convincingly enforces. Edward von Hartmann (q.v.), who makes the Unconscious the ultimate principle of the universe, and whose system also results in Pessimism (q.v.), may be regarded as a follower of Schopenhauer, though he introduced certain modifications into the latter's system that seem to be derived from Hegel.

In opposition to Idealism, Johann Friedrich



## PHILOSOPHY — PHILOXENIAN VERSION

Herbart (q.v.) (1776-1841) developed the realistic elements in Kant's philosophy, and advanced a system which he called Realism (q.v.). He maintains the existence of independent beings beyond experience, existing in the form of simple quality-less "reals." By discarding the reference of mental phenomena to separate faculties and substituting for this formal explanation a statement of their concrete laws and relations, Herbart also contributed largely to the development of psychology as a science. R. H. Lotze (1817-81) shows in some points the influence of Herbart, but criticises keenly the latter's conception of simple independent "reals," and arrives himself at the notion of reality as a system of souls that are united organically with one another and with the life of the Absolute, while each still retains, in some way, and to some extent, its own independence and freedom. Lotze may thus be described as an ideal realist; or, since he finds the ultimate purpose and explanation of things in the idea of the Good, his system may be described as Ethical or Teleological Idealism.

An important philosophical movement called Positivism (q.v.), which still exerts an important influence in France, was inaugurated by Auguste Comte (1798-1857). By Positivism Comte means a mode of explaining phenomena which rejects all reference to the will of the gods or other superior beings (Theology), or to abstract essences or powers (Metaphysics), and deals solely with the invariable laws of the phenomena themselves. The order of the development of the human mind, and hence of all the sciences, is from the theological, through the metaphysical, to the positive point of view. To render sociology, which has been the last in order of development, a positive science, was the main object of Comte's writings. Positive philosophy is not a separate discipline, but the synthesis and systematic co-ordination of all the sciences. Since the publication of Darwin's 'Origin of Species' (1859), philosophy, like all other branches of inquiry, has been especially influenced by the concept of evolution, and this notion has affected, to a greater or less extent, both the method and the conclusions of all recent writers. The only comprehensive "system," however, that has yet appeared, based professedly on this conception, is that of Herbert Spencer (q.v.). In the 'Synthetic Philosophy' Spencer has furnished an account in evolutionary terms of the origin of the physical universe from a primitive nebula, and has also traced the genesis of animal life, and the human mind, as well as the evolution of conduct, and of social life and institutions. He thus aims to give in his philosophy a complete synthesis of the sciences. The question may, however, be raised whether Spencer's adoption of the standpoint and conception of the particular sciences, and especially of the physical sciences, as final, without criticism or modification, does not render his conclusions unsatisfactory as the last word of philosophy.

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**Philosophy, Moral.** See ETHICS.

**Philostratus**, fī-lōs'tra-tūs, **Flavius** ("The Elder"), Greek Sophist and rhetorician: b. Lemnos about the middle of the 2d century A.D. Few facts regarding his life have come down to us. We know that he taught rhetoric at Athens, and subsequently at Rome, where he obtained the favor of the emperor Septimus Severus, and was received into the circle of literati that the empress Julia Domna had gathered around her. His principal work is his 'Life of Apollonius of Tyana,' which is regarded as rather fiction than history. His other works include the 'Heroicus,' dealing with the Trojan war; the 'Eikones,' a description of certain paintings the author says he had seen at Naples; 'Vitæ Sophistarum,' or the lives of several of the Sophists; and 'Letters.'

**Philo Xenian** (fīl-ōk-sē'nī-an) **Version of the Bible**, a translation of the Greek version of the Hebrew Scriptures and of the New



## PHILOXENUS — PHIPS

Testament books into Syriac, made by Philoxenus (or Asenaya), bishop of Mabbogh, early in the 6th century for the use of his co-religionists of the Monophysite or Jacobite sect or branch of the Syrian Church, the Peshitto version, already in existence, being deemed unfaithful. Philoxenus' version was highly esteemed by his contemporaries: he was one of the most eminent writers of Syriac; but his version of the Bible was superseded by two others, and only fragments of it are extant.

**Philoxenus**, fī-lōk'sē-nūs, Greek dithyrambic poet: b. 435 B.C.; d. 380 B.C. He was originally from Cythera, and upon the capture of the island was taken as a prisoner of war to Athens, where he became the slave of Melanippides, the musician, who educated and freed him. For a considerable time he lived at the court of Dionysius I. of Syracuse. He severely wounded the vanity of the tyrant by refusing to praise the latter's verses, declaring, on being given one to revise, that the best revision would be to draw a black line through the entire production. As a result he was put in prison; he either escaped thence or soon after his release left the court. He wrote 24 dithyrambs, including the 'Cyclops,' his most celebrated work, and the 'Deipnon' ('Banquet'), of each of which fragments remain. He was long highly esteemed; and so late as the time of Polybius his dithyrambs were annually presented by the Arcadians.

**Philtre**, fīl'tēr, in popular superstition, a love powder or love potion. From the earliest times it has been supposed that there were means by which love could not only be excited but be directed to a particular object. Various substances from the animal and vegetable kingdoms have been used for this purpose, some disgusting, some injurious, some without any distinguishing character. The truth is, that physical desire may be produced by physical stimuli, which are called *aphrodisiacs*, but it is absurd to suppose that such means can produce a passion for a particular object.

**Phineas Finn, The Irish Member**, a novel by Anthony Trollope, published in 1869. Taking its title from the name of its hero it is the earliest of Trollope's political novels and was followed by 'Phineas Redux' (1873); 'The Prime Minister' (1875), and 'The Duke's Children' (1880). In accordance with Trollope's custom of linking one fiction to another by presenting some of the same characters in each, Phineas and many of the *dramatis personæ* of 'Phineas Finn' appear in the later novels of the series.

**Phineus**, fīn'e-ūs or fī'nūs, king of Salmidessus, Thrace, son of Agenor. He was a blind soothsayer and had received his prophetic powers from Apollo. Different traditions prevail concerning the cause of his blindness, but the one generally accepted is that it was a punishment inflicted upon him for his cruelty to the children of his first wife whom his second wife hated. He was tormented by harpies who seized his food or rendered it unfit for use and was freed from them by Zetes and Calais, in gratitude for which service Phineus fitted out the Argonaut expedition.

**Phintias**, fīn'tī-as. See DAMON AND PHINTIAS.

**Phipps, Henry**, American manufacturer: b. Philadelphia, Pa., 27 Sept. 1839. He was engaged in various business houses of Pittsburg, Pa., until 1861 when he became a member of the firm of Bidwell and Phipps, dealing in powder. Later he engaged in the steel industry in which he amassed an immense fortune. He is actively interested in various educational and philanthropic enterprises, has presented to the public several fine conservatories, established a completely equipped botanical garden in Schenley Park, Pittsburg, in 1900, and in 1903 founded and endowed the Henry Phipps Institute (q.v.) at Philadelphia for the treatment of tuberculosis.

**Phipps Institute, The Henry**, an institution in Philadelphia, Pa., founded by the generosity of Henry Phipps (q.v.) of Pittsburg, Pa. for "the study, treatment, and prevention of tuberculosis." The institution was opened 1 Feb. 1903 and incorporated under the laws of the State of Pennsylvania, 1 Sept. 1903. The medical director is Lawrence F. Flick. The first year there were in the house 52 beds, which were occupied all the time, and 2,000 patients were treated in the dispensary. Inspectors visited the homes of the outside patients to see that instructions were carried out. In 1903 the Institute gave a series of International Lectures which were largely attended. Great opportunities are furnished by the Institute for research into the nature and best treatment of tuberculosis, a disease attended with the greatest mortality of any disease known in civilized countries.

**Phips, or Phipps, Sir William**, American colonial governor: b. Pemaquid (now Bristol), Maine, 2 Feb. 1651; d. London, England, 18 Feb. 1695. His youth was spent as a shepherd and as an apprentice to a ship-carpenter, after which he went to Boston, learned to read and write and then engaged as a trader. He married a rich Boston widow, built for himself a ship and engaged in commerce. Fired with the hope of regaining the treasure from a Spanish ship wrecked off the Bahamas, he went to England and prevailed upon the British Admiralty to furnish him a ship and means to seek the treasure. The expedition was unsuccessful but a second venture in 1667, backed by the Duke of Albemarle, resulted in the recovery of treasure to the value of £300,000, of which Phips' share was £16,000; he was also knighted and made sheriff of New England. In 1690 he commanded a fleet of eight vessels in an expedition against Port Royal which he captured, and later in the same year commanded an expedition against Quebec with a fleet of 34 vessels, but was unsuccessful and on the return voyage nine of his vessels were wrecked. He visited England endeavoring to induce the government to send another expedition against Quebec and while there, through the influence of Increase Mather (q.v.) was appointed first royal governor of Massachusetts. His first official act was the organization of a special court which speedily terminated the prosecutions for witchcraft. While governor he was accused of arbitrary measures and conduct and in 1694 was summoned to London to answer complaints made against him. He received promises of restoration, but died in London before they could be carried out. Consult: Cot-



## PHIZ — PHLOGISTON

ton Mather's 'Magnalia' (1702); Francis Bowen's 'Life of Sir William Phips,' Vol. VII.; Sparks' 'American Biography' (1834-7); Myrand, 'Sir William Phips devant Québec' (1893).

**Phiz.** See BROWNE, HALBOT KNIGHT.

**Phlebi'tis**, inflammation of the veins. It may begin outside of the vein, from some wound, abscess, etc., from which irritant material travels upward in the loose connective tissue of the vein-bed. The inflammatory process invades the coats of the vessel, disturbing their nutrition, and reaching the inner coat, where it causes cloudy swelling and roughness of the surface, on which the blood tends to coagulate in layers, and thus may form a clot large enough to block the vessel. Or the inflammation may begin from within the vessel, owing to a clot forming on its inner wall, and which, acting as an irritant, excites inflammation in the coats of the vessel from within outward. In the first case the formation of matter is likely to occur around the vessel, and parts of the clot, which is soft and loose, are apt to become detached and to be carried by the circulation to other parts, setting up similar changes there. In the second case the vessel is likely to be obliterated and converted into a fibrous cord. The disease is indicated by great tenderness, tension, acute pain, and a knotted, cord-like swelling in the course of a vein or veins, sometimes attended with discoloration of the surface. Dropsical swelling of the affected part or of a whole limb may occur.

Phlebitis may be prevented by proper care in the dressing of wounds, so as to keep the wound clean and healthy. The treatment is various. The patient must be kept perfectly quiet; the part be elevated; nourishing food should be given; tonics are great advantage; stimulants are often required; and antiphlogistics locally applied will allay the inflammation. Abscesses within reach should be opened.

**Phleb'olite**, a calcareous concretion formed within a vein. Such formations are due to the degeneration of coagulations in veins, or occasionally may have their origin in the coats of the vessels. Phlebolites which have formed nodules vary in size from that of a pinhead to that of a pea. They are also called vein-stones.

**Phlebot'omy.** See VENESECTION.

**Phlegethon**, flēj'ě-thŏn, in Greek mythology, a name given to a river of fire in the infernal regions. See COCYTUS.

**Phlegma'sia**, a painful inflammation attended with considerable swelling, especially affecting the cellular tissue, such as phlegmasia glandulosa and phlegmasia myoica. Phlegmasia dolens (phlegmasia alba dolens, white-leg, milk-leg), the principal form, may affect both sexes. It has appeared in convalescence from typhoid fever, and dysentery; in diseases of the rectum; as the result of the removal of fibroids and of the ovaries; but for the most part it is a disease of the puerperal state. It usually occurs in the left leg, but both legs may be affected. As a disease of the puerperal state it is seldom seen nowadays, but when it so occurs it usually appears the second or third week after parturition. Premonitory symptoms are frequently absent, but there may be feverishness for a day or

two. Pain, swelling, and tenderness appear in the upper part of the thigh and extend downward, and in 24 hours the whole leg may be swollen and hard, and more or less tender, but not reddened. The leg is pale or sallow, has a glossy or polished appearance, and is sometimes called marble-leg. Usually in a few days the pain and swelling diminish, but it is often several weeks before the disease disappears, and sometimes the condition lasts indefinitely. After its disappearance persistent aching of the limb, œdema of the foot, muscular weakness, etc., may remain for a long time. The causes of phlegmasia dolens are periphlebitis, phlebitis, and thrombosis. It commonly results from an extension through lymphatic vessels of inflammation from and about the uterus to the tissues surrounding the great vessels of the thigh. The origin of the primary inflammation is not always ascertained, but it most frequently results from uterine infection (puerperal or contact infection) by pathogenic germs introduced by infected hands, instruments, etc., into the uterus. The treatment is both constitutional and local—sleep and rest in recumbent posture, with the limb in a comfortable position; tonics and laxatives if necessary; easily digested food; hot anodyne fomentations; and when the disease disappears, careful bandaging, friction, and favidization.

**Phlegræan** (flēj-rē'an) **Plain**, a volcanic plain on the Campanian coast west of Naples, Italy. Legendary lore locates this plain as the scene of the combats between the gods and the giants. Ruins of numerous Roman buildings are found here.

**Phlegyas**, flēj'ī-as, in Greek mythology, king of the Lapithæ; he was son of Ares (Mars) and father of Ixion and Coronis; he is commemorated in the Hymni Homericæ.

**Phle'um**, a genus of grasses including timothy grass. See GRASSES OF THE UNITED STATES.

**Phlogiston**, flō-jīs'tŏn, in chemistry, a hypothetical substance supposed at one time to be a part of all bodies that were capable of being burned. The conceptions of the terms element and combustion have been many and varied, but the first of real importance to the phlogiston theory was that of Becker (1635-82). He held that all inorganic substances were composed of three "earths," the mercurial, the vitreous and the combustible called "terra pinguis," and that when substances were burned or metals calcined (oxidized) this latter "earth" escaped. Stahl (1660-1734) expanded this idea into what was known as the Phlogiston Theory. This holds that all substances capable of burning, and calcination was recognized as slow combustion, contained a substance called phlogiston and that this was given off when the substance burned. A substance that burned readily contained a large amount of phlogiston and as coal did so with the evolution of a large amount of heat and left little residue it was supposed to be nearly pure phlogiston. A substance that had been burned could be rephlogisticated, and thereby made capable of being burned again by being heated with a substance rich in phlogiston. Thus the result of the burning or calcination of a metal, known as a metallic calc, could be changed back to the metal by being heated with coal. This theory



## PHLOX — PHOCION

was generally accepted by chemists until toward the end of the 18th century. Phlogiston itself was never isolated, though the hydrogen discovered by Cavendish was thought by some to be this all important substance. Facts began to accumulate, however, that seemed opposed to this theory. It was shown that metals gained instead of lost weight when calcined. Phlogisticians at first denied this, but later tried to explain it by claiming that phlogiston possessed negative weight, and that therefore a substance would, of course, be heavier when it had been driven off. Substances would not burn except in the presence of air. This was said to be because the air must be present to take up the phlogiston. The final overthrow of the theory was accomplished by Lavoisier. He showed and proved by careful weighings that a metal when calcined gained in weight and exactly as much as was taken from the air. Later, after the discovery of oxygen and its presence in the air by Lechee and Priestley, he showed that it was this oxygen that combined with a burning substance. Combustion was thus shown to be combination with oxygen rather than loss of phlogiston and the phlogiston theory was abandoned. See COMBUSTION; LAVOISIER; PRIESTLEY; STAHL.

**Phlox**, a genus of herbs of the order *Polemoniaceæ*. The species, of which about 30 have been described, are mostly tall, spreading perennials, and with two exceptions, a Siberian and a Chilean species, are all natives of North America, where they are extensively distributed. Their showy flowers, borne either in terminal clusters or solitary, and their ready adaptability to a wide range of soils and situations, have made phloxes general favorites in gardens. They are hardy and very floriferous, and have developed a large number of hybrid and cross-varieties of great diversity of form, color and markings. They are of two classes: the annuals, all the garden varieties of which have been derived from *P. drummondii*, a Texan species; and the perennials, derived from several species, some of which are still cultivated in the pure natural form in old gardens. Of these last the best known are probably the moss or ground pink (*P. subulata*), which is a favorite plant in rockeries and cemeteries, since it does well in dry soils and forms a dense mat of foliage and bloom. The cultivated perennial phloxes are, however, mostly derived from *P. maculata* and *P. paniculata*. The annual varieties are readily grown from seeds planted under glass or in the open air in spring, the seedlings being transplanted to good garden soil as soon as the weather becomes favorable. The perennial varieties may be propagated by seeds, but since these do not produce progeny like the parent, cuttings of stems or roots, and division of the clumps are generally preferred. Division may be made in early spring or in autumn; stem-cuttings during the summer and root-cuttings in spring or fall. After they commence to grow, cutting plants are managed like seedlings. In the garden, the perennial sorts are planted three or four feet apart and divided every two or three years; the annuals are set a foot apart.

**Phobos** (Greek, "fear," an attendant upon the god Mars), in astronomy, the inner satellite of the planet Mars. It was discovered at Washington, in 1877, by Asaph Hall. It is re-

markable for its small size, and for the rapidity with which it revolves about its primary. Its diameter is only about six miles, and its period of revolution is 7 hours, 39 minutes and 14 seconds. See DEIMOS.

**Pho'ca; Pho'cidæ**; the genus and family of the typical seals. See SEALS.

**Phocæa**, fō-sē'a, ancient Ionian city in Asia Minor, situated on a peninsula between the Gulfs of Elæa and of Smyrna and on a neighboring island. Legend makes it a colony of Athens. It early attained great commercial importance, indeed the earliest Greek coins seem to be those of this city. Clay wares were its main export. Among its western colonies was Massilia, now Marseilles, and as early as the 6th century B.C. tribute was paid the city by native chiefs of southern Spain. But in 540 B.C. after a heroic defense the city was captured by Cyrus' lieutenant Harpagus; many of the inhabitants migrated to Corsica, where they successfully met the attacks of Carthaginians and Etruscans, and then to southern Italy, where they founded the city of Velia. A few of the Phocæans had rebuilt the city in the meantime; and in the Roman period it again grew to prominence and wealth. It was sacked by the Romans during the war with Antiochus; was attacked without success by Aristonicus of Pergamus; and then sank again into obscurity. The Genoese founded the city of New Phocæa near the site of the old in 1421.

**Phocas**, fō'kas, Byzantine emperor: b. Asia Minor; d. Constantinople October 610. He was of low birth and served in the army of Mauritius as an obscure centurion, where he gained a name for brutal courage among his fellows. In 602 he headed a revolt against Mauritius, seized the throne and after his coronation executed Mauritius and his five sons. Later accusing the Empress Constantina of conspiracy against him she with her three daughters was cruelly put to death by his orders. He secured peace with Europe, but Chosroes II. of Persia waged a determined warfare against him and in 610 Heraclius, son of the exarch of Africa, led an expedition against him, invested Constantinople, and put the tyrant to death with cruelty equal to that exercised by Phocas in his sanguinary reign.

**Phocas, Column of**, a monument in the Forum at Rome erected in 608 in honor of Phocas, emperor of the East. The column, 54 feet high, is of such artistic excellence that it is presumed that its workmanship must have been long before the 7th century. It was rediscovered in 1813.

**Phocion**, fō'shī-ōn, Athenian general: b. about 402 B.C.; d. Athens 317 B.C. Of humble descent he was educated under Plato and Xenocrates, receiving instruction which influenced his entire life. His first military service was performed under Chabrias, where he rendered good service in the victory at Naxos in 376 B.C. In 349 he was sent with troops to Eubœa, where he defeated the forces of Philip of Macedon, banished Plutarchus from Eretria, and secured the island against the invasions of Philip. Later he defeated Philip's forces at Megara, re-established the walls to Nisæa, and on a subsequent expedition to Eubœa freed Orcus and Eretria from the Macedonian rule. In 340 he was sent



## PHOCIS — PHŒNICIA

to the Propontis, where he forced Philip to abandon the siege of Byzantium and Perinthus. As leader of the peace party at Athens he advised the surrender of Demosthenes and other orators demanded by Alexander after the destruction of Thebes in 335, but upon the refusal of the demand headed the second embassy and succeeded in appeasing Alexander. After the death of Alexander in 323 Phocion reluctantly assumed command of the forces which were to free Athens from the Macedonian sway. They were at first successful, but ultimately were compelled to make peace. Upon Antipater's death Phocion became involved in an intrigue with Cassander, rival of Polysperchon, and was compelled to flee to Phocis, whence he was delivered up to Polysperchon by the Athenians and by him forced to drink poison. The Athenians later repented of their injustice and buried Phocion with high honors. Consult Plutarch, 'Life of Phocion.'

**Phocis**, fō'sis, an ancient division of central Greece and since 1899 a nome in the present kingdom. It lay to the north of the Gulf of Corinth; was largely taken up by the range of Parnassus, so that there were only a few fertile spots along the river valleys, especially the Cephissus, where excellent wines were grown; and gained most of its importance from the sacred city of Delphi (q.v.). The antiquity of settlements in Phocia is attested by the mention of the district and its most important cities in the Homeric catalogue of the ships in the second book of the Iliad. Myth makes the Leleges, Hyantians and Thracians the first settlers, but the people in historic times were clearly of Dorian stock. The history of Phocis is little more than a series of quarrels over the oracle and treasure house at Delphi, of which the confederation of the 22 Phocian cities claimed to be guardian — a claim supported by Athens, always opposed by the Thebans and with less animus by the Thessalians (who were severely defeated at Hyampolis at the beginning of the 5th century B.C.), as well as by the Spartans, against whom the Dorian Phocians joined Athens in the Peloponnesian War. The first Sacred War, 595–585 B.C., resulted in the destruction of Cirrha, a city which had lived by plundering pilgrims to Delphi. In the second Sacred War Phocis gained control of Delphi in spite of Sparta's intervention, but lost it again 30 years after by the terms of the Truce of Nicias (421). The third Sacred War began with a decree of the Amphictyonic council of 357 B.C., no doubt dominated by Theban influence, condemning the Phocians to pay a heavy fine for having used part of the sacred lands of Delphi; and this decree was finally carried out in spite of the resistance of the Phocians, who were long secretly backed by both Athens and Sparta and who appropriated much of the Delphic treasure to carry on the war.

**Phocylides**, fō-sil'ī-dēz, Greek poet, who flourished about 537 B.C. His poetry was made up chiefly of gnomic precepts, and only 18 fragments have been preserved. A didactic poem in 230 hexameters long passed current as the work of Phocylides, but was shown by Jakob Bernays to be a later forgery. This seems to furnish evidence of the esteem in which Phocylides was held, the only object of the anonymous

author having apparently been to procure prestige for his composition by attaching to it a recognized name.

**Phœbe**, fē'bē, in Greek mythology, the daughter of Uranos and Gæa (heaven and earth), mother by Koos of Asteria and Leto. As the successor of Themis and the predecessor of Apollo she presided over the oracle at Delphi. Later poets speak of Phœbe (the radiant one) as a title of Artemis, the moon goddess.

**Phœbe-bird.** See PEWEE.

**Phœbus**, fē'būs, **William**, American Methodist clergyman: b. Somerset County, Md., August 1754; d. New York 9 Nov. 1831. He entered the ministry in 1783, and was engaged upon various circuits until 1798 when he established himself as a physician in New York. In 1806 he re-entered the ministry, and continued in the service until 1824 when he was placed on the retired list. He edited the 'Experienced Christian's Magazine' in 1796 and wrote 'An Essay on the Doctrine and Order of the Evangelical Church of America as Constituted at Baltimore, 1784' (1817).

**Phœbus.** See APOLLO.

**Phœnicia**, fē-nish'ī-a, in ancient geography, a region and a Semitic kingdom with widely varying boundaries at different periods, but generally defined as the fertile coast region of Syria lying between the Lebanon range and the Mediterranean, and bounded on the south by Carmel and on the north by Latakia (Laodicea) and the country around Cyprus. The name is Greek and has been variously explained; either from *phœnix*, "a palm tree," or from *phœnix*, "red." The former etymology would allude to the palms of the country; the latter to the red brown complexion of the inhabitants, or to the scarlet dye of the murex which was a staple article of trade with this people, or to the region about the Red Sea, whence their own legends say that they emigrated. Very probably none of these explanations is correct. The native name was Chna, familiar to us in the form Canaan and signifying "the lowlands"; it was extended at an early date to cover Palestine. "Tyre and Sidon," the names of the two great Phœnician cities, were often used to include all the cities of the plain. The coast line, 200 or more miles long and broken by several sharp promontories, is followed by a narrow strip of very fine sand; inland are the fertile plains of Acre, Tyre, Sidon, Marathus, etc., varied by round hills, and backed by the range of Lebanon, 130 miles in length and overgrown with the proverbial cedars and other ship timber. Besides the great cities of Tyre and Sidon there were in early times even the minor cities of Arvad, Accho, Orthosia, Arka, Botrys, Berytus, Sarepta, Dora, etc., so that the entire country might have been defined as a series of ports practically forming one unbroken city along the sea. The geology of Phœnicia is simple with its silicious coast strip; its alluvial plains, cut by the rivers Badas (Nahr-el-Melk), Eleutherus, Orthosia (Nahr-el-Berid), Tripolis (Kadisha), Adonis (Ibrahim), Lycus (Nahr-el-Kelb), Magoras (Beirut), Bostrenus (Nahr-el-Auly), Sidon, Litny, Sarepta (Zaherany), and Belus (Acre or Akko); and the mountain ranges of Bargylus and Lebanon, formed of an early limestone, very soft



and broken now and again with igneous rocks. The sandstone is rich in iron in many localities; coal and ochre have been found and there is evidence that the Phœnicians themselves dug extensively for amber.

*Commerce.*—But almost as soon as they devoted themselves to farming and cattle raising in the plains and mining in the hills, the ancient Phœnicians must have begun to fish, to navigate the Mediterranean and to trade with its varied peoples. Whether they had been sailors before coming to the Mediterranean coast is uncertain; the question depends on the solution of the difficult problem of the precise origin of the people. Their own legend that they came from the region around the Red Sea would make it probable that they had known something of shipping and trade before they settled in their new home. At any rate in Phœnicia they were famous sailors and seem to have been the earliest people to dare to sail by night as well as by day, under the guidance of the north star, which they may be said to have discovered. The purple, or, more exactly, scarlet dye made of the shell of the murex; the skilful embroidery, jewelry, and weaving of the Tyrian craftsmen; and glass, which if not discovered by the Phœnicians was evidently improved and largely sold by them—together with the natural products of the country—were the main articles of Phœnician export. Imports were limited only by the variety of the products of the Mediterranean basin, the far West, for the Phœnicians brought tin from Britain, and the far East, for Syria and Babylonia made Phœnicia a market place for exchange with Egypt, and the caravan wares of India and eastern Africa both made their way to Phœnician marts, where there was a great slave trade.

*Colonization.*—But Phœnician colonists were no less proverbial than their traders and navigators. The impulse seems to have been due to the wars in Canaan, which drove the Hivites and Amorites into the northern and maritime country, whence they were sent to settle in Cyprus. It seems probable that by 1500 B.C. the Phœnicians had colonies throughout the Ægean Sea. Soon afterward, at the latest, they settled in Malta, Sardinia, and Sicily, where the cities of Motye, Soloeis, and Machanath (later Panormus) grew up; then Hippos, Ithaca (Utica) and Carthage were planted on the African coast, Carthage becoming one of the greatest maritime powers the world has ever known; and about 1100 they reached the Pillars of Melkarth (or Hercules), now Gibraltar, and founded Gades (Cadiz), a western outpost and a trading station with the countries of the nearer Atlantic.

*History.*—The ethnology and early history of the people are alike uncertain. The Biblical account (Gen. x. 6–15) in making Sidon a descendant of Ham seems to argue for the Hamitic origin of the race. The argument against this from the Semitic character of the language is not conclusive; as in Parthia a Turanian people adopted an Iranian language and became merged to a great degree with the Persians as concerns customs and religion, so here it is possible at least that the Phœnicians may have been originally Hamitic and that they learned a Semitic tongue only after their settling in the eastern end of the Mediterranean. But, taking

into consideration the racial type and the mental characteristics of the people, most ethnologists are agreed on their Semitic origin. Relationship with Egypt then becomes a matter of commerce and trade, merely. The earliest historical mention of the country is in Egyptian monuments and evidences Egyptian control of the Phœnician cities from 1600 to 1300 B.C. Sidon then arose as a great power, withstood the Israelites, and made Dan subject to her, but was unsuccessful in her attack on the Philistine city of Ascalon, which, attacking her in turn, practically broke the supremacy of Sidon. Tyre was the new leader, its supremacy beginning about the middle of the 13th century, colonization being extended and the cordial feeling with the Israelites rising to its highest in the days of Hiram and Solomon. But Tyrian hegemony after 400 years nearly (1250–875) was broken by the Assyrian empire, whose control of Phœnicia lasted, with important intervals of successful rebellion on the part of Tyre, to the last of the 7th century (about 625). Egypt first, then Babylon, now held all Syria; and after Cyrus' capture of Babylon (538 B.C.) Phœnicia was a part of the Persian empire up to 333. In this period much of the old maritime power of Phœnicia returned; she became in short the Persian naval outpost on the Mediterranean. This power prompted a revolt against Persia, which founded a brief period of independence before the capture of Tyre, after one of the greatest sieges in history, by Alexander the Great in 333 B.C., which closes the history of the region.

*Religion.*—The precise nature of the Phœnician religion is as obscure as all Phœnician origins. Philo of Byblus (about 64–141 A.D.), himself a Phœnician, wrote in Greek on this topic in a manner that some critics consider mere Euhemeristic theorizing, but which others accept as actual proof that the gods were merely notable heroes of the primitive period. It seems more probable that, like most other Semitic religions, the Phœnician was a nature worship, possibly monotheistic in origin, but certainly polytheistic and extremely corrupt, vicious, and depraved in historic times. Indeed almost all that is unnatural and vile in Greek cults seems traceable, at the expense of less or more ingenuity, to Phœnician influence. The wickedness of Sodom and Gomorrah and the cities of the plain was proverbial in both the Old and New Testaments; it seems to have been ceremonial and closely connected with the worship of Ashtoreth (Astarte, the *Venus Syriaca*), and not to have been due to the ill-repute that the Phœnicians had for veracity, fidelity and honesty. The word "sodomy," from Sodom or Sidon, is in itself a sufficient commentary on Phœnician worship. Ashtoreth, on the naturalistic theory, seems to be the personification of the moon, as Baal was the sun. Melkarth, the tutelary god of Tyre, in many respects like the Hellenic Heracles, whose very name indeed has been derived from Melkarth (read backward, as the Phœnicians wrote from right to left); Adonis, or Adonai, the god of Byblus, the complaint for whose loss seems to have fashioned a ceremonial elegy, which possibly affected the Ionian elegiac form, and whose name was substituted by the Hebrews for the sacred trilateral name of Yahweh in their texts; and Dagon, the fish-god, are a few of the divinities which sprang up after the early



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monotheistic stage in which Baal alone was worshipped. Human sacrifice was practised, notably to Molech, as we know from the Scripture narrative; and it has been suggested that prostitution as a cult rite may have had its origin in the same notion of averting the divine anger by offering up the most precious and best—an idea carried even further by the emasculated Galli. In the Phœnician temples no statues of the gods were reared, but simple cone-shaped columns.

*Art and Architecture.*—See article PHŒNICIAN ART.

*Language and Literature.*—The Phœnician alphabet was the original, thanks to Sidonian and Tyrian colonies which carried it through the Mediterranean, of that of the Greeks, who reckoned Cadmus, a Phœnician, inventor of letters. It is certain that there were earlier alphabets, for example Egyptian and Hittite; and it seems probable that the Phœnician was derived from the Egyptian. If so it has the virtue of simplification as it contains only 24 letters, practically those of the earlier Greek alphabet with the sign F, for a *v*, *w*, or *f* sound. The importance of this simplified alphabet, the direct ancestor of the Greek, and thus indirectly the parent of all the alphabets of modern Europe, can scarcely be overestimated. The language of the Phœnicians differed so little from Hebrew that a Hebrew scholar has little difficulty in reading it. Like the alphabet it was spread widely over the Mediterranean basin by colonization, but as the Phœnician colonies were overwhelmed by Greece and Rome the language died out; Carthage, destroyed by Rome in 146 B.C., was probably the last place where the language was used. The result is that the greater part of our knowledge of the language is from very indirect sources such as proper names of gods, men, and places, or chance citations in grammatical writings. The direct sources include only the inscriptions on coins or temple walls, votive offerings, etc. These are included in the French Academy's 'Corpus Inscriptionum Semiticarum' (1881 sqq.), and their grammar is dealt with in Schröder, 'Die phönizische Sprache' (1869) and Lidzbarski, 'Handbuch der nord-semitischen Epigraphik'; they date from the 9th century B.C. to the 3d A.D., most being between the 5th and the 2d centuries B.C. The nature of the inscriptions, their brief ceremonial form, make the Phœnician vocabulary which has come down to us consist very largely of names of divinities, the names of men and women being almost without exception compounded of god-names; and the indirect sources, as has been remarked furnish nothing but proper names. These indirect sources are the Biblical texts, citations by Greek and Roman grammarians, and such names, preserving their Phœnician form somewhat, as occur in Greek and Latin translations of Phœnician authors. How large a literature there was in Phœnicia proper and its colonies is problematic. The work of Sanchuniathon of Berytus on cosmogony and theogony, supposed to date from 1200 B.C., is preserved in part in a Greek version by Philo of Byblus, who is reckoned by some modern scholars to have tampered with the original, if original there ever was. Other names are those of the historians Theodotus and Hypsieratus (whose clearly Greek names cast suspicion on their being

actually Phœnicians), Mochus, who is said to have enunciated the atomic theory; and among African authors, Hanno, whose 'Periplus' in Greek version has come down to us, and Hiempsal, king of Numidia, Hamilcar, and Mago, who all wrote on history and agriculture. Mago's work was translated into Latin by Silanus upon the order of the Roman senate, and seems to have been used in Varro's 'De Re Rustica' and in Virgil's 'Georgics.' Virgil's description of the song of Iopas at the close of the first Æneid may prove that he knew something of Punic philosophy; Servius states that this was the case, but it is quite as likely that the outline of the theogony of Iopas is reminiscent of Sanchuniathon, or from some Hellenic source.

*Bibliography.*—Movers, 'Die Phönizier' (1841-56); Kenrick, 'History and Antiquities of Phœnicia' (1855); Levy, 'Phönizisches Wörterbuch' (1864); Bloch, 'Phönizisches Glossar' (1891),—see also titles cited under *Language and Literature*; Renan, 'Mission de Phénicie' (1865-74); Euting, 'Punische Steine' (1871); Rawlinson, 'History of Phœnicia' (1889) and the shorter history in the 'Story of the Nations' series; Pietschmann, 'Geschichte der Phönizier' (1890); Meyer, 'Geschichte des Altertums,' Vol. I. (1884); Gutschmid, 'Phœnicia,' in 'Encyclopædia Britannica,' 9th edition, and his article in the first volume of his 'Kleine Schriften' (1890); and Landau, 'Die Phönizier' (1901).

**Phœnician Art.** The Phœnicians invented little in the domain of art; what remains of their production shows them to have been possessed of the power of assimilation and recombination so as to be able to improve upon models which they derived mainly from Babylonia, Egypt and Assyria. What they produced bore the impress of the most skilful workmen of ancient times and in their developed forms often returned to the countries whence they had sprung. Figures, identified as Phœnicians, on the walls of Rekhmara's Tomb at Thebes, erected in the time of Thotmes III., wear richly embroidered tunics and carry vases in their hands, from which may be inferred the skill already developed in embroidery and pottery-making.

It will be more logical, however, to speak first of Phœnician architecture. Few remains exist of which anything like an adequate account may be derived. The reason is twofold; first, the temples, built of stone, were of monolithic or megalolithic structure, and disappeared, for the most part, during the succeeding supremacy of the Canaanites, who used the material for their own more refined building. The domestic architecture was of wood and metal and has long since crumbled away. Enough remains, however, to enable us to form a basis for reconstructing the system upon which they worked. Contrary to the system of the Greeks, as pointed out by M. Renan, the foundation of Phœnician architecture was the carved rock and not the column. When the wall replaced the carved rock the character of the latter was not wholly lost. The keyed vault was probably unknown to them. Neither did the Phœnicians construct each architectural member out of separate stones, as was demanded by Greek taste; but instead they frequently carved as many as three or four members out of a single block of stone. The refinement of design, which results from the lines



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of the stone following the lines of the building, was wholly absent. Whatever the size of the block in leaving the quarry, it did not diminish in being incorporated into the building.

The existing monuments are chiefly to be found in the neighborhood of the five coast-towns,—Ruad (Aradus); Amrith (Marathus); Jebeil (Byblus); Saida (Sidon); and Sur (Tyre). At Amrith is a temple or shrine in good preservation. It stands in the centre of a rectangular area, 192 feet long by 160 broad. its foundation is block 20 feet square, and 10 feet high, of living rock, showing the depth to which the surrounding area was sunk. The superstructure consists of three wall blocks covered by a roof of a single block, enclosing the interior on three sides only. No ornament is attempted save a fillet, and cornice around the exterior of the roof-block, and a shallow carved vaulted roof on the interior. No steps lead up to the fane. A similar fane, discovered in the neighborhood by Renan during the Syrian expedition projected by Napoleon III., though not so well preserved, bears evidences of an entirely monolithic structure.

The walls of Phœnician towns were of massive stones like the foundations of temples. These were placed in superimposed courses without the use of mortar. Of all Phœnician monuments, the tombs, or structures supposedly tombs, of which there are several remaining structures in good preservation, possess the highest architectural character. The best-known are the "Maghazils" near Amrith, one of which Renan has called "a real masterpiece in respect of proportion, elegance, and majesty." This monument consists of three parts; the basement story being circular upon a square platform or plinth. Above each corner of the plinth stands an engaged lion. The second story is cylindrical, of less diameter than the base, and has a molding of delicate curve at its base and carved dentals and battlements around the upper part. The surmounting story is cylindrical, of still less diameter, crowned by similar carving and finished by a dome. The basement story consists of four blocks, while all above it is monolithic. The type of monument, though rare, may be original with the Phœnicians, as it differs from the pyramidal and the step-terraced terminations of Egyptian and Assyrian monuments.

The four lions upon the tomb are among the most important of the remains of Phœnician sculpture. They are rudely carved and bear some indications of a Mesopotamian conception of animal life, with a peculiarity of technique that allies them with the bas-reliefs or empæstic metal-work by which Phœnician sculpture was almost exclusively represented. Reliefs cut in solid rock at Gineh and Mashnaka of animals and men comparable to Assyrian sculpture, but representing humbler phases of life than that depicted upon the works of Nineveh. Movable sculpture showing Egyptian characteristics, and sarcophagi with bas-reliefs of confused Egyptian and Greek elements have been found at Saisa. Their date is assigned to a time not earlier than the Seleucidæ.

The lack of sculpture remains is due to the fact that the Phœnicians probably made their movable figures out of metal. Upon a wooden core carved either in relief or in the round, the metal was placed and hammered to fit the carv-

ings beneath, forming a so-called sphyrclaton. Bronze was the metal usually employed for ornamented vessels. Reliefs were made of copper, gold, silver, and even tin; these metals being sometimes employed in connection with mosaics of precious stone, ivory and amber. The elaborately ornamented pillars, called Jachin and Boaz in Solomon's temple, the altar of gold, and the table for the show-bread, the great laver supported by lions, together with vessels, lamps, candlesticks and all the implements described in 1st Kings in the Old Testament as appurtenances to the Temple, were of Phœnician workmanship. The bronze dishes embossed and engraved, found by Sir Austin Layard at Nimrud and described in his 'Monuments of Nineveh' are ascribed to Phœnician workmen of the 8th or 9th centuries B.C. The designs upon these vessels show more liveliness of fancy than artistic merit. Figures of men as well as various animals natural and mythological, including the sphinx derived from Egypt, are wrought upon them. The human figures are often purposely grotesque.

In gem-cutting the Phœnicians attained a degree of excellence, while in many of the other minor arts such as ornamental jewelry, embroidery, etc., evidences of their variety and skill are not wanting. See: Renan, 'Mission de Phénice' (1874); Rawlinson, 'History of Phœnicia' (1889); Sayce, 'Ancient Empires of the East' (1884); and Reber, 'History of Ancient Art' (1882).

**Phœnissæ**, fē-nīs'sē, a play of Euripides (q.v.).

**Phœnix**, fē'nīks, Ala., a city of Lee County, opposite Columbus, Ga., 76 miles north-east of Montgomery and situated on the Central of Georgia railroad. It was founded just before the war, was incorporated in 1883, received a new charter in 1894, under which it is now governed by a mayor elected biennially and a city council. It is a city of homes with growing commercial interests. Pop. (1900) 4,163.

**Phœnix**, Ariz., city, capital of the Territory and county-seat of Maricopa County; on the Santa Fé, Prescott & Phœnix railroad; in the south central part of the Territory. A short railroad line connects Tempe, on the Santa Fé, eight miles east of Phœnix, with Maricopa, on the Southern Pacific Railroad. It was settled in 1870 and in 1881 was incorporated. It is in a mining region, where there is good farm land in the valleys. The chief industrial establishments are stock-yards, machine shops, and large jobbing houses. It is a famous winter resort. Its trade is chiefly in fruits, especially oranges, honey, grain, wine, mining products, and livestock. The prominent public buildings are the capitol, the agricultural experiment station, insane asylum, court-house, city-hall, churches, and schools. The educational institutions are Academy of the Sacred Heart, Saint John's Indian School (R.C.), a high school, public and parish schools, and a public library. The government is administered under a revised charter of 1893 which provides for a mayor, who holds office two years, and a council. Pop. (1890) 3,152; (1900) 5,544.

**Phœnix**, fabulous bird, about the size of an eagle. According to Herodotus it came from Arabia once every 500 years to the sanctuary



dedicated to it at Heliopolis, bringing with it the dead body of its parent, which it buried in the shrine. When it felt its life drawing to a close it built itself a nest, from which after its death a new phœnix rose; while other versions speak of a worm, which, proceeding from the body of the dead bird, was developed into a new phœnix. According to a more modern modification of the story the bird, at the age of 500 years, built a funeral pile of wood and aromatic gums, which it lighted with the fanning of its wings, and rose from the flames with renewed life. Similar stories of birds occur in the Oriental mythologies, as, for instance, the myth of the Persian bird *simorg* and that of the Indian *semendar*. Ancient writers mention four epochs of its appearance in Egypt under Sesostris, under Amasis (569-525 B.C.), under Ptolemy III. (247-221 B.C.), and under Tiberius (34 A.D.). In Saint Clement's epistle to the Corinthians it is used as an illustration of the doctrine of the resurrection; it had been regarded by the Egyptians as the symbol of immortality thousands of years previously; it appears on the coins of several Roman emperors as a symbol of their own apotheosis or of the dawn of a more glorious era under their reign.

**Phœnix**, in botany, a genus of palms, containing such valuable species as the date-palm, sago-palm and others of northern Africa and southern Asia. See DATE-PALM; PALMS.

**Phœnix of the House of Hohenlohe, Order of.** See ORDERS, ROYAL.

**Phœnix Park**, in Dublin, Ireland. On 6 May 1882 Lord Frederick Cavendish, chief secretary of Ireland, and Thomas Burke, the under secretary, were assassinated in this park. See DUBLIN.

**Phœnixville**, fē'nīks-vīl, Pa., borough, Chester County; at the junction of the Schuylkill River and French Creek; on the Pennsylvania and the Philadelphia & R. R.R.'s, 23 miles northwest of Philadelphia. It was first settled in 1792, and the borough incorporated in 1849. It is an important centre of the iron industry, and contains rolling mills, blast furnaces, bridge works and iron mills, including one of the largest plants of the kind in the United States. It also manufactures cotton goods, hosiery, silk and matches. The borough has a public park, a hospital, a public library and good schools. The government is by a council and a burgess who holds office for three years; the public school directors are chosen directly by the people. The waterworks are owned and controlled by the borough. Pop. (1890) 8,514; (1900) 9,196.

**Pho'las.** See DATE-SHELL.

**Pholus**, fō'lūs, in the Greek myth, a centaur of the Pholœ, a spur of the Erymanthus range, which separated Elis from Arcadia. When Hercules visited him he opened in his honor a cask of wine, the gift of Dionysus, and the other centaurs who had joined in the revel becoming excited with the fumes of the wine fell upon Hercules with sticks and stones. Hercules fought his way out of the cave and slew many of them with his poisoned arrows, putting the rest to flight. Pholus was accidentally wounded by one of the poisoned arrows from which he died.

**Phonau'tograph.** See PHONOGRAPH.

**Phonetic Spelling**, a system of spelling in which the words are spelled exactly as they are pronounced, the sounds being represented by characters each of which represents a single sound.

**Phonetic Writing**, is writing according to sound. See ORTHOGRAPHY; STENOGRAPHY.

**Phonet'ics**, in the widest signification of the word, ascertains the mechanism of voice-production both in man and in other animals. It investigates the structure and functions of the various organs concerned both in the production and the perception of vocal sounds; hence its object is not only voice but also hearing. But phonetics is commonly understood to apply only to the articulate sounds of human speech and their representation by alphabetic characters. Phonetics in this sense comprises all the many schemes which have been devised for unambiguous representation by alphabetic characters of the vocal sounds employed in language or in a given language, English for example. Some of these phonetic alphabets are intended merely or mainly as a means of discriminating articulate sounds for philological ends, as when the vocalizations of several languages are compared: but others are intended as practical substitutes for the existing alphabet.

The English alphabet is the alphabet of Latin, and for that reason it is inadequate for representation of the very many vocalizations of English which are alien to Latin; for example, the several different values of the vowels. The five vowels have in Latin each two values and no more; they each represent one vowel sound long (or full) and short (or thin, *tenuis*). But the vowel signs in English stand each for several different sounds. For example, *a* stands for the several vowel sounds heard in fate, fat, father, fall, fare, what, and in the initial syllable of among; *e* has at least six values, as in we, wet, here, her, there and the final syllable of gotten; *i* represents seven different sounds; *o* represents eight, and *u* four. Or the sound of *a* in lane may be represented in other words by *ei* (rein) or by *ea* (great).

The several consonants, too, are not restricted to one sound-value: examples, get, gem; cat, cent. Consonant sounds unknown to the Latins are represented by combinations of consonants: *ch*, as in chin, and as in chivalry; *th* as in thin and in than. Then, both vowels and consonants are in a large proportion of the words of the language silent. A phonetic alphabet would, as far as is possible, provide a sign for each vocalization in the language and would eliminate "silent" letters. Many alphabetic schemes to that end have been proposed, perhaps the most notable among them being the phonetic alphabet devised by A. J. Ellis of Cambridge University and Isaac Pitman, which was first published in 1847, and which since that time has been variously modified by them or by others. Though strenuous efforts have been made for the adoption of the Ellis-Pitman or other similar phonetic systems: though primers and textbooks for schools, and works of general literature, including the Bible, and numerous magazines and newspapers, have been printed in phonotype, and alphabetic reform has been zealously and ably advocated in England and the United States, there is as little prospect now



## PHONOGRAPH

of its adoption as there was 60 years ago, or even less.

In the phonetic alphabet of Ellis and Pitman, as at first constructed, 23 of the letters of the Latin alphabet were retained, the remaining 3, *c*, *q* and *x*, being rejected as superfluous. Seventeen new characters were devised to represent sounds that are not represented unambiguously in the existing alphabet. Afterward the 17 new characters were reduced to 11, namely, 7 new signs for vowel sounds, and 4 for consonants. In a phonetic alphabet the signs must always, in whatever position, each represent one definite sound-value and no more. The sounds represented in such an alphabet by the vowel signs *a*, *e*, *i*, *o*, and *u* are the sounds which those vowels have in the words, an, ell, in, on, run.

The consonant signs in the phonetic alphabet stand for the same vocalizations which they represent in the regular alphabet, with this exception, that in the phonetic system they have only one sound: *g* is always hard, as in get, never soft as in gem, the soft sound of *g* being there represented always by *j*; in like manner *s* is always sharp, as in so, never soft as in has: the sound of *s* in has is represented phonetically by the character *z*. The sounds of *sh*, *zh*, *th* and *ng* as heard in she and nation, in leisure and occasion, in thin, in thou and in sing, have in the phonetic alphabet their proper signs, as is seen in the example of phonotypy following.

The modification of the vowel signs to make them representative of vowel sounds not adequately discriminated in the existing alphabet, are seen in the phonotyped passage given below from a defense of the phonetic alphabet by Sir Bulwer Lytton (Lord Bulwer-Lytton). There the vowel sound of *o* in more, of *u* in puzzle, of *u* in delusion, of *u* in confuse, and various other vowel sounds not discriminated in the regular alphabet; also the sound of *ng*, of *sion* in delusion, of *th* in truth, and a number of other vocalizations of English speech, are represented unambiguously in the phonetic characters. Bulwer-Lytton wrote: "A more lying, puzzle-headed, delusion than that by which we confuse the clear instincts of truth in our accursed system of spelling was never concocted by the father of falsehood. How can a system of education flourish that begins by so monstrous a falsehood, which the sense of hearing suffices to contradict?" Or, rendered in phonotypy:

\* A mœr lijn, pœzel-heded deluzon ðan  
ðât bj whiq wi konfuz ðe klir instipkts ov truf in our akœrsed  
sistem ov spelij woz never konkokted bj ðe fader ov fœlshud.  
Hou kan a sistem ov edukeſon flœrif ðat beginz bj sœ monstrœs  
a fœlshud, whiq ðe sens ov hœring sœfœsez tu kontradikt?'

Probably there is no other language whose alphabetic system and orthography are in so chaotic a state as those of the English language. But the very magnitude of the evil constitutes an insuperable obstacle to reformation.

To adopt any radical phonetic system would at once antiquate all the existing literature of the English language. The absurd orthography which we accept as though it were founded in nature itself, would give disgust to a generation that had been accustomed to a rational system; and the "ancient classics" of the year 1903 would be as irksome reading as the writings of

Chaucer or Wyclif are now. The new generation would have to go to school to learn the old A B C and the old orthography, else those "classics" would be caviare to them.

JOSEPH FITZGERALD,  
*Author of 'Word and Phrase.'*

**Pho'nograph**, an instrument invented in 1877 by Thomas A. Edison (q.v.) of Menlo Park, N. J., by means of which articulate sounds can be registered permanently, and afterward reproduced from such mechanical register. The instrument as originally made consists of a mouth-piece, having a stretched membrane; connected with the centre of this membrane is a steel point, which, when the sounds are projected on the membrane through the mouth-piece, vibrates backward and forward. This arrangement is placed before a cylinder which rotates upon a horizontal axis. A spiral groove is cut upon the surface of this cylinder, and a similar spiral screw fitted in a nut is cut upon the axis of the cylinder; the pitch of both spirals is the same. By means of a handle attached to the axis the latter with its attached cylinder can be rotated. The cylinder has therefore a motion of rotation and translation, the latter being at right angles to the plane of rotation. The whole may be set in motion by clock-work, electricity, or otherwise, instead of by hand. When the instrument is to be used a piece of tin-foil is laid round the cylinder, being kept close to it by means of gum or water, and the stand holding the mouth-piece is brought close to one end of the cylinder; the steel point of the diaphragm is then adjusted so as to be just touching, or close to the tin-foil, and above the line of spiral groove. It will be seen, then, that any movement of the steel point due to the motion of the diaphragm will cause a slight indentation of the tin-foil, which will by such movement be slightly depressed into the groove beneath it; and if the cylinder be rotated, that the steel point will, from the pitch of the groove and screw being alike, always be over the line of groove. If the instrument be then set as above described, and some words be spoken into the mouth-piece, while at same time the cylinder is kept in rotation, a series of minute marks are made upon the tin-foil by the movements of the steel point, and these markings have all an individuality of their own, due to the varying sounds addressed to the mouth-piece. So far a *register* only of the sounds emitted has been obtained, and we have now to show how these sounds in this manner, fixed as it were on the tin-foil, can be reproduced. To effect this the mouth-piece must be drawn back, and the cylinder rotated in the reverse direction to what it was at first, so as to bring the same part of the tin-foil with which the operation commenced back to the point at which it started, namely, opposite the steel point. The diaphragm with its steel point is then approached toward the tin-foil as at first, and is now resting upon the same point of the tin-foil as it had previously first indented. The cylinder is now rotated as at first, with the result that the small indentations or sound markings made previously now act upon the steel point by causing it to rise or fall, or otherwise move as the markings pass beneath it; the result of this is that the diaphragm in connection with the steel point is



thrown into a state of vibration exactly corresponding to the movements induced by the forms of the markings, and thus affects the air around so as to produce sounds, and these vibrations being exactly similar to those originally made by the voice necessarily reproduce these sounds to the ear as the words at first spoken. The diaphragm in this way acts as the medium of transmission of sounds to be registered on the tin-foil, and as the medium of reproduction of these sounds from the metallic register on which they have been impressed. The strips of foil can be kept for any length of time before the sounds are reproduced.

In Edison's improved phonograph (1895) tubes of wax are used instead of the tin-foil, the cylinder fitting into the inside of the tube, and the markings being made on the surface of the wax by a fine steel point. The wax cylinders can be used several hundred times, the machine being fitted with a small paring tool which will shave off the record previously made, leaving a smooth new surface. The machine has also been supplemented by the inventor with an ingenious little electric motor with delicate governing mechanism, so that the phonograph can be operated at any chosen rate of speed, uniformly. This motor derives its energizing current either from an Edison primary battery, a storage battery, or an electric-light circuit.

The new and perfected Edison phonograph has gone into very general use, and hundreds of thousands are distributed in American business offices, where they facilitate correspondence in a variety of ways. They are also employed by stenographers as a help in the transcription of their shorthand notes. Heretofore these notes have been slowly dictated to amanuenses, but they are now frequently read off to a phonograph, and then written out at leisure. The phonograph is, however, being used for direct stenograph work, and it reported verbatim 40,000 words of discussion at one convention held in 1890, the words being quietly repeated into the machine by the reporter as quickly as they were uttered by the various speakers. A large number of machines are in use by actors, clergymen, musicians, reciters, and others, to improve their elocution and singing. Automatic phonographs are also to be found in many places of public resort, equipped with musical or elocutionary cylinders, which can be heard upon the insertion of a small coin; and miniature phonographs have been applied to dolls and toys. The value of the phonograph in the preservation of dying languages has been perceived, too, and records have already been secured of the speech, songs, war-cries, and folklore of American tribes now becoming extinct. It is also worthy of note that several voice records remain of distinguished men who "being dead yet speak." Their tones can now be renewed at will, and their very utterances, faithful in accent and individuality, can be heard again and again through all time. Improvements are being made in the wholesale reproduction of phonographic cylinders, by electrotyping and other processes; and the machine, in a more or less modified form, is being introduced as a means of furnishing a record of communications through the telephone. Phonographic clocks, books, and other devices have also been invented.

**Phonog'raphy.** See PITMAN, ISAAC; SHORT-HAND.

**Pho'nolite** (Clinkstone), in geology, a compact gray or green volcanic rock of feldspathic or porphyritic texture consisting largely of orthoclase, nepheline, pyroxene, and sometimes leucite. Found in the United States principally as dikes in the Black Hill region and in the Cripple Creek mining district. More widely distributed in Europe being found in many parts of Germany and in the volcanic region of central France. Also found in the Cape Verde islands. Many phonolites crack up internally into a number of parallel plates so that the stone gives a peculiar sound when struck with a hammer, hence the name.

**Phonom'eter**, an instrument for ascertaining the number of vibrations of a given sound in a given space of time. These instruments are usually made self-registering.

**Pho'noscope**, an apparatus for testing the quality of musical strings, invented by Koenig. Also a combination of an induction coil and battery with a rotating vacuum tube, for translating vibrations of sound into visible figures.

**Phorbas**, fôr'bas, in the Greek myth, a son of Lapithes, father of Augea and Aktor. He was asked by the Rhodians for his assistance in freeing their island from serpents, and for his services was honored as a hero. Many identify him with the constellation Ophiuchus.

**Phorcys**, fôr'sis, **Phorcyn**, or **Phorcus**, an aged sea god, according to Homer; according to Hesiod a son of Pontus and Gæa (sea and land). He was brother of Nereus and Ceto of whom he begot the Graiæ and the Gorgons, and the dragon Ladon that watched over the golden fruit of the Hesperides. He is also called the father of the nymph Thoosa, who was the mother of the Cyclops Polyphemus, the maidens Hesperides, the Sirens and Scylla.

**Phor'minx**, an ancient Grecian lute or lyre. See LYRE.

**Phor'mium.** See FLAX.

**Phororhachos**, fō-rō-rā'kōs, a huge fossil bird of the Miocene age, several species of which are found in the rocks of eastern Patagonia. It was as large or larger than an ostrich, and is "remarkable for the immense size and heavy build of the skull, to which the legs, huge though they sometimes are, bear no proportion; the maxilla is exceedingly compressed, yet very deep, and ends in a strong hook, while the long massive mandible curves upward to meet it." The bird must have resembled in appearance a great, thick-legged ostrich, with the head of a still greater hawk. Its relationships are in dispute, and it is not even certain that it is ratite, the sternum not having yet been disclosed. Evans, 'Birds' (1900), places it in the same group as the epiornis; while Dr. Gadow and others regard it as representing the ratite *Stereornithes*.

**Phosgene**, fōs'jēn or -jēn, in chemistry, COCl<sub>2</sub>, Carbonyl Chloride, Phosgene Gas, Carbon Oxychloride, was first obtained by Davy (1812) by direct union of carbon monoxide (CO) and chlorine in sunlight and is still made by same process. A colorless gas with suffocating odor and very disagreeable effect on respiratory organs; on cooling or under pressure it condenses to a low boiling liquid. A very active



## PHOSPHATES — PHOSPHORESCENCE

chemical agent, used in the manufacture of various chemical substances, particularly dye stuffs, it comes on the market as liquid under pressure in steel cylinders or in solution in toluene.

**Phosphates.** See PHOSPHORIC ACID.

**Phosphatu'ria, or Phosphoruria,** the excessive elimination of phosphates, especially the alkaline salts, in the urine. It may be the result of animal and vegetable food rich in phosphates, and has been noticed in cases of dyspepsia, neurasthenia, debility, acute cerebritis, pleurisy, pneumonia, pachitis, osteomalacia, gout, rheumatism, typhoid fever, and acute mania. The term phosphatic diathesis is now seldom used as applying to "a morbid condition characterized by definite and constantly occurring symptoms, and accompanied by deposit of phosphates in the urine." The ready precipitation of the earthy phosphates from alkaline urine is sometimes spoken of as phosphatoptosis. Phosphaturia is of little importance except where persistent, indicating a tendency to the formation of phosphatic calculi. The urine is alkaline, has a stale ammoniac odor, and a whitish turbidity. When heated, an albuminous cloudy appearance results, which is dispelled by the addition of two or three drops of nitric acid. If the alkalinity and turbidity are caused mainly by decomposition of the urine or the presence of pus or other substances than phosphates, heating and the addition of nitric acid will not clear the urine. A form of phosphatic polyuria with acid urine, sometimes associated with glycosuria, has been noticed. Treatment: Mineral, vegetable, and acid tonics in nearly all cases; good air and exercise; cool or cold salt-water baths; a generous diet; and freedom from anxiety and overwork.

**Phosphine.** See PHOSPHORUS.

**Phos'phor-Bronze,** an alloy made by fusing phosphor-tin with copper. It usually contains 0.053 to 0.76 phosphorus and 4 to 10 per cent of tin. The effect of the phosphorus is probably to reduce action on the oxides of the other metals during the process of manufacture. Phosphor-bronze is of finer grain and color than ordinary bronze. It is as tough as wrought iron, more ductile than copper, is completely homogeneous, and shows great resistance to wear. Because of these qualities it is largely employed for bearings, wire, and cannon. It was invented about 1870 by two Belgian metallurgists.

**Phosphorescence,** fös-fō-rēs'ëns. Since the light of modern science has been turned upon the subject of phosphorescence it would seem that the word must technically lose most of its original meaning. Even before the days of the alchemists it was known that certain bodies possess the power of becoming luminous when placed in darkness and that, too, without apparent combustion. This phenomenon came to be known as phosphorescence, the common belief being that all such bodies contained phosphorus, the light emitted by them being due to its presence. More recent investigation, however, proved that many bodies which glow in darkness do not contain even the slightest trace of phosphorus, but have the power of storing up light when exposed to the rays of the sun,

or light from any strong source, and afterward emitting it. Phosphorescence wrongly implies the presence of phosphorus; in reality it has nothing to do with it. There are really two kinds of phosphorescence—chemical and mechanical; almost all bodies have been found to possess one or the other. The phosphorescence of phosphorus is chemical, a slow oxidation taking place, forming phosphorus tri-oxide ( $P_2O_3$ ). The phosphorescence of those bodies having to be heated is mechanical.

Phosphorescence is really a specialized condition of fluorescence (q.v.). A body is said to fluoresce when it possesses the mechanical property of absorbing energy in the form of short waves invisible to the human eye, such as the ultra-violet waves of the spectrum, and delivering them in the form of longer waves which are visible, as, for instance, violet, blue, or green. The same law seems to apply to the phenomenon of phosphorescence, for example, the rays emitted are of greater length than those absorbed. Most bodies which possess the power of fluorescing will also exhibit the phenomena of phosphorescence.

There are, therefore, distinct conditions under which bodies may become luminous, all arising from very different causes. The reader is warned, however, that the word phosphorescence is still used, and probably will long continue to be used in a general way to cover all bodies which glow in darkness, whatever the cause may be.

A great number of bodies, both in the mineral and animal kingdom, are known to possess the power of phosphorescing; and there is a great difference in the extent of their power, as well as in the color of the light they emit. Indeed, it has been recently found by Becquerel, who invented a wonderfully delicate instrument for studying the phenomenon, that almost all bodies can become phosphorescent under special conditions. His instrument, called the phosphoscope, is capable of detecting the faintest glow of light enduring but the fraction of a second. He discovered that the main causes of phosphorescence are: spontaneous action; elevation of temperature; mechanical action, as friction, percussion, or cleavage; electricity; and isolation.

Among the minerals, those which phosphoresce most brilliantly are probably the sulphides, such as sulphide of calcium and sulphide of barium, also the alkaline earths and carbon compounds. The diamond is highly phosphorescent when placed in darkness, and the ruby and sapphire both give forth a brilliant red light of great purity. Sugar also possesses the property to a marked degree. If an electric charge is transmitted along the surfaces of certain bodies, a somewhat durable phosphorescence is produced. Sulphate of baryta gives a bright green light, acetate of potash a brilliant green light, and rock-crystal a red and then white light. Temperature has a marked effect on the emission of light by these bodies. Of the artificial compounds one of the strongest is formed by mixing three parts of calcined oyster-shells in powder with one of flowers of sulphur, this mixture is ignited in a crucible for half an hour. On subjecting it to the light it acquires the property of shining in darkness. After it has



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ceased to shine its power may be readily restored by submitting it again to the light.

Sir D. Brewster (q.v.) has contributed much valuable information on this subject by the results of his long series of experiments. Some of his results are contained in the following table:

MINERALS	Color of Minerals	Color of Light
Fluor-spar.	Pink.	Green.
"	Purple.	Bluish.
"	Bluish white.	Blue.
"	White.	White sparks.
Calcareous spar.	Transparent.	Yellowish.
Apatite.	Pink.	Yellow.
Arragonite.	Dirty white.	Reddish yellow
Harmotome.	Colorless.	" "
Topaz.	White and bluish.	Bluish.
Rubellite.	Reddish.	Scarlet.
Petalite.	Reddish white.	Bright blue.
Anatase.	Dark brown.	Reddish yellow.

Anatase, he discovered, acts entirely different from other minerals. Its light bursts forth like a flame and is instantly gone. Draper and Lommel have made use of phosphorescence in spectrum analysis in the following manner. It was discovered that if a piece of board or paper were covered with phosphorescent paint and heat were applied to any one point, the phosphorescence at that point would cease. This immediately suggested a means of studying the infra-red region of the spectrum, for if a ray from the infra-red portion were allowed to fall upon such a phosphorescent surface, it at once became apparent by the cessation of phosphorescence at that point.

*Phosphorescence of Organic Matter.*—The phosphorescence of organic matter is of quite a different nature from that of mineral substances, and the recent discovery of luminous bacilli has made possible a general explanation of the phenomena, which, however, has yet to be proved in many instances. It would seem to suggest the hypothesis, particularly in putrefactive processes, that phosphorescence may be due to the presence of a low form of life.

In the vegetable kingdom the property is chiefly confined to the fungals, but it is also noticeable in the algæ. In fungus growths the light becomes stronger during the process of growth or development, and ceases when the plant is mature. Light is emitted chiefly from the under side of the mushroom. Many mosses have been observed to glow in dark recesses of rocks; many flowers possess the same property. As early as 1762 it was recorded that the daughter of Linnæus observed the phosphorescence of a nasturtium (*Tropæolum majus*). Lilies (*Lilium bulbiferum*) and poppies (*Papaver orientale*) have been observed to emit a soft light. Decaying wood, especially in swamps and bogs, has often been observed to give forth a brilliant and beautifully colored light.

Among animals in which the property of luminosity has been observed are examples from almost every group of the zoological series from human beings downward. The phenomenon of the luminousness of the human body just before, or immediately after, death, has not escaped the usual fate of similar strange appearances in being regarded by superstitious persons as of supernatural origin. The hypothesis of the presence of a low form of life, some lu-

minous animalcula, has been offered as a possible explanation in such cases, and not without scientific approval. The same hypothesis is offered to explain the emission of light from decaying fish and putrified meat. Protozoa furnish a prominent example of lumination in the lowest form of life in the small spheroidal *Noctiluca miliaris* (q.v.), an organism closely allied to the infusorian animalculum which appears to be the chief cause of the phosphorescence of the sea. This phenomenon has been known to mariners since the days of the ancients, but only recently has its true cause been known. The Challenger expedition made the discovery that the phosphorescence of the waters near the coasts was due to the presence of *Noctiluca* which are replaced on the high seas by species of *Pyrocystis*. It is undoubtedly assisted by the strongly phosphorescent *Physalia utriculus*, and other *Medusæ*, *Tunicata*, *Echinodermata*, annelids, etc. (q.v.), commonly known as jelly-fish, star-fish, Portuguese men-of-war, etc., all of which seem to have the faculty of emitting light from the general protoplasm of their body, and in other various ways according to the species: (1) from the whole surface; (2) from the marginal corpuscles; (3) from the radial canals; (4) from the ovaries. Among some species the females only are luminous, being apparently endowed with this power as a guide to the males.

Among the animals known to be phosphorescent are many annelids or worms, certain errantia or marine worms; certain myriapoda, centipedes, and millipedes; some insects, among which are the fireflies (*Elater*), the lantern-flies (*Fulgora*), and the glowworms (*Lampyris*), etc., and certain crustacea (*Cyclops*, *Gammarus*, etc.). Those animals known as sea-squirts or ascidians (*Tunicata*) also include luminous forms. The *Salpæ*, and more particularly the compound tunicates known as *Pyrosomæ*, are luminous. The latter name, indeed, has reference to the phosphorescent properties of the genus, which is represented by free and oceanic forms, presenting at night the appearance of undulating masses of flame. Humboldt describes the beautiful appearance of the luminous *Pyrosomæ*, of which genus special species are known—*P. Atlanticum* of the equatorial seas, and *P. elegans* and *P. giganteum* of the Mediterranean, being examples. Mr. Bennett describes the appearance produced by *P. Atlanticum* as "a broad and extensive sheet of phosphorescence."

In regard to the nature and appearance of animal phosphorescence it is difficult to give any exact information, as it is dependent upon surrounding circumstances, temperature, etc. Some fireflies and certain mollusks have been found to be permanently phosphorescent, but generally the light from animals is intermittent, and its production dependent upon certain stimuli of various kinds. Many of them remain dull and quiescent until disturbed, then they are instantly luminous. And so it would seem to be a function entirely under their control. This has recently set to work many scientific minds to discover if possible the real cause of phosphorescence in animals. The light from a glow-worm removed from the atmosphere to a vacuum was observed to cease, while the near approach of a galvanic current increased its



## PHOSPHORIC ACID

power of luminosity. It was therefore believed to depend, at least in part, upon external conditions and influences, even, perhaps, upon oxidation. Various theories have from time to time been adduced. Mayer supposed the light from the sun to be absorbed and re-emitted by the organic protoplasm. Brugnatelli advanced the theory that the food of the animal contains light energy before being swallowed and that after digestion special elaborated organs reconvert it into light. Macaire believed in the presence of phosphorus and coagulated albumen. Spallanzi adopted the hypothesis that the oxygen of the air produced a slow combustion. Darwin and Davy both adopted the latter theory, but it remained for Todd and Macartney to advance what is now perhaps most universally accepted by physiologists and zoologists, that animal luminosity is solely dependent upon the vital forces acting through the nervous system. Just as vital force or nerve energy is transformed into mechanical motion and electricity, so it is, under specialized forms of structure, transformed into radiant energy through the secretions and general tissues, sometimes chemically, sometimes mechanically.

There is no doubt of the wisdom which Nature has shown in endowing animal life with this wonderful power of producing light. It may be used as a lure to attract prey, as is exemplified in many fishes inhabiting the darksome recesses of the deep sea (*Melanocetus*, etc.). It invites the male to seek the female as in *Luciola* and earthworms; the cœlenterates before resorting to a contact battle, and driving their poisonous sting into the body of an enemy, use the power of phosphorescence as a warning signal; it illuminates surrounding regions and allows many an animal to find its way both in atmospheric darkness and in the depths of the sea.

Finally phosphorescence in general presents to the student and the investigator a problem capable of solution for the practical needs of man. In America scientists are turning their attention to the practical possibilities of phosphorescence. Prof. McKissick of the Auburn (Alabama) Polytechnic Institute is deeply interested in the subject and has discovered that the phosphorescent light from many chemical substances possesses the same power of penetration that X-rays possess. He has successfully taken photographs by phosphorescent light and has found that it affected a sensitive plate through an intervening thickness of two and a half inches of wood. Prof. Hallock of Columbia University thinks that much practical utility might be gained from the universal use of luminous paints which could be spread in dark hallways and on the walls and ceilings of office buildings to help out the twilight.

Several inventions have recently been made based upon the principle of phosphorescence, and Prof. Hans Molisch, of Prague, has recently reported to the Vienna Academy of Sciences that he has invented a lamp deriving its power from animal phosphorescence. It consists of a glass jar or long glass tubes which are lined with a preparation of saltpeter and gelatine. This is inoculated with luminous bacteria, and in two or three days the culture is sufficiently advanced to cause a bright light. It is an absolutely cold light, emitting no heat whatever,

and would, therefore, he says, be valuable in mines and powder magazines. The color of the light is bluish-green. The life of this lamp is about three weeks, after which it gradually diminishes in brightness. It can then be restored by re-inoculation.

It would seem that we are near to the secret of phosphorescence. When such common substances as sugar, glucose, and chalk are found to absorb sunlight all day and to give it off in rays during the night, the discovery of some means for rendering those rays visible does not seem to be an impossibility. Therefore it is not unreasonable to suppose that we may some day see it utilized in our hallways, theatres, office buildings, and homes as a practical means of dispelling darkness, also for photographing, bleaching, and other commercial purposes.

ARTHUR S. WITHERSPOON,  
*Editorial Staff, 'Encyclopedia Americana.'*

**Phosphoric Acid**, in chemistry, an acid substance formed by the union of phosphorus pentoxid (see PHOSPHORUS) with the elements of water. The combination may occur in three proportions. When one molecule of the pentoxid combines with three molecules of water, the resulting acid is called "orthophosphoric acid"; when one molecule of the pentoxid combines with two molecules of water, the acid is called "pyrophosphoric acid"; and when one molecule of the pentoxid combines with one molecule of water, the acid is called "metaphosphoric acid."

*Orthophosphoric Acid.*—This is the compound which is always understood, when "phosphoric acid" is mentioned without further qualification. It has the chemical formula  $H_3PO_4$ , and may be prepared, as indicated by the equation  $P_2O_5 + 3H_2O = 2H_3PO_4$ , by dissolving phosphorus pentoxid in water, and boiling the solution. This acid is also formed when phosphorus is heated with nitric acid, red fumes composed of the lower oxids of nitrogen being evolved, while the phosphorus is simultaneously oxidized, passing into solution in the form of phosphoric acid,  $H_3PO_4$ . Pure phosphoric acid (that is, orthophosphoric acid), when free from water, forms a thick, semi-solid mass, with a specific gravity of about 1.88, and it may be obtained in the form of tabular crystals, by evaporating the nearly anhydrous acid in a vacuum, over concentrated sulphuric acid. The crystals melt at  $107^\circ F.$ , and the liquid formed from them solidifies again, when cooled to  $100^\circ F.$ , the temperature at the same time spontaneously rising to  $105^\circ F.$  The crystalline and the syrupy forms both dissolve freely in water, and both deliquesce when exposed to the air. The phosphoric acids form salts, which are known as "phosphates." Common, or orthophosphoric acid, is tribasic, each of its hydrogen atoms being replaceable by a monovalent base. With sodium, for example, it forms three definite, crystallizable compounds. Common neutral sodium phosphate, or "hydrogen di-sodium phosphate," may be obtained in the form of large, transparent, rhombic prisms, by neutralizing phosphoric acid by sodium carbonate, and evaporating the solution. The crystals have the composition  $HNa_2PO_4 + 12H_2O$ . If sodium hydrate is added to a solution of this salt, needle-like crystals of sodium subphosphate, or "tri-sodium phosphate," are obtained upon evaporation,



## PHOSPHOROSCOPE — PHOSPHORUS

these having the formula  $\text{Na}_3\text{PO}_4 + 12\text{H}_2\text{O}$ . If, on the other hand, excess of phosphoric acid be added to a solution of the common phosphate, evaporation yields crystals of sodium superphosphate, or "dihydrogen sodium phosphate,"  $\text{H}_2\text{NaPO}_4 + \text{H}_2\text{O}$ . An orthophosphate is known as "primary," "secondary," or "tertiary," according, as one, two, or three of the hydrogen atoms of the acid are replaced by a monovalent base. With calcium orthophosphoric acid forms three well-defined compounds. The normal phosphate,  $\text{Ca}_3(\text{PO}_4)_2$ , occurs native as the mineral "phosphorite," and also, combined with the fluoride or chloride of calcium, as "apatite." It is likewise an essential constituent of bones, forming about 85 per cent of the weight of their ash. It may also be prepared, artificially, by adding phosphoric acid to a solution of calcium chloride, when it is obtained in the form of a white, amorphous powder. Calcium phosphate, in some form, is an essential constituent of fertile soil, as it is needed for the growth of plants. The normal phosphate, just described, is capable of furnishing both the phosphorus and the calcium; but since it is nearly insoluble, it is not readily absorbed by the plant. By the action of strong sulphuric acid, the normal phosphate,  $\text{Ca}_3(\text{PO}_4)_2$ , is converted into a soluble compound which has the formula  $\text{CaH}_4(\text{PO}_4)_2$ , as indicated by the equation  $\text{Ca}_3(\text{PO}_4)_2 + 2\text{H}_2\text{SO}_4 = \text{CaH}_4(\text{PO}_4)_2 + 2\text{CaSO}_4$ . The compound  $\text{CaH}_4(\text{PO}_4)_2$  is known as "monocalcium phosphate," or (commercially) as "superphosphate of lime," and is prepared artificially on the large scale, from bones and the mineral phosphates of calcium, for use as a fertilizer, for which it is especially adapted by reason of its solubility. Commercial phosphoric acid is prepared chiefly from superphosphate of lime, but the process is a somewhat involved one, and for it the treatises on technological chemistry must be consulted. Pure phosphoric acid, for use in medicine and in the laboratory, is usually prepared by the oxidation of phosphorus, as described above. Dicalcium phosphate,  $\text{CaHPO}_4$ , may be prepared by precipitating a solution of calcium chloride with ordinary sodium phosphate,  $\text{Na}_2\text{HPO}_4$ . It is of far less importance than either of the other phosphates of calcium. Many other compounds of orthophosphoric acid with metallic bases are known, and many of these are used both in the laboratory, and in the arts. Numerous double salts are also known, in which the hydrogen of the acid is replaced partly by one base, and partly by another. Of these, the hydrogen-ammonium-sodium phosphate, or "microcosmic salt,"  $\text{HNaNH}_4\text{PO}_4 + 4\text{H}_2\text{O}$ , deserves special mention, since it is greatly used in the laboratory. It may be prepared by crystallization from a solution containing five parts by weight of crystals of common sodium phosphate,  $\text{Na}_2\text{HPO}_4 + 12\text{H}_2\text{O}$ , and two parts of secondary ammonium phosphate,  $(\text{NH}_4)_2\text{HPO}_4$ .

**Pyrophosphoric Acid.**—When concentrated orthophosphoric acid is heated to  $415^\circ \text{F}$ . until it yields, with silver nitrate, a white precipitate (instead of a yellow one), it becomes converted into a different compound, which is known as "pyrophosphoric acid," has the formula  $\text{H}_4\text{P}_2\text{O}_7$ , and is tetrabasic. The change consists in the loss of a molecule of water, as may be seen by writing the formulæ for orthophosphoric and

pyrophosphoric acids in the respective forms  $2\text{H}_3\text{PO}_4 = \text{P}_2\text{O}_5 \cdot 3\text{H}_2\text{O}$ , and  $\text{H}_4\text{P}_2\text{O}_7 = \text{P}_2\text{O}_5 \cdot 2\text{H}_2\text{O}$ . The salts of pyrophosphoric acid are much more important than the acid itself, and are known as "pyrophosphates." They may be prepared most readily by the action of heat upon the secondary orthophosphates. Thus if common (that is, secondary) sodium phosphate,  $\text{Na}_2\text{HPO}_4$ , be heated to redness, it loses the elements of water, and becomes converted into normal sodium pyrophosphate,  $\text{Na}_4\text{P}_2\text{O}_7$ , as indicated by the equation  $2\text{Na}_2\text{HPO}_4 = \text{Na}_4\text{P}_2\text{O}_7 + \text{H}_2\text{O}$ . This salt can be dissolved in water and crystallized, for it does not readily take up water again, so as to be reconverted into the ordinary orthophosphate. The pyrophosphates are transformed into orthophosphates, however, upon being strongly heated with an alkali or an alkaline carbonate, and also when boiled, in aqueous solution, with the stronger acids. Several of the pyrophosphates, especially those of iron, are used in medicine.

**Metaphosphoric Acid.**—When phosphorous pentoxid,  $\text{P}_2\text{O}_5$ , is dissolved in cold water, it combines with one molecule of the water to form an acid which has the formula  $\text{HPO}_3$ ; the equation being  $\text{P}_2\text{O}_5 + \text{H}_2\text{O} = 2\text{HPO}_3$ . The same compound may be obtained in the form of a glassy, ice-like mass, by heating anhydrous orthophosphoric acid to  $750^\circ \text{F}$ . The vitreous mass so obtained is known as "glacial phosphoric acid." It dissolves in water to form a solution of metaphosphoric acid, and if the solution is allowed to stand for a time and is then boiled, it becomes converted into ordinary orthophosphoric acid. Metaphosphoric acid forms salts, which are known as "metaphosphates"; but these are of much less importance than the orthophosphates and pyrophosphates.

**Phos'phoroscope**, an apparatus consisting of glass tubes arranged in a box and containing phosphorescent substances, as the sulphides of lime, strontium, barium, etc. When this is exposed to the sun's rays or to the light emitted by a gas-burner or burning magnesium, and then removed to a dark place, each tube appears to glow with light of a different color, as red, blue, green, etc. Also an instrument devised by Becquerel for measuring the duration of phosphorescence in different substances.

**Phosphorous Acid**, a compound of phosphorus, oxygen, and hydrogen, possessing acid properties, and having the chemical formula  $\text{H}_3\text{PO}_3$ . It may be prepared by acting upon phosphorus trichloride (see PHOSPHORUS) with water, as indicated by the equation  $\text{PCl}_3 + 3\text{H}_2\text{O} = \text{H}_3\text{PO}_3 + 3\text{HCl}$ . Hydrochloric acid, it will be seen, is formed at the same time; but this may be expelled by boiling. The solution, when concentrated by evaporation in a vacuum and allowed to cool, deposits crystals of phosphorous acid. These melt at about  $160^\circ \text{F}$ ., and, when heated somewhat more strongly, decompose with the formation of phosphoric acid,  $\text{H}_3\text{PO}_4$  and phosphine,  $\text{PH}_3$ . Phosphorous acid is dibasic, only two of its hydrogen atoms being replaceable by bases. It forms a series of salts known as "phosphites," those of the alkali metals being soluble, while the others are mostly insoluble.

**Phosphorus** (Greek, "light-bearer"), a non-metallic element, first prepared in the ele-



## PHOSPHORUS

mentary form in 1670, probably by Brand; although its discovery is also attributed to Boyle and to Kunkel. Phosphorus never occurs free in nature, but it forms an essential part of numerous minerals, prominent among which are apatite and phosphorite. It occurs in bones in considerable quantity, combined with lime, oxygen, and organic matter; and the extensive beds of fossil bones that occur in the Carolinas and elsewhere are regularly worked for the sake of the calcium phosphate that they contain. Phosphorus also exists in various organic substances, notably in brain tissue, in blood, and in the yolks of eggs. Chemically phosphorus has the symbol P, and an atomic weight of 31, when that of oxygen is taken as 16. It may be prepared from calcium superphosphate (see PHOSPHORIC ACID),  $\text{CaH}_4(\text{PO}_4)_2$ , by the following method: A solution of the superphosphate is evaporated to a syrup, mixed with pulverized charcoal, dried, and finally heated to redness in an earthenware retort, the neck of which dips under water. The superphosphate is first reduced, by the heat, to the form of calcium metaphosphate according to the equation  $\text{CaH}_4(\text{PO}_4)_2 = \text{Ca}(\text{PO}_3)_2 + 2\text{H}_2\text{O}$ ; and the metaphosphate is subsequently reduced by the charcoal to calcium triphosphate, carbon monoxid, and free phosphorus, as indicated by the equation  $3\text{Ca}(\text{PO}_3)_2 + 10\text{C} = \text{Ca}_3(\text{PO}_4)_2 + 10\text{CO} + 4\text{P}$ . The phosphorus distils over, and collects below the surface of the water into which the neck of the retort dips.

As prepared in this manner, and purified by redistillation, phosphorus is a colorless, semi-transparent, waxy solid, with a specific gravity of about 1.82, and a specific heat of about 0.19. It becomes brittle at low temperatures, melts at  $112^\circ \text{F}$ ., and boils, under ordinary atmospheric pressure, at about  $550^\circ \text{F}$ . Melted phosphorus may often be cooled to a point considerably below its point of fusion before it again solidifies. It may be obtained in the form of crystals by fusing and cooling it in considerable quantities, or by subliming it in a vacuum, or by evaporating its solution in carbon disulphide. Phosphorus, in the form here described (which is called its "ordinary" form), is exceedingly inflammable. It should never be touched with the fingers, as it is liable to take fire from their warmth; and it should always be cut under water.

When "ordinary" phosphorus is heated to  $500^\circ \text{F}$ . for 50 or 60 hours, in an atmosphere composed of some gas that will not combine with it, it becomes converted into an amorphous, red allotropic modification, whose properties are quite different from those described above. Thus the red variety has a specific gravity of 2.11, is entirely insoluble in carbon disulphide, does not melt even when heated to redness in a sealed glass tube, and takes fire in the air only when heated to  $500^\circ \text{F}$ . Ordinary phosphorus glows in the dark when exposed to the air, the element taking its name from this circumstance. The red allotropic form, however, does not exhibit any such luminosity. Ordinary phosphorus is poisonous, and when handled in considerable quantities by persons with defective teeth, it often induces necrosis of the jaw-bone. Red phosphorus is pronounced, by nearly all authorities, to be non-poisonous; and if it has poisonous properties, they are certainly far less marked than those of the ordinary variety. Ordinary

phosphorus is superficially converted into the red allotropic form by the action of light, its surface first becoming yellow, and then passing into a red. In the presence of a small quantity of iodine, the transformation of the ordinary form into the allotropic one is effected by heat with great facility.

Other allotropic varieties of phosphorus have been described, but their existence is not yet generally admitted. Hittorf, for example, dissolved phosphorus in melted lead, allowed the mass to cool, and then dissolved the lead in nitric acid. Violet-black crystals remained behind, which were composed chiefly of phosphorus; but they have never been obtained entirely free from lead, and it is possible that their character is determined by the lead and other impurities present.

When phosphorus is heated in contact with air, it burns with a brilliant flame, and with the formation of clouds of "phosphorus pentoxid,"  $\text{P}_2\text{O}_5$ . These may be collected in the form of a white, amorphous powder, which absorbs moisture with avidity, and hence is used in the laboratory for drying gases. The pentoxid dissolves in water with a hissing noise, its solution constituting the compound known as phosphoric acid (q.v.). With hydrogen, phosphorus forms a gaseous compound known as phosphoretted hydrogen, or "phosphine." This has the formula  $\text{PH}_3$ , and is best prepared by the action of caustic potash and water upon ordinary phosphorus; potassium hypophosphite,  $\text{KPH}_2\text{O}_2$ , being formed at the same time, in accordance with the equation  $3\text{KOH} + 4\text{P} + 3\text{H}_2\text{O} = 3\text{KPH}_2\text{O}_2 + \text{PH}_3$ . Phosphine is a colorless gas with an offensive odor suggestive of decomposing fish, and it takes fire spontaneously upon contact with the air. The spontaneous inflammability appears to depend, however, upon the presence of traces of another hydride having the composition  $\text{P}_2\text{H}_4$ . Chlorine combines directly with phosphorus, forming phosphorus trichloride,  $\text{PCl}_3$ , which is an oily liquid boiling at  $169^\circ \text{F}$ ., and having a specific gravity of 1.61. The trichloride absorbs chlorine readily, forming a yellowish, solid pentachloride,  $\text{PCl}_5$ .

Phosphorus, on account of the facility with which it ignites under the influence of frictional heat, is extensively used in the manufacture of matches. For this purpose it is usually combined with manganese dioxide, chalk, and glue. For the tips of "safety" matches, a mixture of potassium chlorate, potassium bichromate, antimony trisulphide and minium is often used. This will not ignite readily by ordinary friction, but takes fire easily when drawn across a paper coated with antimony pentasulphide and red phosphorus. Phosphorus is also used in considerable quantities as an essential constituent of various poisons for rats and other animal and insect pests. "Bologna phosphorus" does not contain any true phosphorus, but consists of calcined sulphide of barium (see BARIUM), taking its name from the marked phosphorescence that it exhibits after exposure to a bright light.

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**Phosphorus**, in astronomy, a name given the planet Venus as the morning star; also called Lucifer (q.v.). When it is an evening star it is known as Hesperus and Vesper.

**Phosphorus, Poisoning by.** See TOXICOLOGY.



## PHOTIUS — PHOTO-CHEMISTRY

**Photius**, fō'shī-us, Byzantine scholar: b. Constantinople 820; d. Armenia 891. When he held the office of secretary of state under the Emperor Michael III., the patriarch Ignatius incurred the displeasure of the weak and profligate Michael, was deposed, imprisoned, and sent into exile, and Photius was raised from the standing of a layman to the patriarchal dignity in his place. The installation was recognized by the metropolitans of the patriarchate, but opposed by Pope Nicholas I., whom Photius soon after excommunicated. But the Emperor Michael having been murdered in 867 by Basil, who was raised to the throne, that prince immediately replaced Ignatius in his office, and banished Photius, who, however, resumed his dignity on the death of Ignatius in 878. On the accession of Leo, son of Basil, in 886, Photius was again deposed, and banished to a monastery in Armenia, where he died. His death might have put an end to the division he had occasioned between the Greek and Latin churches, had not the popes refused to acknowledge the priests and bishops ordained by him, and insisted upon their degradation. It is now difficult to arrive at a correct estimate of the character of Photius; for, while his biographers of the Roman Catholic Church ascribe to him craft, violence, and perfidy, the Greek Church has canonized him. He was an able man of the world, but not influenced by the principles which befitted his sacred office; yet he was probably not below the average of the statesmen prelates of his age. His chief remains are: (1) 'Myriobiblion,' an extensive review of ancient Greek literature by a scholar of erudition and judgment. The best edition is that of Bekker (1825). (2) 'Nomocanon' (q.v.). (3) A Greek Lexicon, of which editions have appeared at London (1822) and Leyden (1864-5). A collection of letters (Greek and Latin, London, 1651). (5) A treatise on the Holy Spirit, maintaining the "Single Procession." Consult: Migne, 'Patrologia Græca,' Vol. 101-104 (1860); Hergenröther, 'Photius, Patriarch von Konstantinopel' (1867-73).

**Photo-chemistry**, that branch of chemistry which deals with the chemical changes that are produced by the agency of light. The earliest observed photo-chemical phenomena were the fading of dyes and other colors in a strong light, and the bleaching of linen and similar fabrics, under the influence of sunlight. The oldest known example of the power of light to induce chemical change in an inorganic substance is undoubtedly the blackening of silver chloride—a phenomenon which has been familiar to chemists since the 16th century. At the present time, the number of known photo-chemical phenomena is so great as to be almost past enumeration. The most important of them all is the decomposition of carbon dioxid gas by the green coloring matter ("chlorophyll") that occurs in the leaves of plants; for it is by means of this decomposition that plants obtain the greater part of the carbon that they subsequently utilize in the formation of wood, and of starches and sugars and other analogous food-stuffs. The carbon dioxid gas that exists in the air is absorbed by the chlorophyll corpuscles in the leaves, and is split up, under the influence of sunlight, into carbon and oxygen. The oxygen is liberated in the free state (in large mea-

sure, at all events), and is permitted to escape again into the air. The carbon does not appear to be set free in the elementary state at any stage in the process, but is retained in the leaves in the form of some chemical combination with hydrogen and (probably) oxygen. The precise chemistry of the change is not yet definitely known; but we may perhaps say, with Sachs, that the "first *obvious* product" which is formed in the leaves is starch.

In the blackening of silver chloride there appears to be an elimination of chlorine, and, under ordinary circumstances, a simultaneous absorption of oxygen; the silver chloride ( $\text{AgCl}$ ) being partially converted into an oxychloride, whose formula has been given as  $\text{Ag}_4\text{OCl}_2$  by Hodgkinson, and as  $\text{Ag}_2\text{ClO}$  by Baker. Light acts in an analogous manner upon the other haloid salts of silver; but it appears that the decomposition can never proceed far, in any case, unless some substance is present which is capable of absorbing the liberated halogen. Moisture suffices as the absorbent in the case of the chloride and bromide of silver; but its sufficiency in the case of the iodide depends upon the way in which that salt is prepared. In photography, all three of these salts of silver are used, the chloride being employed in the preparation of positive prints, while the bromide and iodide are used in the manufacture of the negative plates. It is probable that an organic compound of silver is formed in the course of the manufacture of the emulsions that are employed in modern dry-plate photography, this organic compound being (as experience indicates) exceedingly sensitive to the action of light, becoming transformed with extraordinary facility into unstable compounds which are readily reducible by the subsequent action of the reducing agents that are technically known as "developers."

It was formerly customary to consider sunlight as divisible into three essentially different kinds of rays, which were known, respectively, as "heat rays," "light rays," and "actinic (or chemical) rays"; heat rays including those parts of the radiation which are distinguished by a relatively long wave-length, and which are mostly confined to the red and the infra-red parts of the solar spectrum; light rays including those parts which strongly affect the human eye; and actinic rays including those parts of the total radiation which are capable of effecting chemical changes, and which were formerly considered to be mostly confined to the violet and ultra-violet parts of the spectrum. In modern physics this distinction has largely disappeared, especially with respect to the actinic rays; for while it is still admitted that it is chiefly the violet and ultra-violet rays that are concerned in the reduction of silver salts, it is also recognized that many other chemical changes depend for their production upon rays of much greater wave-length. Many changes are known, for example, which are undoubtedly induced by the action of the red and infra-red rays, which have been ordinarily classified as "heat rays." (Consult, for example, Tyndall, 'Contributions to Molecular Physics in the Domain of Radiant Heat.')

The action of light upon a gaseous mixture composed of equal volumes of hydrogen and chlorine has been studied extensively, chiefly by Draper, and by Bunsen and Roscoe. When a



## PHOTO-COLLOTYPE — PHOTO-ENGRAVING

mixture of this kind is exposed to strong sunlight, its constituents combine explosively, with the formation of hydrochloric acid gas; but when exposed to a subdued light, they combine slowly and with considerable regularity. Draper invented an instrument (the "actinometer") for the measurement of the actinic power of a given source of light, basing its operation upon the rapidity with which combination takes place in a mixture of hydrogen and chlorine, when exposed to the light whose chemical power is to be determined. The instrument consisted of a bulb that was filled partially with water and partially with the mixed gases, and which was also provided with a graduated capillary stem, in which a column of mercury or of water served as an index for the determination of any change of volume in the gaseous mixture in the bulb. When the bulb was exposed to a subdued light for a definite time, the hydrogen and chlorine combined partially, and the hydrochloric acid gas that was formed was almost immediately absorbed by the water, in which it is exceedingly soluble. The volume of the gases in the bulb therefore suffered a reduction, which was proportional to the total amount of chemical change induced by the light; and the extent of this reduction in volume was indicated by the movement of the index-liquid in the graduated stem of the instrument. Draper's actinometer was open to two general objections. In the first place (as Draper himself discovered in 1843), the combination of hydrogen and chlorine, in a diffuse light, does not proceed at a rate that is strictly proportional to the time. The further researches of Bunsen and Roscoe showed that the action of the light, in Draper's actinometer, is at first very slow indeed, and that the rate of combination increases, after the lapse of a certain time, up to a maximum value which is thereafter constantly maintained. In some of the experiments it was found that the chemical action during the seventh minute of exposure of the instrument was nearly as great as the total action during the first six minutes, and that the action during the eighth minute was 50 per cent greater than that during the seventh minute. In these particular experiments the instrument could not be relied upon until after the lapse of eight minutes; and the initial period of irregularity would of course be different under other intensities of illumination. Great differences in the indications of the Draper instrument were also found to result from apparently trivial variations in the relative quantities of hydrogen and chlorine present. The second objection to the Draper actinometer is that it can indicate nothing but the power of the light under examination to induce the combination of hydrogen and chlorine, or to perform some other change that depends upon light of the same wave-length as that concerned in this particular effect. A similar objection may be urged, it is true, against every form of actinometer; for no instrument can be constructed which will indicate anything about light of other wave-lengths than those that are concerned in its own operation. The point of the criticism is, however, that in estimating the power of a given light to perform a given kind of chemical change, it is essential that the actinometer that is adopted shall depend for its action upon the same wave-lengths as those that are concerned in the phenomenon for whose

study the actinometer is employed. It is not logical, for example, to use the Draper actinometer for determining the power of a given light to effect the reduction of the halogen salts of silver, unless it is first proved that the combination of hydrogen and chlorine, and the blackening of silver salts, are effected by the action of light-rays of substantially equal wave-lengths. The commonest problem in actinometry at the present time is the determination of the time of exposure in the taking of photographic pictures; and when an actinometer is employed for this purpose, it usually consists of a strip of sensitive paper which is exposed until it darkens to a definite shade; the time required for this blackening being taken as an index of the intensity of the light, so far as its power of reducing silver salts is concerned. It is possible that the initial slowness with which diffuse daylight induces the combination of hydrogen and chlorine is a characteristic common, to a greater or lesser extent, to all photographic processes; but familiar experience in the taking of so-called "instantaneous" photographs indicates that if this initial slowness exists in the case of the modern dry-plate, its period is exceedingly short. Compare PHOSPHORESCENCE; PHOTOGRAPHY.

**Pho''to-col'lotype**, a modern process of printing from the surface of a film of gelatine. A piece of plate glass is coated thickly with a solution of gelatine and potassium bichromate, dried in the dark, and exposed to light under a reversed positive. It is next turned over and exposed, through the glass, to diffused light for a short time to diminish the swelling caused by the subsequent wetting. After well washing to remove the superfluous bichromate, it is rolled with greasy ink which only adheres perfectly to the parts which have not absorbed water, and to the others in proportion to their dryness. The subsequent manipulations are as in lithography (q.v.).

**Pho''to-elec'tric Microscope**, a microscope illuminated by the electric light so that the image of the magnified body can be thrown on a screen in a darkened room.

**Pho''to-elec'trotype**. See PHOTO-ENGRAVING.

**Photo-engraving**, a general term covering various processes by which the action of light upon suitably sensitive surfaces is made to yield plates from which facsimiles of photographs or drawings may be printed. The processes that are commonly and very successfully employed at present, are dependent upon the properties of various substances such as gelatine or similar bodies to undergo certain changes under the action of light.

If a thin layer of asphaltum is spread upon a metal plate and exposed to the light under a negative or positive, the parts under the clear parts of the screen either positive or negative become insoluble, while those under the dense parts remain soluble. When the plate is then washed with a suitable solvent, the soluble parts will be removed, the hardened parts remaining. The plate can then be etched, the asphaltum serving as an etching ground. The result is a relief plate if the black parts of the design were hardened under a negative, an intaglio plate if the whites were hardened under a positive.



## PHOTO-ENGRAVING

Albumen, or white of egg, is soluble in cold water even if allowed to dry. If mixed with a solution of potassium bichromate and spread upon a surface and dried, it still remains soluble as long as it is not exposed to light. Albumen when combined with potassium bichromate acts like asphaltum subject to certain modifications in handling.

If gelatine is mixed with potassium bichromate it retains its qualities if left in the dark, but, exposed to light, it acquires the power of resistance to mordants according to the degree of exposure. These peculiarities of the various substances mentioned, have been used to further the work of the photo-mechanical processes. The aim of them all is to reproduce any photograph or drawing into a block or printing plate without the intervention of other than mechanical means.

The familiar half-tone so generally employed in modern periodicals and books is a very beautiful and successful result of the special application of the action of light upon a properly prepared copper plate. It is dependent for its printing qualities upon the interposition of the so-called half-tone screen between the object photographed and the negative. This screen is made up of pieces of glass that have been very finely ruled and put together in such a way as to make of the intersecting lines a great number of minute dots or stipples. The effect of this upon the negative is to break up the flat surfaces into a corresponding texture of dots, their size depending upon the relative darks and lights of the original. It is in fact a general stippling of the surface affording a grain to which the ink may cling. The very name half-tone suggests limitations, pure whites are only obtained by further manipulation. The fineness or delicacy of the resulting plate is of course dependent upon the character of the screen used. In some of the most beautiful reproductions of to-day, there are as many as 200 or even 300 lines to the square inch. In such cases, however, successful printing is only possible with the very finest paper and the most experienced and careful press work. For ordinary commercial work the screen is rarely over 150 lines to the inch.

In making the half-tone, a negative in reverse made with the screen is put into contact with a highly polished metal plate, usually copper, which has been properly sensitized or coated with a preparation of fish glue, bichromate of ammonia, albumen and water. It is then exposed to the light and afterward washed in water. Those parts which have been protected from the light by the denser portion of the negative will be washed out and the other portions in varying degrees. The plate is then dried and burned in over a suitable heater, when it is ready for etching. Few half-tones are satisfactory if left without considerable after work. In most of them their deficiencies are made up by the skilful handwork of an experienced wood engraver. This combination of the mechanical process with hand work, however, is best omitted unless the engraving is done with judgment. Too many of the plates printed from to-day are neither fish nor fowl. The delicate tints of the plate are so engraved away as to destroy its original qualities without

adding anything to its value as an engraving. Mechanical in the broad sense, there is yet abundant opportunity in the making of half-tones for the exercise of superior judgment and taste. Much depends upon the skill of the photographer and upon the just degree of etching.

The half-tone more than any other of the photo-mechanical processes, has helped to advance and develop American illustrative art. Before its employment, drawings in wash or color had to be re-drawn on the wood block in black and white and in reverse. This limited both the mediums employed and greatly hampered the comparatively few artists who had either the time or inclination to learn to draw in the special way required. With the advent of the half-tone, artists could draw as they chose; size was no consideration for the photographic reproduction allowed for any reduction necessary. Again, there were artists whose work suffered materially at the hands of the engraver; the resulting print was only a fair interpretation, not a facsimile in black and white. The relative small cost of the half-tone, too, has permitted of the freer use of illustrations, and has brought out the work of many men who have attained high places in American art. There have been many claimants for the invention of the half-tone, but it is pretty generally conceded that F. S. Ives, of Philadelphia, was one of the first to make it practicable in 1881. The Meisenbach process, patented in 1882, was the first screen process to be used in a large way. The half-tone, as has been previously said, is employed chiefly in the reproduction of photographs or drawings in which there are tints and masses involving delicate gradations.

For the reproduction of drawings in line or stipple, the process is much simpler, very inexpensive and capable of great expedition. In this work the metal employed is usually a zinc plate coated with asphaltum or with albumen mixed with bichromate and exposed under a reversed black and white negative made from the drawing to be reproduced. After exposure it is washed with a solvent that removes the unchanged part of the coating, leaving the lines of the design in hardened albumen or asphaltum upon the plate. It is then etched into relief and the rough places gone over with a graver and the blank spaces or pure whites routed out. As with the half-tone plate it is then mounted on a block type-high and is ready to print.

Another familiar process employed in the reproduction of line work is known as the swell gelatine process. A bichromatized gelatine film is laid on a glass plate and exposed under a black and white negative. The film is then soaked in water which causes the lines which were protected by the dark parts of the negative to swell up while the others do not swell. The film is then a mold or matrix from which a wax or plaster impression may be taken, and from this an electrotpe can be made. This is a more difficult and uncertain process, however, and is not very generally employed. There are other variations in the processes of reproducing line work, which we have not room to detail here.

Thus far we have dealt with the commoner or more generally employed relief processes. Another most beautiful process involving just the reverse of the methods employed in the half-



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tone is known as photogravure. It may be employed either in the reproduction of drawings, in tint or pure line, and the results are a fascinating richness of texture, a velvety quality that is especially adapted for the reproduction of paintings or old etchings. Some of the most sumptuous and valuable art works of our time are illustrated by the use of the photogravure, and it is constantly employed in the reproduction of drawings and prints of the old masters. One of the simpler methods of producing a photogravure plate is as follows: A copper-plate covered with asphaltum or albumen mixed with a bichromate and exposed under a black and white *positive*. The parts under the clear spaces of the positive are hardened, those under the opaque places corresponding to the lines of the original remain soluble. Washing with a solvent bares the metal in the soluble places, and the plate is then etched, the hardened coating forming a resist. A grain is obtained in this process by first sprinkling the plate with powdered resin which is made to adhere by heating. Photo-aquatint is another familiar method for the reproduction of intaglio half-tone plates. There are a number of processes known under various names that are somewhat similar in general character and involve adaptations in the use of sensitized gelatine. Among these, the best known are the Woodburytype, the stannotype, the heliotype, the collotype and the autotype.

With the advent of color in the pages of our leading magazines, a new impetus has been given toward the development of methods by which direct reproductions can be made of colored originals. In the so-called three-color process much has been accomplished, but very much still remains to be done. The process is based upon the theory that all the colors in the chromatic scale may be derived from the three primaries, red, blue and yellow. In making the half-tone negatives from a colored original, ray filters are used, which are transparent color mediums that permit only certain rays to be effective in the photographic plate. The resulting plates printed the one upon the other in just the proper shades of red, blue and yellow, ought to result, theoretically, in an exact copy of the original. As a matter of fact thus far these color reproductions have at best been but fair approximations. One chief reason for this is the limitation of effect involved in any superposition of colors, and this is particularly evident when applied to the use of colored printing inks. Other reasons for the lack of complete success in this work are the difficulties of securing absolutely correct negatives, exact registration in the printing and just the right shades of the primaries. In some directions notably in the reproduction of certain textiles, the three-color process has been successful, but as yet it retains many crudities and is far from being satisfactory when employed in the copying of paintings. There are a number of modifications of this process, and very often the employment of a fourth printing in a carefully harmonized tint does much to soften and blend the ordinary colors employed.

In all of the various processes employed in photo-engraving, much has to be left to the skill of the operator. Certainly we owe much to the men who have done their part toward furthering the advancement of the mechanical pro-

cesses. While the general principles and processes employed in these reproductive arts are well known and common property, there are yet many special adaptations and more or less secret methods that have grown out of special experimentation and experience.

Modern art has been brought into the household by our illustrative magazines and papers, and the art of all time can be studied in the cheap reproductions made possible by these modern photographic processes. For the photolithographic process see PHOTO LITHOGRAPHY.

J. B. CARRINGTON,  
*Assistant Editor 'Scribner's Magazine.'*

**Photography.** The fact that light visibly affected matter—darkening some that was light and lightening some that was dark, and changing and discharging colors, must have been noticed before history began to be recorded, although it was not till perhaps the fourth quarter of the 18th century that it began to receive anything like systematic attention; not until Scheele, a Swedish chemist, noticing that silver chloride darkened under the rays of the sun, sought for experimental evidence of the cause and consequence. He found that the action was practically confined to the lower end of the spectrum, the blue-violet and the ultra-violet; and that the result was a liberation of chlorine. Scheele was followed by many others, some of whom added more or less to the desired information; but not till 1791 does any one seem to have thought of it as a means of picture making; at which date there is ample evidence in a book, 'Tom Wedgwood, the First Photographer,' published in 1903 by Duckworth & Company, of London, that Wedgwood made photographic copies of pictures, probably using the salts of silver and by "contact printing." A more or less full account of his methods, written by Davy, appears in the 'Journal of the Royal Institute' for 1802, but although it is known that he worked with Davy in the laboratory of the Institution it does not appear that the latter had any share in the photographic experiments.

To Nicephore Niepce, however, belongs the honor of getting the first camera image, which he did in 1827, although he had been experimenting since 1814; but as, according to Daguerre, it required an exposure of from seven to eight hours, it left much to be desired; and it is safe to say that practical photography was not reached till 1839. Early in January of that year, Daguerre first reported the results of his process and published a description of the same on 19 Aug. 1839. On 31 Jan. 1839, Talbot, who had obtained permanent prints and camera images as early as 1835, reported his process to the Royal Society and on 21 February following, published the details of the same. At the same time in the early part of 1839, Mungo Ponton, in a paper read at a meeting of the Royal Scottish Society of Arts, made known to the world his discovery that soluble organic matter, in the presence of an alkaline bichromate, was rendered insoluble by exposure to light—a discovery the value of which was not recognized for some years, but which is the basis of all that is included in "process work."

Daguerre and Talbot had been working independently and without knowledge of each other for several years, the latter alone and on



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scientific methods, having been a student of science, especially chemistry, from his school days; the former empirically and, for some time before he reached the goal, in conjunction with Niepce. Niepce had been working at the problem since 1814. He obtained camera images in 1827, and two years later, at the solicitation of Daguerre, entered into partnership with him. From the documentary evidence available, it is at least certain that the suggestion of the action of iodine on a silver plate—which led to ultimate success—came from Niepce. Be that as it may; it is worthy of notice that, working on different lines and with different material, Daguerre and Talbot found success in the same metallic haloid, the same silver iodide, although made in a very different way and giving very different results. Each was able to secure photographic impressions, one on sensitized paper, the other on a sensitized plate, but were unable to prevent the image from fading out until Sir John Herschel in 1839, the same year, discovered that hyposulphite of soda dissolved out the silver unaffected by light, thereby fixing the image. Daguerre's process, to which he had given the name "daguerreotype," consisted in exposing the highly polished surface of a silver plate, or a copper plate coated with silver, to the vapor of iodine. The silver iodide thus formed passed through various colors, depending on the length of the exposure, and experience soon showed the color which had the highest degree of sensitiveness. This, on exposure in the camera, produced no visible image, but, on exposing the plate to the vapor of mercury (such small quantity as arose from a temperature of about  $140^{\circ}$ ) an image was developed, the mercury vapor having adhered to such parts as had been acted on by light, and in proportion to the quantity or intensity of that light.

The image thus formed was of exquisite delicacy, the minuteness of its detail being limited only by the degree of perfection of the optical appliances; but the process was slow, requiring an exposure of minutes. Professor John William Draper, M.D., LL.D., of the University of the City of New York, with improved lenses early in 1840 made the earliest sunlight picture of a human face by this process. The subject was his sister, Miss Dorothy Catherine Draper. The picture is the property of Sir William Herschell of England. Nearly a year later, Goddard in England and another of the same name in America added bromine, which reduced the exposure to seconds. About the same time an improvement hardly less important was made by Fizeau, known as "gilding," the deposition of an extremely thin film of gold on the surface of the plate, which materially added to the beauty and permanence of the image. The difficult point about the daguerreotype was that it could not be duplicated or multiplied except by making duplicate original pictures with a plurality of lenses, as is now done with the ferrotype or tin type. Each exposure yielded a picture complete in itself, but only one, a positive; whereas the altogether easier although apparently more complicated method of Talbot gave a negative that could be duplicated from or multiplied to any extent.

Talbot's process (calotype, he termed it, but better known by his own name) had for its

support paper, and according to his first description was made as follows: A sheet of paper was brushed over with a solution of silver nitrate, dried and dipped into a solution of potassium iodide and again dried. This he called iodized paper; it was hardly if at all sensitive to light, and would keep indefinitely. To make it sensitive, it was brushed over with what he called gallo-nitrate of silver, a mixture of solutions of silver nitrate and gallic acid; and after exposure in the camera the image was developed by brushing over with the same solution and the application of a gentle heat. The image so produced was a "negative"; that is, the lights and shades were reversed, darks in the subject being represented by lights or white paper and *vice versa*. The advantage of this lay in the fact that a sheet of the same paper placed under this negative and exposed to light resulted in a positive, an image in which the lights and darks were in their right position; and that an unlimited number of such positives could be made from such negative. But as positives on calotype paper would require development, the same as the negative, Talbot recommended the employment of the silver chloride paper first brought before the Royal Society, which simply required exposure to light, or what is now known as "printing-out paper." To facilitate this printing, and to avoid as far as possible the grain of the paper in the paper negative, he subsequently saturated it with wax; and later on, paper iodized and waxed, or "waxed paper," became an article of commerce.

About this time, 1840, too, the "amateur" may be said to have come on the stage. Le Gray's wax-paper process, a modification of the talbotype, which consisted in waxing the paper before iodizing it, had come into use; and although it was slow it yielded fine results; so fine, indeed, that some of the negatives made then are quite equal to anything turned out at the present time, notwithstanding all the improvements that have followed. Mention may also be made here of what was known as the albumen process, first proposed by Niepce de Saint Victor, a nephew of the original Niepce, but perfected by Le Gray about 1850. Iodized albumen was spread on a glass plate and sensitized by immersion in a solution of silver nitrate; and it gave results that for delicacy of detail have not been equaled except by the daguerreotype; results so perfect that for certain purposes—such as transparencies for the stereoscope and for enlarging—it has no equal, and, consequently, is still in use.

In 1850, the introduction of a practical method of employing collodion as the sensitive film and glass as its support, gave photography a new impetus. Collodion, a solution of a variety of gun-cotton in a mixture of alcohol and ether, was suggested by Le Gray, in 1850; but it remained for Scott Archer of London in 1851 to give it a practical form, and it took like wildfire. Compared with the daguerreotype, it was simplicity itself, while in delicacy of detail and beauty, it was not far behind; and, more important still, the image might be either positive, so as to be available at once, or negative, with all the advantages of unlimited multiplication. The image on a collodion plate is positive when examined by reflected, and negative by transmitted, light. With a comparatively short ex-





1. The Original Print.



2. The Yellow Plate.



3. The Red Plate.



4. Red and Yellow Combined.



5. The Blue Plate.



6. Combination of the Three Colors.

Showing the different steps in obtaining a picture in colors from a single negative.







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posure and development, the plate needs only backing with some black substance to supply the shadows to convert it into a very beautiful picture. With longer exposure, and development continued until the highest lights are opaque, followed by intensification, if need be, the image is negative, and capable of giving prints of the very highest quality. The developer used is a solution of sulphate of iron and acetic acid, while the fixing agent to fix or dissolve out the film unacted upon by light, is a solution of cyanide of potassium. From this duality of the collodion film there arose two classes of professional photographers, the few, with higher ideals and catering to the better class of the people, adhered to negatives of considerable size, generally "whole plate,"  $8\frac{1}{2} \times 6\frac{1}{2}$ —supplying only one print at a time. The other class, the many, contented themselves with small positive prints, and the "carte de visite" soon displaced the glass positive, or, as it was called in America, "ambrotype."

But collodion, or wet collodion, as in the light of after developments it was called, however convenient for the professional, heavily taxed the amateur who went afield. The plates had to be prepared and finished on the spot, which entailed, even when only the smaller sizes were used, the transportation of an amount of apparatus and material that would greatly incommode a modern amateur. This led to a demand for a process that could be employed in the field as easily as wax paper, and, after many attempts, the result was what was then known as "dry collodion," 1856-7. A dry collodion plate differed from a wet in having the free silver nitrate washed away; but if then dried and exposed, only a weak, useless image could be obtained, as it required something to take the place of the silver as an absorber of the liberated iodine and bromine. This absorber, or sensitizer, as it was called, consisted first of certain preparations of gelatine, then tannin, and ultimately almost any kind of soluble organic matter, tea, coffee, malt, beer, albumen, etc. But such plates were slow, five, ten and fifteen minutes being quite usual, even on well-lighted landscapes, and although it was a great relief to have nothing to take to the field but a dozen plates in half as many double slides or plate-holders, the amateur was not satisfied.

The next step in advance was the introduction of Sayce and Bolton of the "collodio-bromide emulsion in 1864-5." This did away with the troublesome preparation of the plate in the silver bath, it being only necessary to pour the sensitized emulsion directly on the plate and set it up to dry. Exposures were now much shorter, but still far behind wet collodion, and so the search for greater rapidity continued. Henry J. Newton, an amateur photographer, in 1870 prepared a collodio-bromide emulsion of considerable sensitiveness, which was successfully used prior to the introduction of the faster process. The emulsion idea was really the turning-point. It was in 1871 that Dr. R. L. Maddox of England, an amateur photographer, while using photography as an aid in his microscopical work, discovered the possibilities of an emulsion composed of isinglass gelatine and bromide of silver, and published a description of his process that year in the 'British Journal of Photography,' submitting specimen negatives to the publishers. His process may be said to be

the beginning of the now universally used gelatino-bromide process, commonly known as the "dry plate" process. In the preparation of the emulsion, only certain kinds of gelatine are suitable, and much time was spent in discovering which was the best. King, in 1873, improved the emulsion by washing out the free silver, thereby increasing its rapidity. In the same year Burgess began the manufacture and introduction of prepared plates. Bennett in 1874 sold a dry sensitized emulsion or pellicle which could be prepared for coating plates by simply dissolving in hot water. Later Bennett in 1878 made a great step in advance by "cooking" or heating the emulsion at a given temperature for a certain period of time. This wonderfully increased the sensitiveness of the emulsion to light to such an extent that glass plates coated with a film of it became from 30 to 50 times more sensitive to light than wet collodion, which was then considered standard. At a meeting of one of the London societies, Bennett showed full-timed negatives made with such brief exposures as to fairly astonish those present. Mockhoven in 1879 discovered by the introduction of ammonia into the emulsion remarkable rapidity was obtained nearly equal to the "boiling or heating" method of Bennett. Very soon several dry plate manufacturers began to supply the prepared plates for the use of photographers. About 1880-1 plates began to be made in the United States by Cramer & Norden, photographers in Saint Louis, Mo., and John Carbutt in Philadelphia. It was a new industry, for heretofore photographers were required to prepare their own plates, always quite bothersome and uncertain.

In 1884 A. L. Henderson, an English photographer, demonstrated before the Society of Amateur Photographers of New York, the process of making a gelatino-bromide emulsion. The general process is shown in the following formula as used by Henry London:

First make the following two solutions:

No. 1.	
Bromide of potassium.....	20 grams
Gelatine, Nelson's No. 1.....	3 grams
Iodide of potassium.....	4 grams
Distilled water.....	170 c. c.
Alcohol, 95 per cent.....	25 c. c.

No. 2.	
Nitrate of silver.....	25 grams
Distilled water.....	170 c. c.

Then make

No. 3.	
Heinrichs' special gelatine.....	34 grams
Nelson's No. 1 gelatine.....	4 grams
Distilled water.....	180 c. c.

Each of the above solutions may be prepared separately, in ordinary light. Solution No. 1 is placed in a water bath of warm water, and constantly stirred with a glass rod; when all the ingredients are completely dissolved, it is tested with blue litmus paper for acidity; if not acid, it is made so by the addition of enough of the following to turn the litmus slightly red:

Distilled water .....	5 drams
Acetic acid .....	1 dram

No. 1 solution is thoroughly mixed by being placed in a hot water bath and agitating, then in a darkened room illuminated only by a faint non-actinic light. No. 2 solution is mixed with No. 1 solution in the form of a fine stream so that the silver may come in contact with the bromide and be converted into bromide of silver. After cooling to 90° F. a solution of alcohol 5 c. c. (nearly 2 drams) and ammonia (Sp. Gr. 910) — 110 minims is added a little at a time. The emulsion is then kept under heat over night at a temperature of 100° F. and solution No. 3 heated up to 125° F. and then cooled down to 100° F. is added to the sensitized solution. The whole is allowed to cool until it solidifies into the form of a jelly, this is compressed and sifted



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through a screen until it is broken up into small particles and is then washed in water for several hours. The water is drained off and the emulsion dried. It is then melted at a temperature of 135° F. and 20 c. c. of alcohol is added. Is filtered while liquid in a warm condition, and then coated upon leveled glass plates usually placed upon a marble slab. On cooling the film solidifies, the plate is then removed and placed in a drying closet. After this operation it is ready for use in the camera.

The foregoing is the basis of the process now used by all the large manufacturers of dry plates, who consume many tons of silver gelatine and glass to supply the demand. Specially constructed machinery is used for preparing and coating plates and paper with the sensitive emulsion on a large scale. To explain the magnitude of this work, there was made in the year 1903 a single positive print on gelatino-bromide paper in Germany 40 feet long by 5 feet wide. A special building was constructed to hold the immense reel, over 13 feet in diameter, on which the exposed paper was wound and developed.

The convenience to the novice or skilful photographer of having a sensitized plate ready prepared and capable of being used at any time, gave a great impetus to photography, and extended its field of usefulness in a remarkable degree. The great sensitiveness of the plates facilitated the practice of instantaneous photography which led to the manufacture of the hand camera, an instrument carried in the hand by a handle, having a finder for locating the image to be photographed, a shutter adjustable for rapid or slow exposures, and a focusing device so arranged that the instrument can be used at a moment's notice without the aid of a tripod. The first practical machine of this kind was invented by a German, M. Schmid, and was introduced by E. & H. T. Anthony & Co. of New York in 1884-5. It was found that the sensitized solution could be applied to celluloid transparent film as well as to plates. This lightened the work of the photographer and avoided the danger of breakage which the use of glass entailed. John Carbutt of Philadelphia was the first to introduce coated cut celluloid films in 1883. In 1888 there was introduced by George Eastman of Rochester, N. Y., a new miniature hand camera named the "kodak," which carried spools or rolls of paper sensitized with a film of gelatino-bromide emulsion of sufficient length to take at least 100 small pictures about three inches in diameter. After each exposure the paper was reeled off, bringing a fresh surface behind the lens. The spool of exposed paper was removed in a dark room and developed there. From the paper negatives thus obtained, prints were made on the same plan as from the paper negatives made by Fox Talbot. Or by a tedious process the developed gelatine film was removed from the paper support and mounted upon a transparent gelatine sheet, which avoided the grain of the paper. A year later improvements were made in the manufacture of celluloid films, whereby they could be produced in long strips, and these supplanted the paper at first employed. The film of the present day is simply a refinement of the first celluloid rollable film, with the additional improvement that it is wrapped in an extra length of non-actinic opaque paper, allowing the roll to be inserted in and removed from the camera in open daylight, thereby dispensing with the usual dark room. The rollable film is of great utility to tourists

and others. The manipulation of the gelatine film requires the use of cool solutions not exceeding a temperature of 80° F., on account of its tendency to soften and dissolve away if too warm. This tendency is checked by the use of alum or formaldehyde.

On the Continent, in the United States and some other countries, the ferrous oxalate developer (first proposed by Carey Lea in 1878) was at first preferred for developing the bromide film either on plates or paper; it is prepared by mixing two chemicals separately. First a saturated solution of neutral oxalate of potassium is made, acidified slightly with oxalic acid, then a solution of sulphate of iron 500 grams to 1,000 c.c. of water slightly acidified with sulphuric or acetic acid. Prior to development one part of the iron solution is mingled with six parts of the potash solution, which makes a sherry-colored solution. In this several plates or sheets of bromide paper may be successively developed. In England the pyro ammonia developer was preferred, and is prepared by dissolving about four grains of pyrogalllic acid in one ounce of water and adding a drop or two of strong ammonia. The negative obtained had a brown and yellow color, rendering it a slow printer. In 1882 Herbert Berkley discovered that a small quantity of neutral sodium sulphite added to the pyro ammonia developer retarded the oxidation of the developer and prevented the yellow pyro stain, yielding negatives of a bluish black color.

Soon after this, in the United States, prior to 1884, H. J. Newton suggested the use of sodium carbonate (ordinary sal soda) as a substitute for the alkali ammonia in the pyro developer, which with sodium sulphite made a solution that was particularly adapted to the production of negatives having quick printing qualities. The sodium sulphite prevented the yellow stain, and the carbonate of sodium was more stable than the evaporative ammonia.

The proportions of the developer were:

Sodium sulphite .....	185 grams
Pyrogalllic acid .....	30 grams
Water .....	500 c. c.

### ALKALINE SOLUTION.

Sodium carbonate (crystals) .....	125 grams
Water .....	500 c. c.

For a developer, 30 c.c. of pyro solution and 30 c.c. of alkaline solution are put into 185 to 305 c.c. of water. It was found about this time to obtain the best results on plates having had instantaneous exposures, that potassium carbonate as an alkali superseded soda, and this is largely used at the present time, in combination with soda, particularly for the development of shortly-timed plates. In 1889 and since then the new coal tar developing agents were introduced under the name of eikonogen, metol, glycin, ortol, etc. They largely take the place of pyrogalllic acid. The fixing agent for dissolving out the creamy unacted-upon film, after development, is hyposulphite of soda.

Printing methods in photography have been as varied and their improvements as great as in the case of the negative. At first prints were made on plain silver chloride paper, and when the ammonia-nitrate was substituted for the plain nitrate, some were made that are not excelled by anything at the present day. The desire for greater detail, however, brought into use albuminized paper, which not only came





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#### A BROOD OF WILD CHIPPING SPARROWS.

Photographed on the author's hand by himself, using an air bulb and long tube. The mother bird is feeding her young, and the other parent flew just as the exposure was made.



#### ROCK BASS.

Photographed in Water.







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into universal use, but held its sway until comparatively recent times. About a decade ago it was displaced by paper coated with a chloride emulsion, a highly glossy family, generally known as the "aristo." This still continues in use and is largely used in prints intended for process reproduction, on account of the clear rendering of fine details. For truly pictorial work methods which give "mat" or plain paper prints are preferred. The principal, or the most generally employed, are the "carbon" and the "platinum" methods, both introduced in the sixties, though both lay dormant for many years.

Carbon, probably the best of all printing methods, although platinum is a close second, is more of a mechanical than a chemical process. It uses a paper coated with bichromated gelatine, colored with finely divided carbon or other pigment. This is exposed under a negative, and wherever light has reached the "tissue," as it is called, and just in proportion to the quantity or intensity of that light, the gelatine becomes insoluble. Immersed in warm water, the soluble parts of the tissue (those protected by the opaque or semi-opaque parts of the negative, and consequently the lights of the picture) soften and are washed away. Just who first proposed carbon it is difficult to say. Fargier, in France, was early in the field, but to Swan of England is due the credit of first making it a practical process; although Blair of Perth, Scotland, was the first to recognize the crucial part of it—the necessity for *exposing through the back of the tissue*, or, in other words, developing from the side opposite to that which was exposed. Platinum was introduced by Willis of England in 1874, and is based on the fact that a platinum salt is reduced to its metal in the presence of potassium oxalate and a ferrous salt of iron. At first the paper was coated with the ferric salt of iron and exposed to light under the negative, the light changing the ferric to the ferrous salt. Development was effected by a hot solution, a mixture of the oxalate and the platinum salts; but more recently the platinum has been mixed with the iron, and development carried on in a cold solution of potassium oxalate.

During recent years two modifications of the carbon printing process have come into pretty general use, especially among pictorialists; "gum-bichromate" and "ozotype." They are simpler than the original method, do not reverse the image, need no transfer, and are supposed to give greater control.

In the gum-bichromate process, paper is evenly coated with a suitable mixture of gum-arabic, coloring matter and potassium bichromate, and dried. It is printed under a negative in the ordinary way and developed by floating on water of suitable temperature, assisted by brush action, letting the water fall in streams and sometimes mixed with sawdust to assist the removal of color from the lights.

In the ozotype process perfected by Manly, paper is coated with a patented sensitive solution consisting of potassium bichromate and certain other salts, dried and printed as in gum-bichromate; and may then be kept indefinitely. To develop the print the printed paper, with a slightly visible image, is soaked in a solution of hydroquinone acetic acid, copper or iron sulphate, etc., according to the effect desired, and, under the solution, brought into

contact with a piece of carbon tissue, or the "plaster" prepared by the patentee. Development takes place in warm water, the coloring matter of the plaster or tissue adhering to the parts of the print acted on by light. The ferro prussiate process (blue print process) was discovered in 1842 by Sir John Herschel.

Not the least important of what may be called the side issues, or secondary applications of photography, are the various productions generally included under "process work"; photogravure, half-tone, collotype, photo-lithography, swelled gelatine, etc., all the various methods used for book and magazine illustration, and some of which are employed in almost every printing-office. Here, too, Talbot seems to have been the pioneer. It is true that Poitevin, and after him Fizeau, made intaglio plates by depositing copper on a developed, not fixed daguerreotype; but such could never become commercially available; while as early as 1843, we know that he was working at a method of engraving on metal prints from his negatives, and in 1852 and 1858 he took out patents for his methods. In the first he coated a steel plate with bichromated gelatine and exposed it to light, under the negative, for from 15 to 30 minutes, soaked or washed in water, soaked in alcohol, and dried. To break up the deeper shadows he printed under crape and even glass, with ruled lines, and etched with platinic chloride applied with a brush. He also covered a plate with an aquatint ground, consisting of particles of resin applied before coating it with the gelatine. In the second method, in addition to various modifications, he dusted the printed plate with powdered resin, fixed it by heating, and etched with perchloride of iron. So well, indeed, had he studied the subject, that the photogravure of the present day is almost identical with that patented by him in 1858, and prints from those plates, made a year later, now existing, compare favorably with most of the work of the present time.

The collotype, a photograph in printing ink, termed now "albertype," may be taken as an example of the best of its kind. It is produced as follows: A glass plate was thickly coated with bichromated gelatine, and to give it the necessary hardness a little chrome alum was added. It was first exposed to light for a short time on the glass side, and then under a negative in the ordinary way till the desired impression was made. Soaked in water, only the parts not acted on by light absorbed it sufficiently to refuse to take ink from the lithographic roller, and in this way excellent prints in half-tone were made. It was known as "lightdruck," "heliotype," etc., and is still more or less in use. Almost as early, and still more extensively employed, was photo-lithography. Asser of Amsterdam was the first to put it to practical use, but probably it is to Osborne of Melbourne that we are indebted for the modifications which made it the process now employed by every map-maker in the world. Briefly, a sheet of suitable paper is coated by floating on a solution of bichromated gelatine or albumen; printed under a negative, and inked either by a roller or, better still, by spreading the ink evenly on a stone, and passing the paper through the press once or twice as if drawing a proof. The inked sheet is then laid face down on warm water if gelatine has been employed,



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and cold if albumen. The gelatine, where light has not affected it, swells and dissolves, leaving ink only where light has acted, the parts representing the dark lines of the original. A spray with water or even a slight wash with a sponge makes it ready, after drying, for transferring to the stone, and the quality of the work will depend on the care given to the preparation of the transfer.

But the two most generally employed methods of reproduction are "photogravure" and the "half-tone"; the former for the reproduction of paintings and photographs for high-class book illustration, which, being an intaglio production, is printed in the copper-plate press, and consequently more costly than the latter. Particular methods are generally kept as trade secrets, but something like the following is usually adopted: A negative is first made from the painting or photograph, and from this a positive. The positive is printed on a plate of copper coated with a solution of bitumen, which, as was discovered by Niepce, becomes insoluble on exposure to light. The plate is then soaked in oil of lavender or other solvent of bitumen, and etched. "Half-tone," however, is by far the most important of all the "process" methods. It has revolutionized book and especially magazine illustration, made wood engraving almost a lost art, and, by its accurate reproduction of the photograph, given to illustrated books of travels and natural history a value they did not previously possess. As with photogravure, half-tone blocks may be produced in various ways, and some of them are regarded as trade secrets; but the following is the method most frequently adopted: From the photograph, preferably on glossy paper, is made a negative; and to break it up into the necessary dots the plate is exposed behind a lined screen. The lines may be all the way from 80 to 250 per inch, depending on the purpose for which the block is to be employed; a "screen" consisting of two ruled plates, placed face to face, with the lines at right angles or otherwise crossed, and cemented together. The negative must also be reversed from right to left, and this may be accomplished either by a prism or a mirror placed in front of the lens of the copying camera, or by stripping the negative from its glass support and reversing it while printing on the copper. The shape and size of the diaphragm opening is also of importance, as it acts in conjunction with the screen, and has considerable influence on the nature of the dots.

Frederick E. Ives invented the first successful half-tone process and half-tone three-color printing in 1878, when he had charge of the photographic laboratory at Cornell University. The half-tone process was simplified in operation in 1880, introduced commercially in Philadelphia in February 1881, and patents issued in the same year. This was a photo-mechanical process, the translation of the body shades of the photograph into definite line and dot, as required for typographic printing, depending upon the relation of ruled V-shaped lines to the uneven surface of a photogelatine relief.

The half-tone process now universally employed was the result of Mr. Ives' effort in 1885 to obtain the results more directly and economically, by substituting the application of an optical V line to a camera image for the application

of the ruled V line to the photogelatine relief. The crossline sealed screen and the regulation of the gradation of line and dot by screen distance and special lens diaphragms was a part of the invention as operated by Ives in 1886, and afterward taught to others, but not patented.

Photography in natural colors, or, as Sir W. de W. Abney has it, in the colors of nature, has almost from the first been the dream of many experimenters; but, notwithstanding all that has been done, we are no nearer it than when they began. Color photography, however, that is, photographs having the semblance of the natural colors, has made considerable progress. Becquerel was the first to secure on silver chloride something approaching the colors of the spectrum, but got no further; and to Ducos du Haroun is due the credit for, in 1869, clearly foreshadowing the three methods which include all that has as yet been done in it—the superimposing of three-color images, Joly-McDonough colored lines, and Lippmann's interference process. Taking them in the order of their least importance, Lippmann's method is to expose a very thin sensitive film backed by mercury as a reflector, to the colored object. Incident light reflected from the metallic mirror in contact with the film results in interference, and, as the constituents of white light are of varied wave-lengths, produces in the film a series of planes parallel with its surface, emitting colored light exactly as does the soap-bubble; but the process is difficult, and not likely ever to be more than a scientific curiosity. In the Joly-McDonough method a negative is made in the ordinary way, but with a glass plate with closely ruled colored lines in front of and in contact with the sensitive plate. From the negative so made a positive is printed, and a second or viewing screen with similar colored lines is placed in contact with it, and in exact register with the impressed lines, the result being a picture in the semblance of the natural colors.

The "three-color" method is the most important, as it has the greatest commercial possibilities, and gives the most varied and most satisfactory results. Although Collen, in 1865, was probably the first to suggest the method, and Du Haroun, in 1869, outlined it clearly, they and those that followed them were on the wrong track, working on the theory of Brewster, which never could lead to success, instead of that of Young, Helmholtz, and Maxwell, now universally accepted. The first to recognize this was Fred E. Ives of Philadelphia, and to him more than to any other, or indeed to all the others together, are we indebted for the great progress that has already been made. The first experimental half-tone three-color plates and prints were made in 1881, and had the characteristics which were patented by others many years after. Briefly, three negatives—color records they may be called—are made on orthochromatic plates; plates, that is, made more or less sensitive to the green and red of the spectrum as well as to the blue, each exposed under a suitable colored screen or color filter. Each of the negatives so made includes practically only one of the series of three wave-lengths that, separated, produce the sensation of color, and when combined that of white light. From these negatives half-tone blocks are made and printed, one over the other, in suitably colored inks.



## PHOTOGRAPHY — PHOTO-LITHOGRAPHY

A serious objection to silver-bromide, the sensitive salt in the ordinary photographic plate, is the fact that it is so much more sensitive to the blue-violet than to the green and red of the spectrum as to give a very false rendering of color values or luminosities, the darker colors showing as the lighter, and *vice versa*. Dr. W. H. Vogel was, perhaps, the first to find that the addition of certain dyes to the emulsion tended, to a large extent at least, to equalize the sensitiveness; and to plates prepared with such an emulsion or soaked in the dyes after preparation, he gave the name of orthochromatic or isochromatic. But even the most evenly sensitive of such plates are still more sensitive to the blue-violet than to the red and green and for the best results—the true rendering of color luminosity, it is desirable to employ color filters or screens that will absorb the excess of blue-violet.

The beginning of the moving picture idea was early in 1878, prior to the introduction of the present rapid dry plate, by E. J. Muybridge, a photographer in San Francisco, Cal., who photographed the movements of a racing horse owned by Leland Stanford by having a series of individual cameras placed in a row about one foot apart, the shutters of which were electrically operated automatically, as the horse moved forward. This first experiment proved that a trotter's feet are entirely off the ground together twice during the making of a stride. In 1896 Edison and others perfected the moving film system in combination with a shutter.

In scientific investigation photography has been remarkably helpful. It has taken the place of manual labor in record-keeping, measured the velocity of flying bullets, shown the true positions of animals in motion, and created the "new astronomy." As early as 1840, Draper had made photographs of the moon; in 1857 De la Rue established heliographic observation of sun spots, a work begun at Kew, and continued at Greenwich till the present time. Employed in every solar eclipse since 1860, photography has told us all that we know of the corona and chromosphere; it has revealed the mystery of the hitherto puzzling nebulae, and, by virtue of the fact that the light action is cumulative, has told of the existence of stars so far away as to be beyond the ken of the human eye, aided by the most powerful telescope yet made. At the Astro-photographic Congress that met in Paris in 1887, it was resolved to make a photographic survey and star-map of the heavens, and at present there are 18 telescopes, each of 13-inch aperture, engaged in that work in various parts of the world, while in most of the more important observatories photography and the spectroscope are joined together and made daily, or rather nightly, to tell us more and more of the mystery of the heavens.

As an educational adjunct, photography has played an important part. The projection lantern finds a place in every well-equipped lecture-room, and the photographic lantern-slide lends itself equally to the teaching of science and the illustration of travel. The beauty and accuracy of the photographic lantern-slide, and the ease with which it is made, make it equally available to the college professor and the itinerant lecturer, enabling the one to show to a whole class what otherwise would require to

be handled by the members one by one; and giving to the other an opportunity of making a comfortable living, and in some cases amassing a fortune, by amusing and instructing the popular audience. Hardly less important, although much less popular, is the enlarging of small objects, "photomicrography." In bacteriology, histology, etc., its importance can hardly be overrated, affording, as it does, illustrations in works dealing with such subjects that are without a suspicion of the imperfections of draftsmanship, and showing, as they do, when orthochromatic plates are employed, the different luminosities of the various stains.

Nor is photography less important from a social point of view. While it displaced miniature painting, a style that only the rich could enjoy, it gave a better likeness of loved ones equally available to rich and poor. It has given us correct instead of fancy or distorted views of the manners, customs, and scenery of distant lands; enabled the cottager to decorate his walls with better pictures than were available to his richer neighbor previous to its advent, and given a new interest to periodical literature by the low cost and excellent quality of its illustrations. Not less wonderful has been its influence commercially. It has created new branches of trade and manufacture, and largely increased many that were in existence before, furnishing well-paid work to hundreds of thousands of both men and women. The glass-maker and the optician have wrought together till they have given us lenses as nearly perfect as we can hope to see; the chemist has given us new material and improved the old, building factories for the manufacture of some by the ton that, previous to the advent of photography, were only known as curiosities of the laboratory; while the camera-maker has so exercised his ingenuity as to give us cameras of perfect workmanship and almost automatic in their action.

Compared with most other branches of science and art, photography is still in its infancy, so that greater improvements may be looked for. But be that as it may, surely enough has been done to make the 19th a memorable century to the photographic historian.

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**Photography in Color.** See COLOR PHOTOGRAPHY.

**Photogravure**, fō'tō-grā-vūr', a process of engraving in which, by the aid of photography, subjects are reproduced as plates suited for printing in a copper-plate press. The process known as heliogravure is essentially the same. See PHOTO-ENGRAVING.

**Photo-glyph'ic Engraving**, a method of photo-etching invented by Fox Talbot. See PHOTO-ENGRAVING.

**Photo-he'liograph**, an instrument for observing transits of Venus and other solar phenomena, consisting of a telescope mounted for photography on an equatorial stand and moved by suitable clockwork.

**Pho'to-lithog'raphy**, a method of producing by photographic means designs upon stones, from which impressions may be obtained in the ordinary lithographic press. The first requisite



## PHOTOMETER—PHOTOMETRY

for the production of a good result by this process is a suitable original. The drawing should be made with perfectly black lines throughout, no matter how thin the lines are; the scale of reduction should not be too great; the best proportion is obtained when the drawings are made about one third larger than the required block; the paper used should be white and smooth in texture.

The negative for a line-block is made preferably by the wet plate or collodion process, because of the facility with which these plates can be intensified, and the clearness of the lines; the negatives for this process must be reversed. See PHOTOGRAPHY.

**Photom'eter**, an instrument intended to indicate relative quantities of light, as in a cloudy or bright day, or to enable two light-giving bodies to be compared. A photometer in common use was invented by Bunsen; it consists of a screen of thin paper moistened with a solution of spermaceti in turpentine, except a spot in the centre. This screen being placed on a stand at a fixed distance from a source of light of constant intensity, the ungreased spot appears darker than the greased part. One of the lights to be compared is then placed in front of the screen, and adjusted at a distance such that the ungreased spot is illuminated as much as the rest of the screen. A similar experiment being made with the other light to be compared, the intensities of the two are to one another in the proportion of the squares of the distances from the screen at which the lights must be placed in order to cause the disappearance of the ungreased spot. The art of measuring the intensity of a source of light is termed photometry.

**Photometry** is the art of comparing the intensity of a source of light with that of another source which is taken as a standard. The possibility of making such comparisons depends upon the power of determining by means of the eye when two neighboring fields of view, illuminated respectively by the two sources in question, are equally bright. The sensitiveness of the eye to inequalities of brightness does not greatly exceed one per cent, even under the best conditions; and since it frequently falls below that value from fatigue and from various other causes, numerous attempts have been made to find photometric methods which are independent of this organ, but thus far without much success.

**Photometers.**—Any instrument for the measurement of the intensity of a source of light is termed a *photometer*. Since all attempts to substitute for the eye such instruments as the thermopile, the bolometer, and the selenium cell have, for the ordinary purposes of photometry, led to unsatisfactory results, all existing photometers which have come into general use are based upon the above mentioned power of the eye. The earliest form, which was originally described by Bouguer, was invented early in the 18th century. It consisted of a screen  $AB$  (Fig. 1) illuminated by the sources of light  $S$  and  $s$ , the intensities of which were to be compared. The partition  $PC$  prevented the light of  $S$  from falling upon  $BC$  and that of  $s$  from reaching  $AC$ . The distance of the two sources from the screen was adjusted until the illumination of  $AC$  appeared to the eye to be equal to that of  $BC$ .

Since the illumination produced by a source

of light is inversely as the square of its distance:

$$b_1 = \text{Const.} \frac{I_1}{d_1^2}$$

$$b_2 = \text{Const.} \frac{I_2}{d_2^2}$$

where  $d_1$  and  $d_2$  are the distances of  $S$  and  $s$ , respectively, from the screen,  $b_1$  and  $b_2$  the illumination of the screen due to  $S$  and  $s$  respectively and  $I_1$  and  $I_2$  the intensities of the screens. Since  $b_1 = b_2$  we have

$$\frac{I_1}{I_2} = \frac{d_1^2}{d_2^2}$$

An ingenious modification of this instrument, devised by Lambert (1760) and subsequently used by Rumford (1794) is known as the

*Shadow Photometer or Rumford Photometer*. In this apparatus an opaque body, usually an upright rod ( $R$ , Fig. 2) is placed in front of the screen. The surface of the screen is illuminated by both sources but the two shadows  $A, B, C, D$ , are each illuminated by light from one of the sources exclusively. When these shadows are equally bright the distances of  $S$  and  $s$  from the shadows which they illuminate determine the relative intensity of the two sources.

Ritchie (1826) introduced a new principle into photometry. He placed the two lights to be compared at the ends of a track or bar along which a box containing two mirrors  $M, M'$  (Fig. 3) could be moved, until the rays from  $S$ , reflected at  $M$  to the left half of the screen  $AB$  gave an illumination equal to that from the rays from  $s$  reflected by  $M'$  to the other half of the screen. This screen was of some translucent material, usually paper.

Bunsen (1841) substituted for the Ritchie screen a sheet of unsized paper the central, usually circular, portion of which had been rendered translucent by the application of oil or of melted paraffin. The paper when placed between two sources of light, the plane of the paper perpendicular to the incident rays on either side, affords a very simple and convenient means of determining when the illumination from the two sides is equal. When subjected to unequal illumination from the two sides the translucent portion of the face toward the brighter source appears dark, the unoled portion bright. On the other face the reverse is true (see Fig. 4). As the paper is moved away from the brighter source and toward the weaker an interchange in the appearance of the two surfaces occurs and there is a neutral position in which both appear alike and in which it is scarcely possible to distinguish the translucent portions. When this position has been found the relative intensities of the two sources may be calculated from the law of inverse squares. To facilitate the observations the bar or track upon which the paper screen is mounted is divided into a convenient number of equal parts.

The sheet of paraffined paper, technically known as the Bunsen disk, is usually mounted in a wooden box with blackened walls (the photometer carriage), which slides or rolls along the track between the sources of light. Two small mirrors ( $M$  and  $M'$ , Fig. 5), mounted obliquely within the box, enable the operator to observe simultaneously the two faces of the paper ( $O.O.$ ).



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In practice the paper is frequently used with an oiled central disk, the remainder of the surface being rendered translucent by treatment with oil or paraffine. To avoid the use of oil or paraffine which gives a surface which soon becomes soiled from dust in the air, two similar paper screens are sometimes employed. Identical portions, in form either a disk or a star, are cut out from the centre of each. A sheet of tissue paper placed between the two then affords a translucent region which takes the place of the oiled paper of Bunsen's original device.

The various forms of photometer already described and all others which depend upon the power of the eye to detect slight inequalities of illumination are essentially of equal sensitiveness. They are all limited by the sensitiveness of the eye and approach the maximum degree of delicacy as we fulfil more and more nearly the conditions under which the eye can be used to the best advantage. All forms of the Ritchie and Bunsen photometers, of each of which many modifications have been devised, are, however, subject to a peculiar source of error. It is found that when two sources of light, the relative intensities of which are known, are compared by means of such photometers, observers will persistently set the instrument to a false position. The majority of observers find apparent equality at a position toward the left-hand source. The errors which are constant for a given observer, however great his experience, range from 1 per cent to 10 per cent. They appear to be analagous to the errors which occur when one endeavors to bisect a straight line by the eye without the use of instruments. The existence of this personal error has led to the substitution, whenever extreme precision is desired, of a form of photometer in which only one eye is used and in which the conditions of maximum delicacy are more completely met than in any of the earlier types of instrument.

The photometer in question was invented by Lummer and Brodhun. In this photometer as in the instruments of the Ritchie and Bunsen types, the two sources of light to be compared are mounted at the end of a graduated bar or track. Upon this runs the photometer carriage, the essential features of which are as follows:

1. An opaque screen ( $O.O$ , Fig. 6) upon the whitened faces of which the light from the two sources shines; each face of the screen being illuminated exclusively from one of the sources of light.

2. The device by which both faces of the screen can be observed simultaneously without the use of both eyes. This consists of two precisely similar mirrors  $M, M'$ , mounted facing each other within a dark box not shown in the diagram. The diffusely reflected rays from the screen reach these mirrors at an angle of  $45^\circ$  and are reflected as shown in the figure. Where the reflected rays cross each other at an angle of  $90^\circ$ , is placed an ingenious arrangement technically known as the Lummer-Brodhun *body*, ( $BDEF$ ) which consists of two right-angled reflection prisms placed with oblique faces together so as to form a cube. The face of one of them is, however, cut away so that contact occurs only over a small circular space in the middle of the face. Light from the source  $S$

(Fig. 6) diffusely reflected from the left hand face of the screen and received upon the mirror  $M$ , enters the *body* through the face  $AB$ . Those portions of the beam which reach the central face of contact pass through uninterrupted, while all other portions are intercepted by total reflection within the prism. Light from  $s$ , diffusely reflected from the right-hand face of the screen, is reflected by the mirror  $M'$  to the face  $DE$  of the *body*. Those portions which fall upon the central area of contact pass through, but the surrounding portions are totally reflected and leave the *body* in paths parallel to and surrounding the path of the transmitted beam which has come through the face of contact from the mirror  $M$ . Observations are made by means of a small telescope  $T$ , the field of view of which consists of a disk of light coming from  $S$ , surrounded by a ring of light from  $s$ . If the illumination of the side of the screen facing  $s$  be brighter than that upon the opposite face of the screen, which receives its light from  $S$ , one sees a bright disk of light surrounded by a dark ring. When the position of the photometer carriage upon which the screen, mirrors, body and telescope are mounted is moved to a position such that the two sides of the screen are equally illuminated, disk and ring are equally bright. The distances from the two sources are then read upon the scale of the photometer bar and the relative intensities of the sources are computed. The accuracy of this form of photometer depends upon the following conditions: (1) The opaque screen must stand in the line joining the two sources of light. (2) Its two faces must be identical in character both as regards color and power or diffuse reflection. (3) The mirrors  $M$  and  $M'$  must be identical as regards reflecting power and must be symmetrically placed. (4) The Lummer-Brodhun body must be optically perfect so that transmission through the faces of contact will be complete.

The construction of the instrument is such as to permit of reversal by revolving the whole apparatus upon a horizontal axis through  $180^\circ$ . The face of the screen which previously was lighted from the source  $S$  by means of the mirror  $M$  and the prism  $ABG$  now receives its light from  $s$  and *vice versa*. Any lack of uniformity in the two sides of the apparatus is thus readily detected and can be eliminated.

*Standards of Light.*—When, owing to the development of the gas industry, the art of photometry began to take on commercial importance, it became necessary to have recognized standards of comparison. The standard adopted in France was a vegetable oil lamp with mechanical draft burning colza-oil and known from its inventor as the *Carcel lamp*. The dimensions of the lamp were carefully specified together with the form and size of the chimney and the amount of oil (42 grams an hour) to be consumed.

In England the light-unit adopted by gas manufacturers and subsequently legalized by the Board of Trade was the light given by a candle. The British standard candle was made of spermaceti. It was slightly conical in shape for convenience in molding and of such size ( $\frac{9}{10}$  inch in diameter at the bottom, 10 inches long and  $\frac{8}{10}$  inch in diameter at the top) as to consume 120 grains of wax per hour. The wicks



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were made of three strands of cotton, each strand consisting of 18 threads.

In Germany the manufacturers of illuminating gas adopted as their standard a candle of paraffin. This candle, which is known as *Vereinskerze*, had a diameter of 22 mm. The wick consisted of 25 strands of cotton. The height of the flame when burning normally was 50 mm. In Munich the legalized standard agreed upon be-

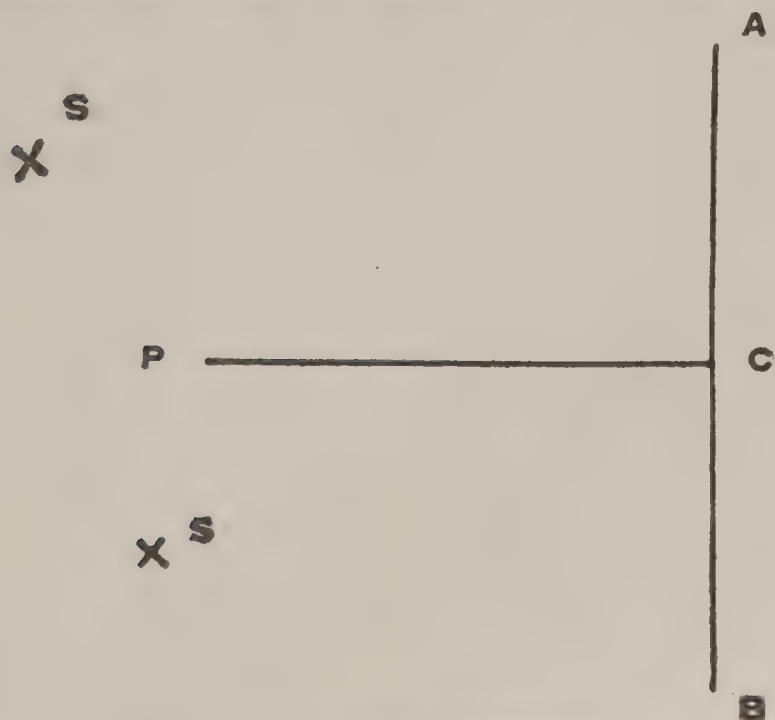


FIG. 1.—Bouguer's Photometer.

tween the city and the gas company was the light from a stearine candle slightly conical in form, of a mean diameter of 20.5 mm., the height of the flame being 56 mm.

The practical advantage of the candle as a light unit, which consists in the fact that it is a form of light with which the public is familiar, led to the introduction in France of a standard candle known as *la bougie de l'étoile*. This was a stearine candle consuming 10 grams an hour. Its light was approximately equal to  $\frac{1}{7}$  of a carcel. The height of the flame was 52.5 mm.

Extended studies of the performance of standard candles and countless attempts to determine the relative intensities of the various forms legalized in the different countries have only served to demonstrate the inadequacy of this source of light even when prepared with the utmost care, to serve as a standard in photometry. Almost the only advantage such a unit possesses is found in the fact that the term *candle-power* has a familiar sound to the public.

The range and character of the fluctuations of the British standard candle may be seen from the curve in Fig. 7 which is taken from measurements made by Sharp & Turnbull ('Transactions of the American Institute of Electrical Engineers,' Vol. 13, page 145, 1896). The curve covers a period of 60 minutes during which the brightness of the candle was observed at intervals of 30 seconds. It will be seen that the intensity of the flame is subject to frequent fluctuations often amounting to more than 10 per cent.

The altogether unsatisfactory performance of the various forms of standard candle has led to numerous attempts on the part of photometrists to find a more reliable standard of light. A form of standard lamp introduced by Methven (1878) and consisting of an Argand burner for ordinary illuminating gas with a metal screen which cuts off all but the central portion of

the flame has been extensively used in gas photometry. The tests of this standard have shown, however, that it is subject to variations but little less than those of the candle, owing to the variable character of the gas employed. In 1877 Harcourt introduced a standard lamp in which the petroleum product known as pentane is the fuel employed. This substance which is obtained by fractional distillation cannot be readily obtained in complete purity, but the distillate which boils off at 50° C. consists largely of pentane with a small proportion of other closely allied hydrocarbons. The liquid is highly volatile and in the Harcourt lamp the vapor is ignited at the end of a metal tube extending about two inches above the wick. A modified form of the pentane standard lamp is extensively used in gas photometry in the United States and is said to give excellent results.

If a luminous flame is to be the standard it is essential to find a fuel of known and definite composition and to devise a lamp which will insure its combustion under uniform conditions. Extensive experiments with lamps burning vegetable and animal oils and with a variety of petroleum lamps have only demonstrated the necessity of a proper fuel.

One of the few available fuels of known chemical composition is amyl acetate. A standard lamp in which this liquid is used as the combustible was described by Hefner-Alteneck in 1884 (*Elektrotechnische Zeitschrift*, 1884, page 20). The performance of this lamp was so promising that it was, after thorough and systematic study at the Imperial Physico-technical Institute in Charlottenburg, reduced to standard form. The modified type of amyl-acetate lamp thus produced has become recognized as the most reliable and desirable form of primary standard thus far proposed.

The Hefner lamp in the final form given it, as the result of the experiments made in Charlottenburg, consists of a cylindrical body of brass upon which is mounted the wick tube. This is a vertical tube of German silver, the height,

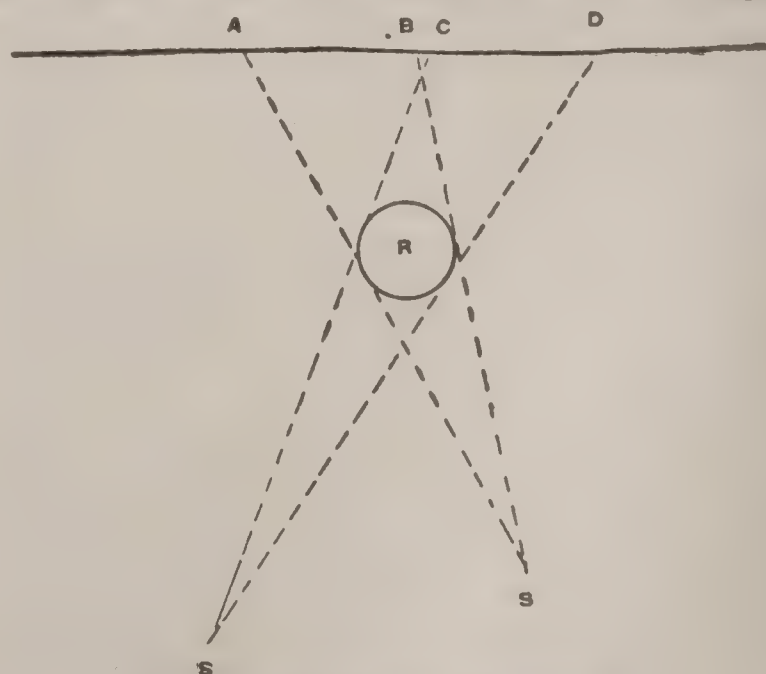


FIG. 2.—The Shadow Photometer.

diameter and thickness of wall of which are accurately specified, and the dimensions and details of construction of which must be followed with precision if the intensity of the flame is to agree closely with the standard. Upon the accuracy with which it is possible to follow these specifications, in metal working, the performance of the lamp depends. Lamps which are



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faithful copies of those upon which the original investigations were carried out, give results far more consistent as to intensity of light than have been attained with any other form of standard in which a flame is used, and it is this complete and accurate reproducibility which has caused the Hefner lamp to be adopted as the best available primary standard. The light-giv-

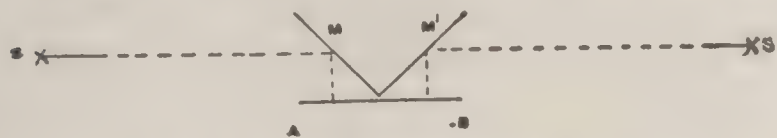


FIG. 3.—The Ritchie Photometer.

ing power of the flame of this lamp, like that of all flames, varies not only with the composition of the combustible but likewise with the height of the flame and with the amount of moisture in the surrounding air. The relation between flame-height and intensity as determined by Liebhenthal to whom our knowledge of the performance of the Hefner lamp is chiefly due, is shown in the following table:

Flame heights	Intensities
20 mm.	0.38
25 mm.	0.55
30 mm.	0.70
35 mm.	0.85
40 mm.	1.00
45 mm.	1.12
50 mm.	1.25
60 mm.	1.50

To determine the height of the flame a gauge, which consists of a lens throwing a magnified image of the tip of the flame upon a disk of ground glass is mounted with its axis 40 mm. above the top of the wick-tube as shown in Fig. 8. The character of the wick does not affect appreciably the intensity of the flame.

A precise relation between the intensity of the Hefner unit and the various standard candles cannot, owing to the inconstancy of the latter, be said to exist. Since, however, candle-power is still the term according to which nearly all artificial sources of light are rated it has been found necessary to adopt some definite ratio. The photometrists of the Physico-technical Institute, using numerous data obtained by various observers, found as a mean value, 1 Vereinskerze = 1.2 Hefners; also 1 British Standard Candle = 1.14 Hefners, or 1 Hefner = .877 B. S.

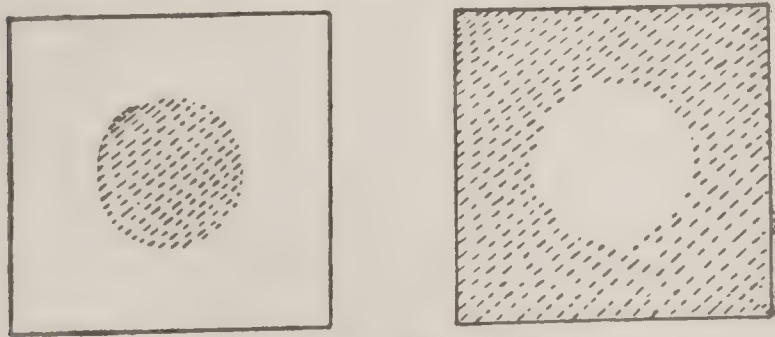


FIG. 4.—The Bunsen Disk.

Candles. Schiele from extensive measurements found 1 Hefner = .881 B. S. Candle. It is probable that the factor .88 gives as fair a ratio representing the average performance of the candle as can be obtained.

Another substance of definite composition the flame from which would be a very desirable standard of light is acetylene. The advantage of such a flame over that of the amyl-acetate lamp, the ruddy color of which makes comparisons with the brilliant sources of light used in modern illumination, uncertain, lies in the fact

of its far greater intensity and whiteness. Unfortunately acetylene on account of its richness in carbon will burn without smoking only when mixed, before escaping from the burner, with a considerable amount of air. In all practicable forms of acetylene burners thus far devised the openings for the egress of the gas are very small. It is on this account difficult to produce burners all of which will give precisely the same candle-power. Owing likewise to the minuteness of these apertures the burner is subject to partial choking by small particles of lime, etc., deposited from the gas. Thus the amount of gas flowing under a given pressure is reduced and what is quite as serious, the proportions of the mixture of acetylene and air upon which both the brightness and the color of the flame depend is changed. Because of the difficulty of burning acetylene under completely controllable conditions; there is at the present day no standard burner for use in photometry, but as a secondary standard, subject to repeated comparison with some reliable primary source, the acetylene flame has been found to be of great value.

Incandescent solids maintained at a constant temperature by the action of the electric current

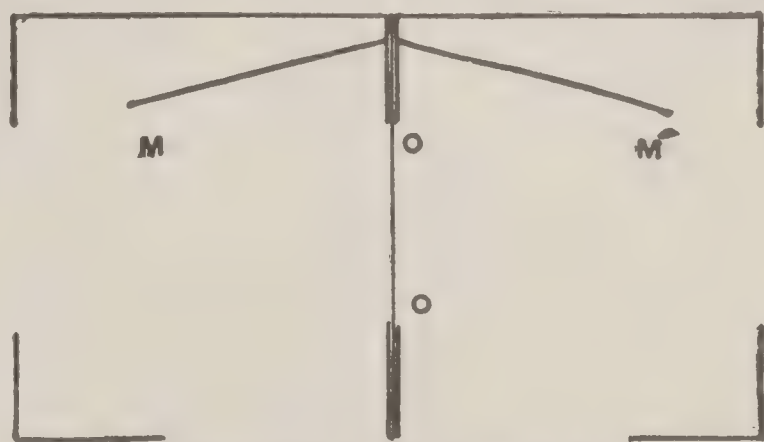


FIG. 5.—Mirrors and screen of Bunsen Photometer.

would seem to offer possibilities for the construction of a light standard free from the objections to which all standard flames are necessarily open. Numerous attempts to produce light standards based upon this principle have been made; the most noticeable being that of Violle. Violle's device consisted of a mass of platinum brought to its melting point by the action of the current. He proposed to define as the standard the light from a square centimetre of the surface of the metal at the temperature of solidification. The advantages of a standard capable of such rigorous definition was so obvious that the electrical congress assembled at Paris in 1881 appointed a committee to determine the question of its practicability. Extended experiments at their hands and on the part of the members of the Imperial Technical Institute in Charlottenburg have unfortunately led to the conclusion that the platinum standard cannot, with the means ordinarily at command, be made to give constant results.

In the meantime studies of the performance of the ordinary incandescent lamp have shown that we have in it, when properly prepared and handled, a source of light better adapted as a working standard than any other at present available. The carbon filament heated in vacuo by means of a constant current is subject to changes of illumination only as the result of the slow disintegration of the carbon or of gradual loss



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of vacuum in the bulb surrounding the filament. By the use of storage batteries supplemented by the regulation of a resistance in the circuit it is possible to maintain the filament of an incandescent lamp in a state of incandescence, the constancy of which leaves little to be desired. Given one such lamp, the intensity of which is known or is arbitrarily taken as the unit, it is possible to determine the voltage at which other lamps have the same intensity, so that it is possible to make copies of the original which, whenever subjected to current at the proper voltage, will return to the intensity at which they were when the comparison was made. Thus while it is not possible to construct incandescent lamps which shall at a prescribed voltage give a definite illumination, it is on the other hand possible by comparison of such lamps with a given standard to find the various voltages at which they will have equal intensities.

The use of the incandescent lamp does not fully solve the problem of the standardizing of light sources; for the determination of the lamp from which the copies are to be made must be

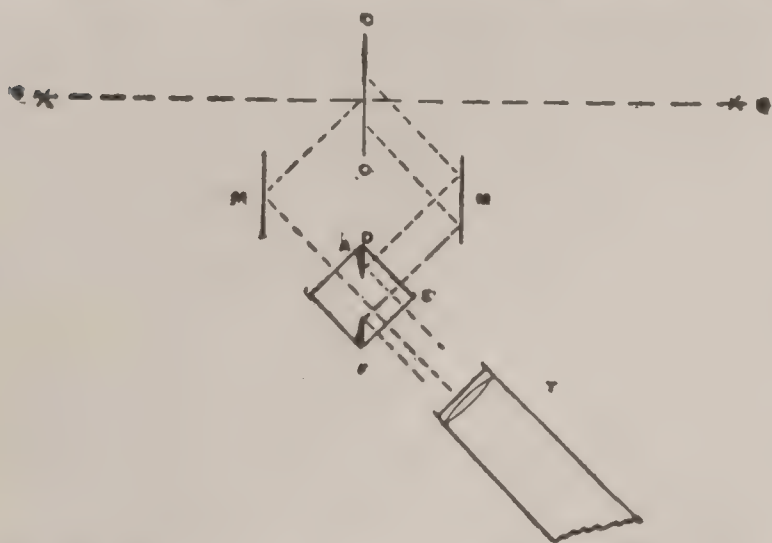


FIG. 6.—Diagram of the Lummer-Brodhun Photometer.

by reference to some primary standard such as the Hefner lamp. Having once adjusted one incandescent lamp to agreement with the standard, however, one may make copies of these which will agree with one another much more closely than any two Hefner lamps or than a single Hefner lamp upon successive trials will agree with itself. If one were to start anew, with the Hefner lamp as a standard, and make another set of standardized incandescent lamps, these, though highly uniform, might show no better agreement with the former set than that which one can obtain in subsequent trials with the lamp itself. Such variations of the Hefner lamp amount to about 2 per cent.

The province of the art of photometry does not end with the determination of the intensity of the light sent out in a given direction from any source. One of its chief purposes is to enable us to deal definitely and intelligently with the problems of illumination, and these are complicated by the fact that, in general, sources of light do not radiate with equal intensity in all directions. The accepted unit of illumination among photometricians on the continent of Europe is the *lux*, which is the illumination received from a source of unit intensity at a distance of one metre. The unit source in this definition is the Hefner lamp already described, so placed that the light is received from it in the horizontal plane. The term *bougie-metre* is also used in

speaking of this unit of illumination. The term *bougie* (or candle) in this definition is not any of the standard candles already described but a hypothetical candle equal to the Hefner. In countries where British measures are still in vogue a unit of illumination frequently employed is the *candle-foot* which is the illumination afforded by a British standard candle placed at a distance of one foot from the illuminated surface.

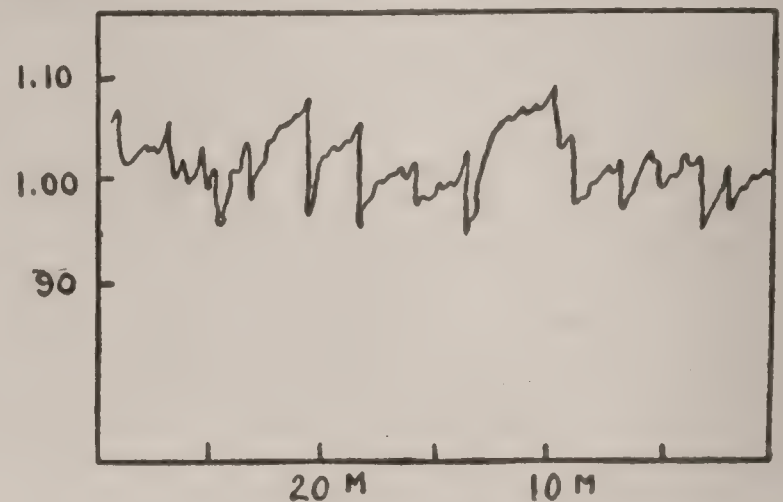


FIG. 7.—Fluctuations of a British Candle.

The distribution of light from the various sources used in artificial lighting is far from uniform, and it is necessary therefore in order to give a complete description of the lighting power of any source to determine the intensity of the source as viewed from all possible directions. In the case of certain sources of light such as the incandescent electric lamp this is easily accomplished by mounting the lamp at the end of the photometer bar in a holder so constructed so as to permit of rotation about both a vertical and a horizontal axis without displacing the centre of the lamp from its position. In the case of other sources, such as the arc lamp and most

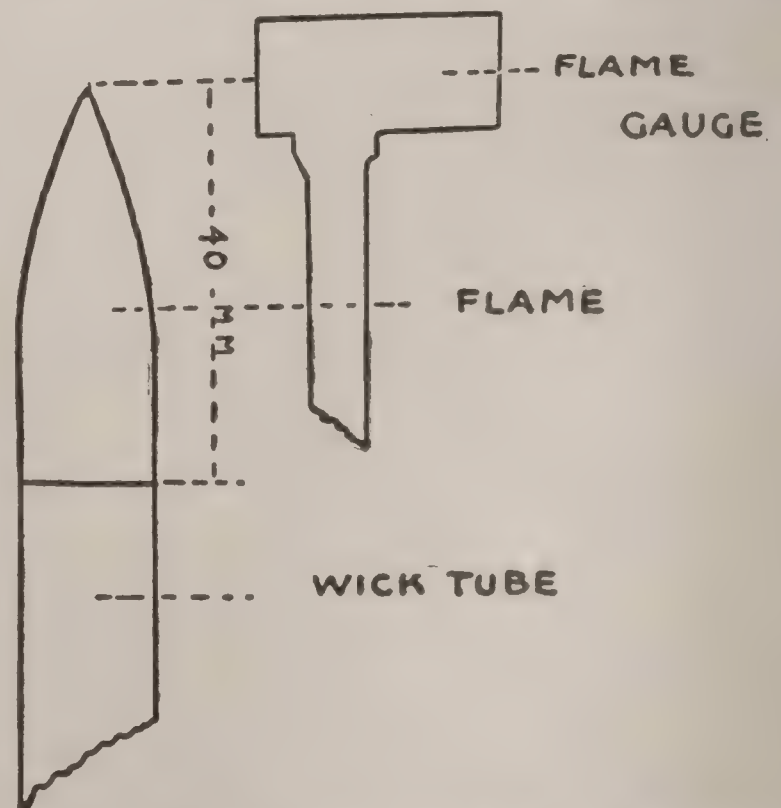


FIG. 8.—Wick tube, flame and gauge of the Hefner lamp.

flames, which cannot be tipped from the vertical without modifying the distribution of light or interfering with the performance of the lamp, it is necessary to have recourse to a mirror, placed in the axis of the photometer bar, by means of which light can be reflected along the bar. By varying the angle of the mirror the



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light can thus be viewed from any desired direction. Corrections must of course be made for loss of light at the surface of the mirror.

The results of the exploration of the field of light around a given source are usually expressed by means of curves. The curve showing the distribution in a horizontal plane is called the curve of horizontal intensities. The corresponding curve for any vertical plane is a curve of vertical intensities. In Fig. 9 are given

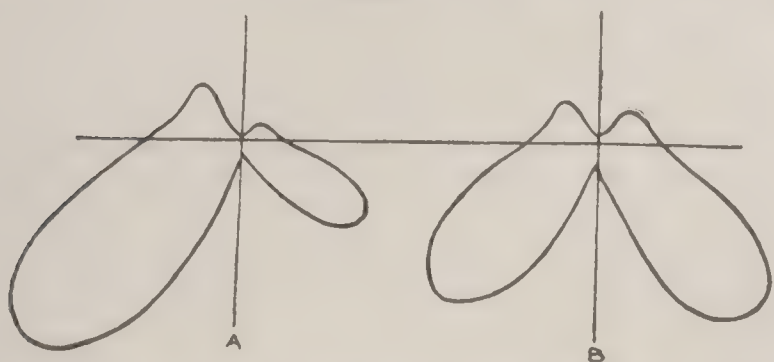


FIG. 9.—Curves of vertical intensities (open-arc lamp).

two typical curves of vertical intensities from measurements of an open-arc lamp without shade. Fig. 10 is a diagram showing the illumination of the ground at different angles when such a lamp is used in street lighting. When the curve of horizontal intensities is a circle, a single curve of vertical intensities suffices to completely describe the performance of the source of light; when, however, as is usually the case, the curve of horizontal intensities is not a circle, the curve of vertical intensities will vary in form as the vertical plane to which the curve applies is revolved about a vertical axis through the centre of the source of light. The average intensity of a source of light viewed in the horizontal plane is called the *mean horizontal intensity*. The average intensity, taking into consideration every possible point of view, is called the *mean spherical intensity* of the source.

The rigorous determination of either of these quantities in the case of unsymmetrical sources would take an infinite number of readings. In the case of the incandescent lamp, which will permit of such treatment, it is, however, possible to obtain the mean horizontal intensity by rotating the lamp upon its vertical axis at the end of the photometer bar. Measurements made upon the lamp revolving thus at a speed of several revolutions per second are found to agree well with the mean horizontal intensity as determined by plotting a series of readings, taken from different positions at a horizontal plane with the lamp at rest, and integrating the curve thus obtained. The approximate determination of mean spherical intensities of nonsymmetrical sources such as the arc lamp, when made with the ordinary photometer and mirror, involves the taking of many individual readings. In the Franklin Institute tests, made at the Electrical Exhibition in Philadelphia in 1885, 65 measurements were made in each determination and these were combined in computing the main spherical intensity. These readings were made from 38 directions distributed as evenly as possible around a sphere of which the light was the centre. To avoid this laborious process numerous special forms of photometer have been devised of which the most successful is that invented by Matthews and used in the extensive studies of the arc light recently carried on under the auspices of the

National Electric Light Association. In this instrument which is known as Matthews *integrating photometer* 24 large mirrors are arranged around the source, the mean spherical intensity of which is to be determined, in such a way as to produce upon the photometer screen an illumination proportional to the mean spherical intensity. The adjustment of these mirrors is such as to direct simultaneously toward the photometer the beams of light which the eye of an observer would receive if he were to view the source successively at angular intervals of  $15^\circ$  in a vertical plane. The intensity of the light received in these various directions must further be reduced in the ratio of the sine of the angle between the direction of view and the vertical, and this is done by the interposition of glasses which are smoked until they transmit the desired proportion of the light falling upon them. With this instrument the photometer gives by a single reading a value proportional to the mean spherical intensity of the source.

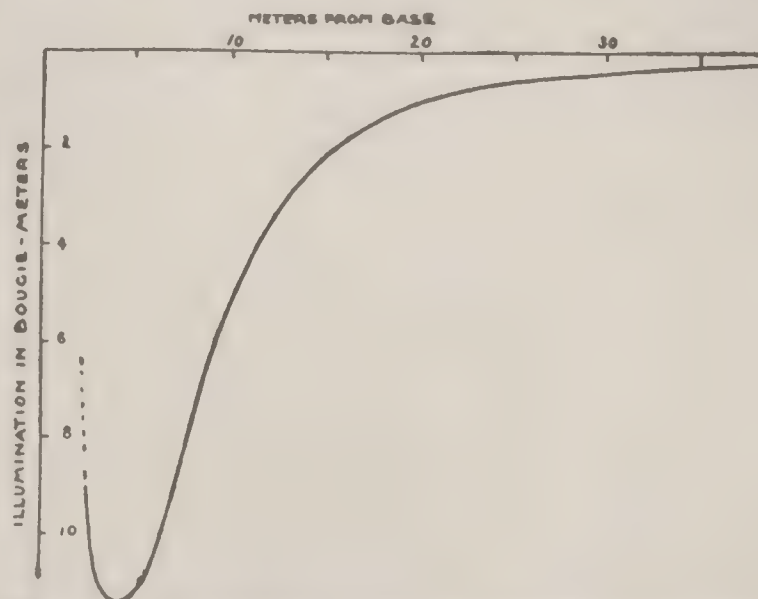


FIG. 10.—Illumination from an open-arc street lamp.

*Bibliography.*—Palaz, 'La Photometrie Industrielle' (translation by Patterson); Stine, 'Photometrical Measurements'; Bell, 'The Art of Illumination.' See also the reports of the committee on photometry in the 'Proceedings' of the National Electric Light Association; various papers in the 'Transactions' of the American Institute of Electrical Engineers, in 'La Lumière Electrique,' in the 'Elektrotechnische Zeitschrift,' and in 'Schilling's Journal für Gas- und Wasserversorgung.'

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**Pho'to-phone**, the name given an apparatus for transmitting articulate speech to a distance along a beam of light. It was first described in 1880 by Professor Graham Bell, known in connection with the telephone, at the Boston meeting of the American Association; but already in 1878 its inventor had announced the possibility of "hearing a shadow" by means of a similar agency. The success of the photophone depends on the peculiarities of the metal selenium. Crystalline selenium offers a high degree of resistance to the passage of an electric current; it is eminently sensitive to light; and the resistance is less when exposed to light than in the dark, being in some cases only a 15th in the light of what it is in the dark. Professor Graham Bell, his friends and assistants devised some 50 forms of apparatus, for so varying the trans-



## PHOTO-SCULPTURE—PHOTOTHERAPY

mission of light to prepared selenium as to produce audible sound. In the photo-phone found most serviceable the transmitter is a plane mirror of silvered microscope glass or thin mica; the receiver, fixed at a distance without any connection, is a parabolic reflecting mirror, in the focus of which is placed a sensitive selenium "cell," connected in local circuit with a battery and telephone. When the apparatus is used, a strong beam of light is concentrated by a lens in the plane mirror; the speaker directs his voice against the back of this mirror, which is thrown into vibrations corresponding with those of the voice. The reflected beam of light, to which corresponding vibrations are also communicated, is directed through a lens to the receiving mirror, and creates in the selenium cell a rapidly variable current, which at the end of the telephone attached becomes audible again as vocal sound. When first described, the photophone had been used effectively with a distance of 230 yards between transmitter and receiver. The rays of the oxyhydrogen light, or of an ordinary kerosene lamp, suffice for transmitting articulate speech. The loudest sounds obtained from the photo-phone were produced by means of a perforated disk, noiselessly revolving so as rapidly to interrupt the light in transmission. It was also found that a very audible sound could be procured from the selenium without the aid of telephone and battery. A beam of intermittent light will produce a strong musical note from the selenium. Further experiment showed that selenium is not the only substance thus sensitive to light. Still louder sounds than these obtained from the selenium directly, though not articulate, were got from diaphragms of hard india-rubber and of antimony; and sounds of varying intensity were given out by many other substances, including gold, silver, platinum, copper, zinc, lead, paper, parchment, and wood.

**Pho'to-sculp'ture**, a novel process used by sculptors for producing statuettes by the aid of photography. It was invented by M. Villème, a French sculptor. The model stands, in a studio of special construction, in the centre of a circle of 24 cameras, by all of which he is photographed at the same moment. The 24 negatives are then projected in succession on a screen by means of an optical lantern, and the artist goes over the outline of each with the tracer of a pantograph, a cutting tool acting upon a lump of modeling clay, mounted upon a turn-table, being substituted for the usual pencil. After each photograph is gone over, the clay is turned through 15°, and after a complete revolution it is removed and finished by hand.

**Pho'tosphere**, in astronomy, the luminous envelope, supposed to consist of incandescent matter, surrounding the sun. See SUN.

**Pho'tother'apy**, the treatment of disease by light—sunlight and electric light. (For treatment by the Roentgen ray or X-ray, see RADIOTHERAPY.)

From the very earliest times sunlight has been considered an important aid in the preservation of health. The ancient Greeks and Romans exposed their naked bodies to the sun in the open air to recruit mental and physical energies, and built balconies or terraces (*solaria*) on the roofs or southern walls of their dwellings,

so that the occupants could sun themselves. Exposure to the sun's rays was also adopted by the physicians of those times as a remedy for many affections, "especially dropsy, inflammation of the kidneys, and paralysis." Celsus, the Latin writer, recommended for those with weak digestion a house "well lighted, having the winter sun"; but while he and Galen advocated sunlight as a remedial agent they pointed out the evils resulting from excessive insolation. Much has been written within the last century on the remedial value of sunlight. In 1815 Cauvin presented a thesis "on the benefits of insolation"; prior to 1820 Ebernier, Girard, and others discussed the effects of sunlight on animal life; and in 1847 Richter, at Göttingen, wrote on "insolation, or the power of the sun on the human body." In 1848 Perreira spoke of solar light as a "vivifying and vital stimulus," adding: "In maladies characterized by imperfect nutrition and sanguinification, as scrofula, rickets, and anæmia, and in weakly subjects with œdematous limbs, free exposure to solar light is sometimes attended with the happiest results."

The importance of light for healthy growth and development has been recognized by sanitarians for many years. Solaria or sun-rooms are a part of some modern hospitals. Houses and rooms receiving little or no sunlight are unhealthful. In a military barrack at St. Petersburg the mortality was three times greater on the dark than on the light side of the building. Animals and plants living in the dark become bleached, as is celery. Clinical observations show that a want of sunlight produces depression of spirit, lack of energy, loss of appetite, disturbance of digestion, turbid urine, and a kind of homesickness. The face becomes pale (etiolation), the blood is thin, the red corpuscles are diminished, pulse is frequent and weak, palpitations of the heart occur on the slightest exertion, there is muscular debility, little recuperative power, and an increased susceptibility to contagious diseases.

Interesting experiments and observations have been made as to light, by Becklard, Becquerel, Draper, Edwards, Gardner, Hunt, Landgrebe, Hammond, and others; but, as one of the writers observes, "we do not know what is the exact effect produced by light. Does it," he inquires, "act directly, or is its only effect to modify the intensity of certain functions, such as respiration?" Later Edward Smith proved that light is a powerful stimulus to respiration, that "under the influence of daylight one third more atmospheric air enters the lungs than under darkness or even under exposure to artificial light." Hence the vigor of the "ruddy, healthy peasant who retires to rest with his cattle and is up with the lark" is believed to be mainly due to the thorough oxygenation and subsequent reddening of the blood by much contact with oxygen in the light and air of the day. Where direct sunlight cannot be obtained in rooms, reflected sunlight by means of mirrors has been found serviceable, in the maintenance of health. A room with a southern exposure is desirable. Sternberg and others have shown that bright sunlight, independently of the heat of the sun, is germicidal, destroying various pathogenic organisms, sometimes within a single hour. Sunlight is thus an important disinfectant. The sterilizing influence of light in



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the purification of water and sewage has been repeatedly proved (see STERILIZATION). But the fact that the germicidal property of light chiefly depends on its blue and violet rays was proved by Finsen near the close of the 19th century. It has been recently stated that the strongest sunlight has too feeble bactericidal properties for therapeutic purposes; for example, it does not kill bacterial skin-disease in the summer; but a concentrated focused light, transmitting as many blue, violet, and ultra-violet rays as possible, such as the concentrated electric light of Finsen, is necessary. This light kills bacteria in a few seconds when spread on a thin film of agar. But Angell in 1878 had reported cases of acne speedily cured "by exposure to direct and entire sunlight."

Light has long been considered a complex agent. It has been known that the sunbeam is resolvable into rays of various colors (violet, indigo, blue, yellow, green, orange, red), which embody luminosity, heat, and actinism, the chemical property of light. It was known that the red rays of the spectroscope were heat-rays; that the rays toward the violet side were actinic or chemical; that luminosity was strongest in the orange and yellow rays. Later it was discovered that there are invisible heat-rays beyond the red, and actinic rays beyond the violet, and these were called ultra-violet. About 1845 Gardner and R. Hunt experimented with the rays separated by a prism, and ascertained some interesting facts as to the effects of blue, yellow, and violet rays upon vegetation. Ponza, an Italian physician, found blue and violet light to be soothing to the insane. Gen. Alfred Pleasanton, in his advocacy of blue light as an invigorator, claimed too much for it, and the "blue-glass" craze died out. Most physicians believed that treatment by isolated rays of light did not possess "very essential therapeutic value." A few clung to the idea that if the excess of heat and light could be eliminated the actinic rays might be of value.

It was reserved for Niles R. Finsen, a physician of Copenhagen, in 1895, to utilize scientifically the constituent or spectroscopic elements of light as therapeutic agents. In 1832 Pictou of New Orleans, published a pamphlet proving that the absence of light would prevent supuration and pitting (scarring) in smallpox, and recommended that the eruption should be protected from air and light. Finsen, by numerous experiments on worms and insects, convinced himself that under red light they were comfortable, and under blue light were irritated. Then reading Pictou's pamphlet, he inferred and advised that keeping smallpox patients in a red light would be as efficacious as darkness in preventing pock-marks by excluding the irritating actinic rays. If the skin is protected against the chemical rays inflammation will diminish and suppuration be prevented. In August 1893 Svendsen in Norway and in November 1893 Benckert in Sweden used the red-light treatment with smallpox patients, and found that suppuration was abolished, scars were rare and insignificant, and the disease was shortened. Even a very little daylight admitted to the room did harm, so sensitive was the inflamed skin to the actinic rays. In mild cases a clear red light was found sufficient; in severe cases a deep red light was necessary. Having proved that red light was inimical to the germs of smallpox and

other eruptive diseases, Finsen turned his attention to the effect of decomposed light on other germ-diseases, especially lupus. He proved (1) that the bactericidal action of light is practically limited to the blue, violet, and ultra-violet rays, and is greatly intensified by concentrating the rays by means of a suitable apparatus; (2) that the actinic rays so concentrated will penetrate the skin to a small degree and will go deeper if the red blood be pressed out of it—hence they would be of value in superficial cancer, baldness of microbic origin, acne, etc.; (3) that they have power to produce an inflammation of the skin (*erythema solare*). Finsen's first case of lupus was successfully treated in 1895, with an ordinary arc electric light and a hand-lens, the red and ultra-red rays being filtered out through blue water. He then devised and used a sun-apparatus consisting of two lenses of glass, one plain, the other convex, framed in a brass ring, mounted on a stand, and which admitted of adjustment and focusing. Between the lenses was a bright blue weak ammoniacal solution of copper sulphate. Discovering that the ultra-violet rays were more efficacious than the violet in killing bacteria, he abolished the blue-water filter which prevented the ultra-violet rays from passing, and used clear distilled water, which sufficiently absorbs the red and ultra-red burning rays. Lenses of clear quartz-crystal were substituted for those of glass, it being found that they are better heat-filters and allow the chemic rays to pass almost unimpaired. As sunlight could not be depended upon for regular and systematic treatment, Finsen turned to the electric light.

The Finsen apparatus as now constructed consists of an arc-lamp, of from 40 to 80 amperes, and one or more telescopic tubes of brass for concentration and focusing. Each tube closed is 3 feet 4 inches long and can be extended 10 inches. The head-piece of the tube has two plano-convex lenses of quartz-crystal, one with the convexity toward the light, the other with the plane surface in contact with the plane surface of the first lens. Toward the lower end of the tube there is a chamber for distilled water, designed to diminish the heat-rays not eliminated by the crystal lenses. The light-rays, emerging from this bath, are concentrated by another quartz-crystal plano-convex lens at the distal end of the tube upon the surface to be treated, the convex surface of the lens being toward the patient. To enable the rays to penetrate the surface more deeply by squeezing out the blood a compressor may be used, consisting of two quartz-crystal lenses, one plane, the other convex, with a chamber between having an inlet and outlet, through which water can be kept continuously flowing still further to cool the rays. This compressor is either held in place by an attendant or tied on. An improvement by Hopkins of Brooklyn admits of the adjustment of the tube on a stand to suit the case to be treated, as in uterine carcinoma.

The objections to the Finsen apparatus are the cost, the usually frequent and tedious treatment necessary—one hour a day for months—and the effects sometimes produced on the eyes. It has mainly been used in cases of *lupus vulgaris*, and *lupus erythematosus*, birth-marks, acne, and rodent ulcer.



## PHOTO-TOPOGRAPHER — PHRENOLOGY

Though Finsen's discovery may not do all that has been claimed for it, it marks a great advance, especially in the cure of lupus. Out of 456 cases treated by Finsen, 130 were cured; the disorder had not recurred in from one to five years. Cases of abdominal malignant cancer have been successfully treated in this country. It is claimed by originators of improved apparatus that as much can be done therewith for lupus in 20 minutes as Finsen effected in an hour or more, that only 30 amperes, instead of 80 are necessary, and that one application in several days is sufficient.

The Minim light, suggested by Minim of Saint Petersburg, which is an ordinary incandescent light, covered by a bulb of natural blue glass, with a reflector, has proved valuable in the treatment of various forms of ulcers, in *alopecia areata*, in contusions, and in other acute injuries. Minim also offers this light as a substitute for the Finsen light in lupus.

Doctor Hopkins of Brooklyn, claims the treatment by the light of the Hopkins lamp is a cure for pulmonary tuberculosis in the first stage, as well as for many cases in the second stage, and that it has been of great comfort and has prolonged life in a number of instances in the third stage of the disease. The lamp consists of a 50-ampere searchlight in a brass cylinder, with a French condensing-lens, 18 inches in diameter. It focuses at a distance of about 12 feet. The light passes through a sectional screen of blue glass, two feet square, to cut out the heat-rays, and impinges upon the chest of the patient. Half-hour exposures to this light are found to be sufficient.

The German Light-Bath is used for treating the naked body by concentrated light. It consists of a couch in a cabinet or sheet enclosure, with two or more lamps within it comprising from 40 to 80 amperes. This bath of light has proved efficacious in malnutrition, marasmus, and various forms of debility, and in neurasthenia and other neurotic affections.

Undoubtedly, light scientifically used is destined to be an important therapeutic agent.

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**Pho''to-topog'rapher.** See SURVEYING.

**Pho''totro'pism,** same as heliotropism (q.v.).

**Phragmi'tes.** See REED.

**Phranza,** frän'zä, or **Phranzes,** frän'zās, **George,** Byzantine historian: b. 1401; d. about 1477. He was chamberlain of Manuel II. (Palæologus), and was a warrior and diplomat in the service of Constantine XIII., whose life he saved in the siege of Patras (1429). After the capture of Constantinople by Mohammed II. (1453) he escaped to Corfu, and retiring to a monastery, wrote his interesting and reliable 'Chronicon' or Byzantine history, covering the period from 1259 to 1477, and the chief authority for the author's own time. There are editions by Alter (1796) and Bekker (with Latin translation 1838).

**Phrase,** in music, a short division of a composition, in compound time sometimes contained within one measure, but usually consisting of two or more measures, closing with a half-cadence or a cadence. Two united phrases ending in a cadence form a section, and two sections,

the first terminating with the dominant, and the second with the tonic harmony, constitute a perfect musical idea. The musical phrase is analogous to the literary sentence; their proper interpretation and rendition, termed "phrasing," into which the due elements of accent and rhythm enter, is one of the distinguishing characteristics of the art of the vocalist or instrumentalist, without which any musical performance is merely mechanical. The term phrase is applied also to any short passage performed without break, and the irregular phrase qualifies a passage with any unusual number of measures. Consult Goodrich, 'Musical Interpretation' (1899).

**Phrenology** (Greek, *phren*, mind; *logos*, discourse), the science or doctrine which teaches that there exists a relation between the several faculties of the mind and particular regions of the brain, and that these are the organs of those faculties; in accordance with this theory phrenologists chart the cranium of man in sections, each section being taken to represent the seat in the brain of some definite faculty or mental or moral disposition. That the brain as a whole is the organ of mind we should incline to regard as an instinctive judgment were it not that some of the most highly gifted races, as the Hebrews, the Egyptians, nay even the Hellenes, as is proved by their vocabularies and their literature, recognized various organs and viscera as the seats of the intellective and of the emotional faculties; the heart, for example, was for the primitive Romans the seat of understanding, of wisdom, as also for the Egyptians, the Hebrews, the Greeks; but at the same time it was for them the organ of feeling and emotion. But Pythagoras (6th century B.C.) held the brain to be the seat and organ of understanding; yet Aristotle, 200 years later, taught that the heart is the master organ of life and intelligence, and that the brain is a cold, inert, bloodless organ, the sole function of which is to temper the heart's excessive heat. But for Plato the heart was the chief organ of intellect, and the great naturalists, anatomists, and physicians who lived later adhered to Pythagoras' view despite the very high authority of the Stagirite. Even in the Middle Ages when Aristotle's authority was supreme, the scholastic philosophers rejected his doctrine on this point, and Albertus Magnus in the 13th century and very many other philosophers and naturalists after him divined a localization of faculties in the brain; Albertus saw in the anterior region the seat of judgment or ratiocination, in the medial, that of imagination, and in the posterior region the seat of the memory; and his successors in a similar way distributed the seats of the several faculties of the soul in the different regions of the brain. Hence, Francis Joseph Gall, though justly accounted the founder of modern phrenology, did but revive the ancient knowledge and develop it further. He expounded his views on the subject in lectures at Vienna in 1796 and later, but in 1802 was compelled to discontinue them by order of the Austrian government prompted by the ecclesiastical authorities. Gall had already attached to himself a gifted pupil and efficient coadjutor in the person of John Gaspar Spurzheim, and the pair pursued their investigations in concert and delivered lectures on phrenology throughout France and Great Britain. In both countries they gained enthusiastic disciples not only among



## PHRIXUS — PHRYGIA

the less educated class but among the learned also — such men as Sir George Mackenzie, Archbishop Whately, Laycock, Macnish, Andrew Combe: the last named was universally recognized as the ablest expositor of the doctrine in Great Britain, and its indefatigable propagandist. Phrenological societies sprang up everywhere in England and the United States, and the principles of the science were propounded and defended in a number of periodicals, British and American, the first both in point of time and in authority being the British 'Phrenological Journal,' published in Edinburgh and edited by Dr. Combe till his death in the United States, 1847. The popular interest in phrenology which for 30 years or more was at fever heat languished and died away till now phrenological societies are heard of no more and phrenology has now but one representative in the periodical press of the United States.

Phrenology, as finally developed, is the work rather of Spurzheim and of Combe than of its first founder, Gall. Gall located 27 special faculties out of the 35 usually recognized; but to Spurzheim is due the credit of having systematized and justified Gall's data and of having enriched the science with important discoveries. Not the least of Dr. Spurzheim's merits is the improvement made by him in the nomenclature of the science: for example, when what in Gall's scheme is called *murder*, Spurzheim calls *destructiveness*, a term which is more comprehensive as well as more exact; or when of Gall's two terms *veneration* and *religion* Spurzheim retains only the first, in which the second is comprised. The 27 faculties identified by Gall are by Gall himself named and numbered as follows: 1, veneration; 2, love of offspring; 3, friendship; 4, courage, self-defense; 5, murder; 6, cunning; 7, the sentiment of property; 8, pride, self-esteem, haughtiness; 9, vanity, ambition; 10, cautiousness; 11, memory of things, educability; 12, local memory; 13, the memory for persons; 14, memory for words; 15, memory for languages; 16, colors; 17, music; 18, number; 19, aptitude for mechanic arts; 20, aptitude for drawing conclusions; 22, wit; 23, poetry; 24, good nature; 25, mimicry; 26, religion; 27, firmness of character. (The numerical figures do not apply to Spurzheim's phrenological chart.)

Spurzheim classified these faculties, propensities and other characters as follows:

### SPURZHEIM'S CLASSIFICATION AND LOCALIZATIONS.

Spurzheim recognizes two great classes of human faculties, namely:

#### I. Feelings, divided into:

1. Propensities, or predispositions only to certain kinds of acts.
2. Sentiments, or impulses which prompt to emotion as well as to action, and these are either
  - a, Lower, common to man and lower animals; or
  - b. Higher, peculiar to man.

#### II. Intellective faculties:

1. Perceptive faculties.
2. Reflective faculties.

##### PROPENSITIES.

1. Amativeness. 2. Philoprogenitiveness. 3. Concentrativeness. 4. Adhesiveness. 5. Combativeness. 6. Destructiveness. 6a. Alimentiveness. 7. Secretiveness. 8. Acquisitiveness. 9. Constructiveness.

##### SENTIMENTS: LOWER.

10. Self-esteem. 11. Love of Approbation. 12. Cautiousness.

##### SENTIMENTS: HIGHER.

13. Benevolence. 14. Veneration. 15. Conscientiousness. 16. Firmness. 17. Hopefulness. 18. Wonder. 19. Ideality. 20. Wit. 21. Imitation.

##### PERCEPTIVE FACULTIES.

22. Individuality. 23. Form. 24. Size. 25. Weight. 26. Color. 27. Locality. 28. Number. 29. Order. 30. Eventuality. 31. Time. 32. Tune. 33. Language.

##### REFLECTIVE FACULTIES.

34. Comparison. 35. Causality.

Consult: Gall and Spurzheim, 'Anatomie et Physiologie du Système Nerveux' (1810-19); Gall, 'Des Dispositions Innées de l'Ame et de l'Esprit' (1812); Sewall, 'An Examination of Phrenology' (1837); Fowler, 'Phrenology and Physiology' (1844); 'Phrenological Journal,' xxxi. 4 (1885); Donaldson, 'The Growth of the Brain' (1898); Barker, 'The Nervous System' (1899); Holländer, 'The Mental Functions of the Brain' (1901).

**Phrixus**, phrik'sūs, in Greek mythology, the son of Athamas and Nephele, and the brother of Helle. When about to be sacrificed to Zeus, he was rescued by his mother and carried to Colchis upon a ram with golden fleece.

**Phrygia**, frij'ī-a, in ancient geography, a country of Asia Minor, occupying the central plateau west of the Halys and the interior desert, but otherwise very ill-defined, since the country varied much at different times and in general was an ethnological, rather than a geographical, term, as it was applied to the district occupied by the Phryges or Phrygians. The region was broken by sharp valleys, was extremely fertile, especially on its western slope, and was rich in gold as is evidenced by the myth of its King Midas. He was said to be the second king of the country succeeding his father Gordius, a common laborer who founded the kingdom about 800 B.C. The names of Gordius and Midas are frequently repeated in the list of Phrygian kings, and this account of the foundation of the kingdom is scarcely credible. Indeed it seems that a much earlier Phrygian civilization spread over Lydia, Cappadocia, and Lycaonia as well as Phrygia, leaving behind it monuments of its peculiar art and a road system, later utilized by the Persians. Intercourse with the Greek cities of Asia Minor seems to date from the 9th century B.C., and with the European Greeks, through the colony of Sinope (founded 751) in the 8th century. But 100 years later the Phrygian kingdom was wiped out (680-670 B.C.) by the invasion of the Cimmerians, who seem to have held the country till about 620, when the Lydians conquered Phrygia, to hold it until the conquest of Lydia by Persia. Persia's downfall transferred Phrygia to Macedonia, and it became a part of Pergamus, and in 90 B.C. was incorporated into the Roman province of Asia. Phrygian slaves were highly prized among the Greeks, probably as early as the 5th century.

Ethnologically the Phrygians seem to have been closely related to the Armenians. Both were of Indo-Germanic stock, as has been proved by recent studies on the Phrygian language, which is known to us only from the



## PHRYGIAN CAP—PHYLACTERY

scanty remains of widely scattered inscriptions and a few glosses; many of the funereal inscriptions are in Greek, save for the curse at the end on him who "disturbs my bones," which was written in Phrygian. The language, like Armenian, seems to be Iranian in its affinities. Inscriptions in its peculiar alphabet, the exact value of some signs in which are still unknown, are found in Lemnos and in Egypt. Some few of its words agree almost exactly with the Greek, and many loan words from the Phrygian seem to be found even in the Homeric dialect. Most of the sepulchral inscriptions alluded to are found on tombs with peculiar conventional patterns of great boldness and skill in design, the figures being mostly of a heraldic type strangely suggestive of Oriental rugs. The most famous of these tombs are those of the early kings, including Midas, in the hills near Sangarius, all apparently mere memorials and not actual burial places. The Phrygians seem to have been essentially a rustic people, and their religion was a nature worship, in which the great divinity was Ma or Ammas, the Great Mother, also called Cybele, which seems to have meant "the mountain goddess." Her seats were Dindymus, Sipylus, and Ida, and she was the goddess of vegetation and of all life and generation. Her cult passed to Greece in the 5th century, and her black stone image was carried to Rome in 204 B.C. Closely associated with her was Attis, again a divinity of nature's powers of reproduction. Consult: on Phrygia in general and on its history, Ramsay, 'Historical Geography of Asia Minor' (1890) and 'Cities and Bishoprics of Phrygia' (1895-7); on topography and scenery, Ouvré, 'Un Mois en Phrygie' (1896); on language and inscriptions, Ramsay, in 'Journal of Hellenic Studies' (1882, 1884), 'Journal of the Royal Asiatic Society' (1883), and 'Zeitschrift für vergleichende Sprachforschung' (1887); and on archæology and myth and religion, Perrot and Chipiez, 'Histoire de l'Art dans l'Antiquité' (Vols. III. and IV., 1886, 1890), and Roscher, 'Lexikon der griechischen und römischen Mythologie,' s. vv. Attis, Kybele, Men, etc. (1884 sqq.).

**Phrygian Cap.** A cap worn by freedmen.

**Phrygian Language.** See PHRYGIA.

**Phryne**, frī'nē, famous Greek courtesan: b. Thespiae, Boeolia, in the 4th century B.C. She was named Mnesarete, but on her coming to Athens, where she became a flute player and later a hetæra, was called Phryne (literally "toad") "because of her complexion." She grew rich in her profession; and became the mistress of the sculptor Praxiteles, who modeled after her his statues of Aphrodite and made two portrait statues of her. Many stories of her are told, the most famous being that of her promise to rebuild from her own purse the city of Thebes on the condition that the city should be inscribed "Destroyed by Alexander; rebuilt by Phryne"—an offer which was declined. Quintilian is the first authority for the story of her trial before the Areopagus, in which her lawyer Hyperides, seeing that he would lose the case, drew her clothes from her breast and shoulder, showing the judges a beauty so perfect as to force them to declare her innocent. During an Eleusinian festival, another story relates that she appeared in the sea bathing in full view of

the pilgrims, a theme taken by the painter Apelles for his picture of Aphrodite Anadyomene (that is, "rising from the sea-foam"). In later art Phryne figures in a famous fresco at Pompeii and in the painting of Gérôme (1861) and in the statue by Pradier.

**Phrynichus**, frīn'ī-kūs, early Greek tragic poet. He was an Athenian, won his first tragic victory in 511 B.C., and was writing in 476 B.C., at which time his 'Phœnissæ' was presented with much pomp by Themistocles. Besides the 'Phœnissæ,' which was imitated by Æschylus in the 'Persæ,' Phrynichus wrote several works, the titles of nine others having been preserved. His 'Μιλήτου ἄλωσις,' ('Capture of Miletus'), Herodotus says, was the cause of his being fined for thus employing a national calamity, and a law against tragedies of political content. Phrynichus is said to have been the originator of several improvements in the drama.

**Phtha**, thä. See ПТАН.

**Phthiotis**, thī-ō'tīs, the southernmost of the tetrads of ancient Thessaly and since 1899 a nomos, or governmental division of the Greek kingdom. The ancient district, famed as the home of Achilles, included the region about the Othrys range between the valley of the Sperchius and the great plain of Thessaly. The present division, which before 1899 formed a nomos together with Phocis (q.v.), has now been separated; its area is about 1,800 square miles; pop. (1896) 71,025. Capital city Lamia.

**Phthisis**, thī'sīs. See CONSUMPTION.

**Phycocyanin**, fī-kō-sī'a-nīn, **Phy''coerythrin**, **Phycophæ'in**, pigments coloring the blue-green, red, and brown seaweeds respectively. See ALGÆ.

**Phycology**, that department of botany which treats of the algæ or seaweeds.

**Phycomycetes**, **Phycophytes**. See FUNGI.

**Phyfe**, fīf, **William Henry Pinkney**, American orthoepist: b. New York 13 June 1855. He was educated at Columbia and has published 'The School Pronouncer'; 'How Shall I Pronounce?'; 'Five Thousand Words Often Misspelled'; 'Five Thousand Facts and Fancies'; 'Ten Thousand Words Often Mispronounced'; etc.

**Phylac'tery** (Gr. φυλακτήριον, a receptacle for safe-keeping. The Hebrew word means "frontlet"); a sort of small box containing four passages from the Pentateuch, namely, Exodus xiii. 1-10, 11-16, Deuteronomy iv. 4-9, xi. 13-21. The phylactery or *tephillah* was a small leather case fastened to a band, and each male Jew of 13 years of age and upward wears two of them at morning and evening prayer. One is bound round the head in such a way that the case comes between the eyebrows. In this case are four compartments, each containing a strip of parchment with one of the four passages above mentioned. The other band with a simple phylactery is fastened round the left arm, the little case being turned toward the heart. The practice of wearing these *tephillin* was developed out of the commands in Exodus xiii. 9 and 16, and Deuteronomy vi. 8, and in its present form dates from about the 1st century before the Christian era. In Matthew xxiii. 5, Jesus condemns the Pharisees for making broad their phylacteries. The name phylactery, from a Greek word mean-



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ing "to guard," refers to their use as amulets for protection against demons. Consult: Beck, 'De Judæorum Ligamentis Precativis'; and 'De Usu Phylacteriorum' (1679); Townley, 'Reasons for the Law of Moses.'

**Phylæ**, fī'lē, in Greek history, the several tribes of a city or nation, each composed of men who traced their descent to a single common ancestor. The Ionians were made up of four such tribes which settled themselves in Attica, namely the Geleones, the Hopletes, the Agikores, and the Argades. They were the foundation of the Athenian state and were divided into three phratries. Solon recognized these four Old Ionic tribes. Cleisthenes organized them into 10 tribes which he called after Old Ionian heroes, and these were again divided into demes. In 307 B.C. two new tribes were added, and these in honor of Demetrius and his father Antigonus were named Demetrias and Antigonis. A 13th Hadrianis was added in honor of the emperor Hadrian (123 A.D.) The Dorians had three tribes, the Hylles, Dymanes, and Pamphytes, forming the main body of the state, and in Sparta were divided into 10 Obes.

**Phylarchus**, fī-lār'kūs, Greek historian, who flourished about 215 B.C. He was, according to some, an Athenian, according to others an Egyptian. He wrote 28 books of 'Ἱστορίαι' ('Histories'), a work apparently containing accounts of not only Greece and Macedonia, but also Egypt and other contemporary states. It covered the period from the invasion of the Peloponnesus by Pyrrhus to the death of King Cleomenes of Sparta. Polybius and Plutarch attack his credibility, yet Plutarch made extensive use of Phylarchus' work in his own lives of Cleomenes and Aratus. Only a few fragments remain.

**Phyllis**, fil'is, in Greek myth, a daughter of Sithon, king of Thrace, who from grief at the absence of her beloved Demophoon took her own life, and was changed into a leafless almond tree. When Demophoon returned and flung his arms around the tree it burst into full leaf.

**Phyl'ite**, (1) a mineral related to or a variety of ottrelite, found as micaceous scales in the mica schist of various parts of Massachusetts and Rhode Island. Hardness 6 to 7; color greenish-gray to black. In composition a hydrated silicate of iron, aluminum, and manganese. (2) A finely crystalline metamorphic rock which is a fine-grained mica schist and may be considered a transition type between an ordinary mica schist and a slate.

**Phyl'ium**. See LEAF-INSECT.

**Phyllocar'ida**, a name given by Packard to the group of crustaceans called *Leptostraca* by other authors. But a single genus (*Nebalia*) is known, a small shrimp-like form occurring in seas of moderate depth. The group is characterized by having a bivalve carapace, 21 body-segments, of which eight are in the abdomen, and leaf-like thoracic feet resembling those of the *Phyllopoda*.

**Phyllop'oda**, the most primitive group of existing crustacea. The name refers to the feet, which are broad leaflike structures, the thoracic appendages being unjointed, while those of the head are typically arthropodan. The number of segments of the body varies between very wide

limits, those of the abdomen being without appendages. In all except the *Branchipidæ*, a carapace is developed, either as a broad oval plate covering the thorax, or as a bivalve shell closed by adductor muscles like a clam. The group is divided into the *Branchiopoda* (q.v.) with numerous segments, most of the species being inhabitants of fresh water (see APUS); and the *Cladocera* (q.v.), in which the segments number less than a dozen, the species being some inhabitants of fresh water, others of the sea. Most of the fresh-water species are normally parthenogenetic (see PARTHENOGENESIS), the males appearing only at rare intervals; indeed the males of some species are unknown. Many are inhabitants of pools which dry up in hot weather; and it has been found that with some species the eggs need to be dried before they will develop. Many species lay two kinds of eggs, thin-shelled summer eggs and thicker-shelled winter eggs. In the *Cladocera* the dorsal part of the carapace serves as a brood-pouch, the eggs here undergoing their development, sometimes nourished by fluids secreted by the mother. The species of *Artemia* (see BRINE-SHRIMP) are remarkable from the fact that they live in salt springs and lakes, or in tubs and vats filled with brine, but are unknown in the sea or in fresh waters. Consult Packard, 'Text-book of Zoology' (1897).

**Phylloxera**, or **Vine-pest**, an American aphid (*Phylloxera vastatrix*), destructive to grape-vines. It has four forms; sexual, leaf-gall, root, and winged. The sexual female lays an egg upon the vines during the autumn. About the time the buds open the larva hatched from this egg forms a gall upon the upper surface of a leaf and in about two weeks commences egg-laying, soon producing from 500 to 600 eggs within the gall it has made. The young which appear in about a week disperse to other parts of the vine and form galls like the first. During the summer six or more generations are produced and the leaves may be completely covered with galls. The last brood produced before cold weather migrates to the roots where the insects hibernate until spring. During the growing season of the second year several generations of wingless females are produced upon the rootlets which swell more or less at the points of attack. In early autumn these root forms may produce winged females, which fly to the vines and lay eggs to continue the life-cycle. Often, however, no winged forms may be produced for several years, the root forms being capable of continued reproduction under favorable conditions. Flight is not the only means the insect has for distribution; it may be carried by vines transplanted from infested vineyards to new ones, by birds and insects to whose bodies the leaf form may cling; by winds which carry the leaf form either with leaves torn from the vines or otherwise; and through the crawling of the root form through cracks in the earth.

Though the insect is an American species, it has done little damage upon American varieties, since these are more resistant, probably because of the thicker bark of their roots and their robust habit of growth. But upon the European varieties of *Vitis vinifera* the root-form is especially troublesome. It was introduced into France upon American vines about 1859 and, not only in France but throughout the grape-



## PHYLLOTAXIS — PHYSICAL CRYSTALLOGRAPHY

growing sections of Europe, it quickly spread and did enormous damage. It is now known in nearly all grape-growing countries of the world. It is believed to be responsible for the failures of European varieties in America where, however, it was unknown at first except in the Rocky Mountain region and then, somewhat later in California upon European vines. Since the root form, which is seldom seen, is the destructive form, methods for combating it were rarely satisfactory. The most frequently tried were probably bisulphide of carbon injected into the soil and flooding the ground. The one preventive remedy now practised is the grafting of the European varieties upon the roots of American varieties especially those derived from *Vitis labrusca*, *V. æstivalis*, and *V. riparia*. Since this discovery was made, experiments have been made in the growing of European varieties in America, the vines having American roots, the object being to discover the cause of previous failure of the European varieties. The successful termination of these experiments will probably mean the establishment of European varieties in the East as well as upon the Pacific Coast. Consult Marlatt, 'Principal Insect Enemies of the Grape' (Washington 1898). See GRAPE INSECT-PESTS.

**Phyllotaxis**, in botany, the arrangement of leaves on a stem, three common positions being opposite, alternate, and verticillate. See LEAVES.

**Phy'sa**. See POND-SNAILS.

**Physa'lia**. See PORTUGUESE MAN-OF-WAR.

**Physic-nut**, the seed of *Jatropha purgans*, or the plant itself, a shrub belonging to the tropical order *Euphorbiaceæ*. These seeds have strong emetic and purgative properties, due to a fixed oil which is expressed and used in medicine under the name of jatropha-oil. The seeds of another species (*J. multifidus*) are called French or Spanish physic-nuts, and these yield oil of pinhoen. See JATROPHA.

**Physical Constants**. See WEIGHTS AND MEASURES.

**Physical Crystallography** treats of the physical properties of crystals, or those that depend upon cohesion and elasticity, and upon the action of radiant energy (light, heat, magnetism and electricity). In general the physical properties vary with the direction and any measurable property can be represented by a line in the given direction. These lines determine a surface which represents the physical structure of the crystal, and for most of the physical properties this surface is one of three kinds, a sphere, a spheroid, or an ellipsoid. In isometric crystals the physical properties may be represented by a sphere; they are said to be isotropic. A spheroid represents tetragonal and hexagonal crystals, which constitute the uniaxial class; an ellipsoid, orthorhombic, monoclinic and triclinic crystals, or the biaxial class. According to the property concerned we speak of optically isotropic, thermally isotropic, etc.

### COHESIVE PROPERTIES OF CRYSTALS.

**Cohesion** is the term applied to the attraction by which parts of the same substance are held together in consequence of which they offer resistance to any force separating them. Cohesion is shown in such important properties as cleavage, gliding, parting, percussion-figures, etch-figures, corrosion and hardness.

**Cleavage**, or the property of crystals breaking in certain definite directions, is a very important and easily recognized property of crystals. The smooth cleavage-faces formed are parallel to crystal faces or possible crystal faces. Thus a cubic crystal of galena can be cleaved parallel to the cube, while in a cube of fluorite the cleavage is obtained on the eight corners, that is, parallel to the octahedron, a form occasionally observed in fluorite. And so in calcite, no difference what the shape of the crystal, the cleavage is always in three directions at angles of  $105^\circ$  to each other (parallel to the unit rhombohedron). A cleavage plane is necessarily a direction in which the particles are close together because in directions normal to this the distance between the particles are comparatively great. Thus in Fig. 1 cleavage may take place in directions *a*, *b* or *m*, but we would not expect cleavage in direction *d*. Hence cleavage is more commonly parallel to crystal faces with simple indices. (See Fig. 1.) Cleavage is defined (1) by the direction, as octahedral, dodecahedral, rhombohedral, basal,

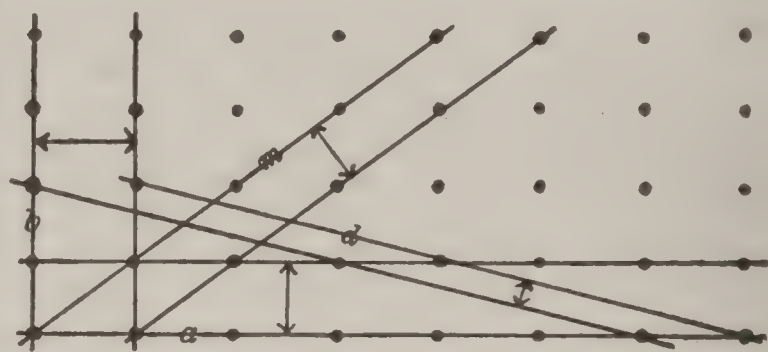


FIG. 1.

etc., (2) by the ease in obtaining and character of the surface, as perfect, imperfect, fibrous, distinct, indistinct, etc. Cleavage may be parallel to more than one crystal form and this fact is apparent from the difference in the character of the cleavage. For example, the monoclinic mineral, gypsum, has a very perfect cleavage parallel to the clinopinacoid, yielding flat plates, but these plates are rhombic in outline due to two other minor cleavages, one fibrous, parallel to the unit pyramid, the other conchoidal, parallel to the orthopinacoid. The discovery of cleavage in calcite led to Haüy's discovery of the law of rational indices and to the establishment of crystallography as an exact science.

**Gliding**.—Closely related to cleavage directions are gliding planes, directions parallel to which the particles may sometimes glide or slip when pressure is exerted in a certain direction. Thus if a slender crystal of stibnite supported at the ends is pressed downward with a dull knife edge, it is bent at this point without affecting the other parts. The fine striations or "nicks" on a cleavage face of stibnite are due to same cause—a pressure parallel to the basal pinacoid, which is a gliding plane. The gliding may be accompanied by a revolution of  $180^\circ$  bringing a part of the crystal into twinning position. Thus if pressure is applied by a dull knife blade normal to the obtuse edge of a cleavage fragment of calcite, a small portion of the calcite will be reversed in position, forming a calcite twin with the rhombohedron (0112) as twinning plane. Also a blow on a cleavage piece of calcite will result in the production of striations parallel to the longer diagonal of the rhomb, which are due to secondary twinning.



## PHYSICAL CRYSTALLOGRAPHY

**Parting.**—The planes along which gliding has taken place are often planes of easy separation called parting-planes. Parting resembles cleavage, but is distinguished by the fact that parting takes place only in certain definite planes, those of the molecular disturbance, while cleavage may be obtained in any part of the crystal in the given direction, and the size and number of cleavage pieces is limited only by the mechanical appliances at our disposal. Examples of parting:—magnetite, octahedral; pyroxene, basal; calcite, rhombohedral ( $01\bar{1}2$ ).

**Etch-figures.**—A very important method of investigating the symmetry relations of crystals is the etching produced by a solvent. When a crystal is acted upon by a solvent such as water, or acid, the action is not uniform but begins at certain points and proceeds more rapidly in some directions than in others and if stopped at the right time the faces are found to be covered with little angular figures of definite shape called etch-figures. The etch-figures are usually shallow depressions bounded by minute faces. The fact that these faces are usually the general forms often enables us to determine the crystal class. The shape of the etch-figures depends upon the solvent, time, and temperature, but they always conform in symmetry to the class to which the crystal belongs. On similar faces the etch-figures are alike and on dissimilar faces they are unlike, and with the same conditions of time, temperature and solvent they will be of the same shape and in parallel position on any face of a crystal. No rule can be given for obtaining etch-figures, for it is simply a question of ease of solution. Crystals soluble in water may yield etch-figures by passing a moistened cloth over the surface, while the more refractory minerals such as topaz must be treated with fused caustic potash. The difference in the symmetry of cal-



FIG. 2.

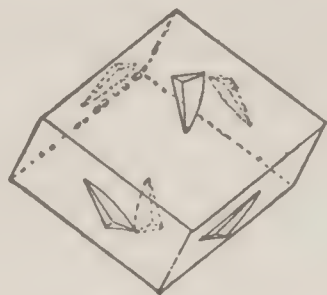


FIG. 3.

cite and dolomite is well brought out by means of the etch-figures. Calcite (Fig. 2) shows the symmetry of the ditrigonal scalenohedral class, while dolomite (Fig. 3) shows the symmetry of the trigonal rhombohedral class.

**Corrosion.**—Another method of investigating symmetry is to cut a sphere from the crystal and submit it to the action of the solvent for some time when it is found that the sphere is changed in shape. Thus a sphere of quartz subjected to the prolonged action of hydrofluoric acid is attacked rapidly in the direction of the vertical axis but scarcely at all in the direction of the horizontal axes, the resulting form being a sub-triangular lens.

**Percussion-figures.**—See topic: PERCUSSION FIGURES.

**Hardness.**—The resistance of a smooth surface to scratching is called hardness, and in crystals varies with the direction. Thus on the face (100) of cyanite the hardness is much less

in a direction parallel to the vertical axis  $c$  than it is in the direction at right angles to this — and in calcite the hardness is less on the face (0001) than it is on other faces. For ordinary purposes the hardness is stated in terms of Mohs' scale of hardness (see MINERALOGY), but there are methods for determining it accurately by means of the instrument known as the *sclerometer* (q.v.). From the data obtained there is constructed the so-called "curve of hardness," which has the same symmetry as the crystal.

### THE OPTICAL PROPERTIES OF CRYSTALS.

**Nature of Light.**—According to the now generally accepted undulatory theory, light is propagated by a rapid wave-motion in the so-called ether which it is believed occupies space as well as all material bodies. The wave motion of light may be regarded as analogous to waves sent along a rope, A B, by shaking one end while the other end is attached. (See Fig. 4.) The mo-

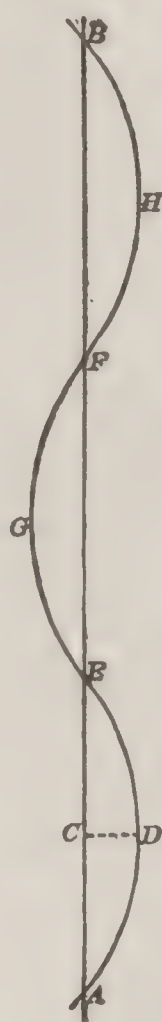


FIG. 4.

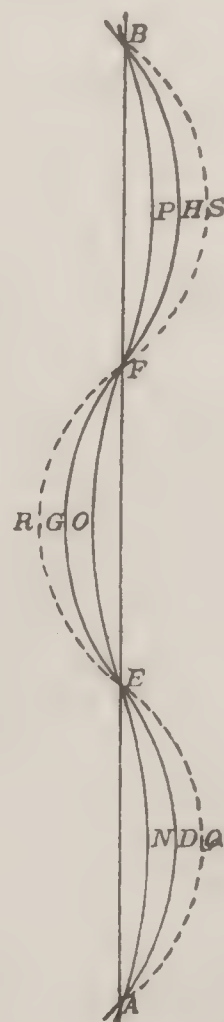


FIG. 5.

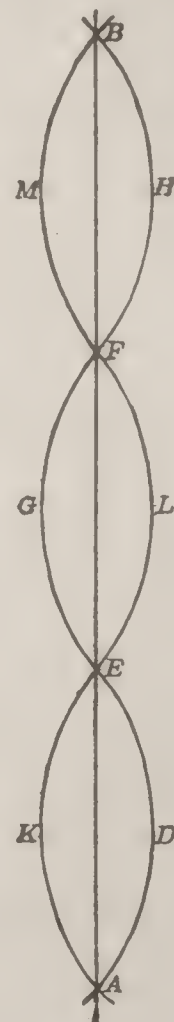


FIG. 6.

tion of the parts of the rope is transverse to the direction of propagation of the wave. Here the distance between successive troughs or crests, A F, E B, or O H, is called the wave-length, denoted by  $\lambda$ . The amplitude is the distance  $2CD$ . The phase depends upon the position and direction in which a particle is moving. The intensity of light depends upon the amplitude and the color depends upon the wave-length. Waves of light are very minute. They vary from red rays with a wave-length of about  $\frac{1}{80000}$  of an inch to violet rays of about  $\frac{1}{150000}$  of an inch. White light is the effect of all the waves of various colors together. In ordinary white light the transverse vibrations are supposed to be in all possible planes.

**Interference.**—Waves of light may travel along the same line at the same time and interfere with each other, the effect being to form new waves. Thus in Fig. 5 the waves A D G H B



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and A N O P B produce the new wave A Q R S B. When the two waves are the same in amplitude and wave-length but differ in phase by half a wave-length,  $\frac{1}{2}\lambda$ , or by any odd multiple of  $\frac{1}{2}\lambda$ , they destroy each other and darkness is the result. This is illustrated in Fig. 6, where the two waves A D G H B and A K L M B neutralize each other.

*Interference Colors of Thin Plates.*—If a cleavage piece of selenite or calcite is slightly pried apart with a knife blade, there results when viewed with reflected light a series of colored bands called *Newton's colors*. This effect is due to the formation of a wedge-shaped film of air between the cleavage plates and may be explained as follows: A ray of light A B (Fig. 7)

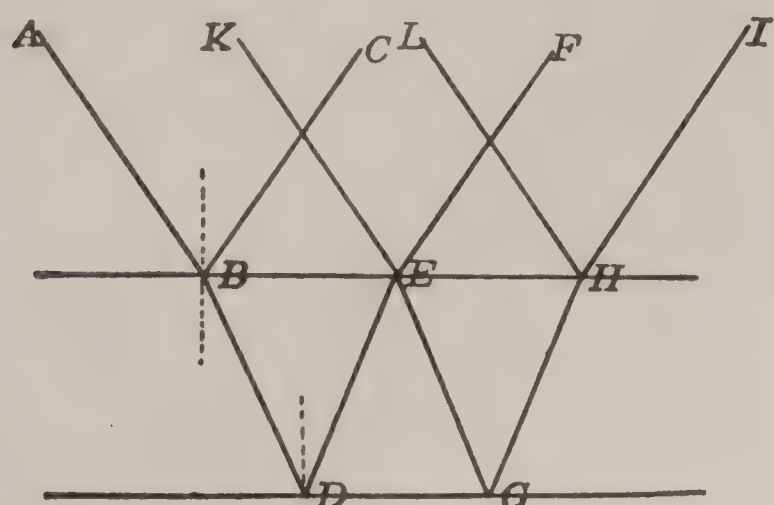


FIG. 7.

entering the film is partly reflected (B C) and partly refracted (B D). The part refracted on reaching D is again reflected D E, but on reaching E is partly refracted, E F, and partly reflected, E G, and so on. The incident ray A B gives rise to a number of parallel rays B C, E F, H I, etc. But the incident light consists of a number of parallel rays, K E, L H, etc., as well as A B. The ray K E F for example is formed by the direct ray K E and by the refracted and reflected ray D E; they have traversed different directions and consequently differ in phase.

For certain thicknesses of the film the phase differences are  $\frac{\lambda}{2}$ ,  $\frac{3\lambda}{2}$ ,  $\frac{5\lambda}{2}$ , etc. For these cases

there will be darkness if monochromatic light (of one wave-length) is used. For other thicknesses of the film, there will be only partial interference.

With ordinary white light there will be bands of colors as we have observed which are the results of superposing the effects due to light of various colors.



FIG. 8.

*Refraction.*—When a ray passes from one medium into another it is bent or refracted, due to a difference of velocity of light in the two media. Whatever the direction of the incident ray there is a constant ratio between the angle of incidence ( $i$ ) and the angle of refraction ( $r$ )—

$$\frac{\sin i}{\sin r}$$

so that  $n = \frac{\sin i}{\sin r}$ . (See Fig. 8.) The value  $n$  is

called the index of refraction. The index of refraction has a constant value for every substance and is usually referred to air as unity. The in-

dex of refraction varies for light of different wave-lengths. Accurate determinations are usually made with monochromatic light. An approximate method for the determination of the relative index of refraction especially applicable to minerals in thin rock sections is the Becke method. If a microscope is focused sharply on the contact between two minerals (or between a mineral and Canada balsam in which it is imbedded) and then with the condenser lowered, the tube of the microscope is raised slightly, a white line appears on the side of the mineral with the higher index of refraction.

### INDICES OF REFRACTION.

Ice.....	1.31	Quartz.....	1.55	Cerussite...	1.99
Fluorite....	1.43	Calcite.....	1.60	Sphalerite..	2.37
Orthoclase..	1.52	Topaz.....	1.62	Diamond...	2.42
Salt.....	1.54	Zircon.....	1.95	Rutile.....	2.76

*Double Refraction.*—If a cleavage piece of calcite is placed on a dot the dot appears double, and as the calcite is revolved one dot is stationary while the other one seems to move around it. The ray producing the stationary dot is the ordinary ray,  $o$ , while the other one is the extraordinary ray  $e$ . (See Fig. 9.) The produc-

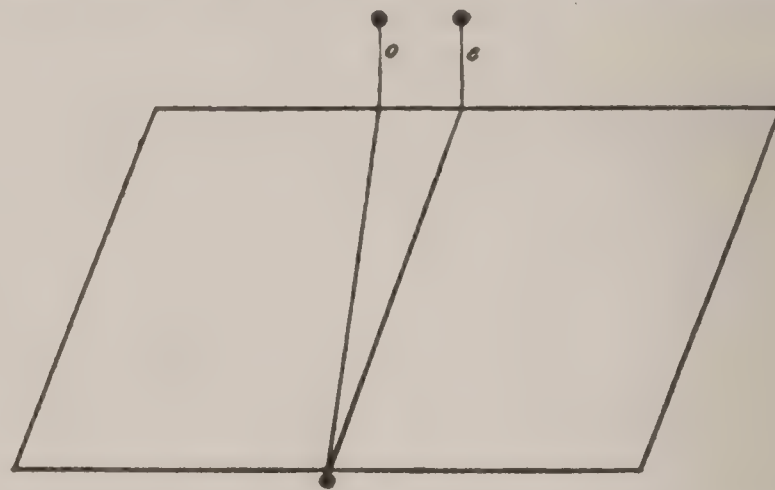


FIG. 9.

tion of the two refracted rays is called double refraction, and although only a few minerals such as calcite show it ordinarily, it is convenient to think of other minerals as producing this effect. The divergence of the two rays is known as the strength of the double refraction or birefringence.

### STRENGTH OF DOUBLE REFRACTION.

	Weak	Medium to Strong	Very Strong
Apatite....	0.004	Augite....	0.021
Orthoclase..	0.009	Chrysolite.	0.036
		Titanite...	0.121
		Calcite....	0.172

The practical tests for the double refraction are in the interference colors soon to be described.

*Polarized Light.*—Ordinary light consists of transverse vibrations of the ether in all possible planes about the line of transmission. Polarized light consists of vibrations in but *one* plane, which is called the plane of vibration. The change of ordinary light to polarized light is called polarization and results by one of several methods. (1) By reflection at a certain angle of incidence ( $\tan i = n$ ) called the angle of polarization. (2) By absorption. If two sections of a transparent crystal of tourmaline cut parallel to the vertical axis are placed together with their axes coinciding, light passes through, but if one of the sections is revolved  $90^\circ$ , no light passes through. Light in entering the tourmaline is doubly refracted, one set of waves is absorbed,



## PHYSICAL CRYSTALLOGRAPHY

while the other set, the vibrations of which are parallel to the vertical axis, are transmitted. On entering the second tourmaline this set passes through if the axes coincide, but if the axes are perpendicular no light can pass through. (3) By Nicol prisms. The best and most practical method of producing polarized light is by means of the apparatus known as Nicol prisms. A Nicol prism is constructed as follows. A cleavage prism of transparent calcite (Fig. 10) is cut

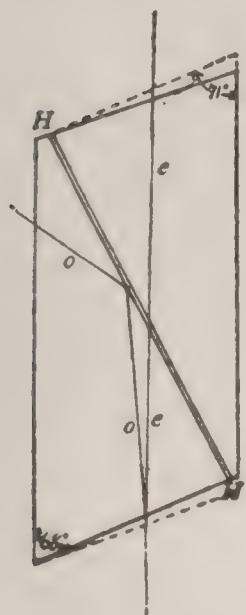


FIG. 10.

diagonally along the line H H and then the two parts are cemented together with Canada balsam. The end faces are ground off slightly so that an angle of  $68^\circ$  is formed. (See Fig. 10.) The ordinary ray *o* with an index of refraction of 1.66 is totally reflected. The extraordinary ray *e* with an index of refraction of 1.54 (practically that of the balsam) passes through the prism with little, if any, change. The plane of vibration of the nicol is through the shorter diagonal of the prism.

**Polariscope — Polarizing Microscope.**—The instrument used for examining crystals in polarized light is a polariscope.

The modern polariscope most in use is the polarizing microscope, which in addition to the equipment of an ordinary microscope has a rotating stage and two nicols, one the polarizer below the stage, the other, the analyzer between the objective and eye-piece. The polarizer or lower nicol ordinarily remains in position while the analyzer or upper nicol slides in and out of the microscope tube.

**Interference Colors.**—Besides the production of interference colors by means of thin films already discussed, they may result from doubly refracting substances in much the same way. The interference color depends upon the thickness. The interference colors for varying thickness may be easily seen by examining a quartz wedge with the polarizing microscope. The succession of colors beginning with the thin end is somewhat as follows: Iron-gray, grayish-blue, white, straw-yellow, orange-yellow, deep red, violet, blue, green, yellow, bright red, light blue, green, faint red, etc. There is a recurrence of the colors just as we found in the case of Newton's colors. From the iron-gray to and including the deep red are the first order colors, from this red to the bright red are the second order colors, from the bright red to the faint red inclusive, the third order colors, and so on. After the fourth and fifth orders are the so-called high order colors, which are very faint tints difficult to distinguish from white. The interference color depends upon the thickness, the substance, and the orientation (direction in which the section is cut). For thin rock-sections, with a thickness of 0.03 to 0.05 mm, orthoclase, quartz and apatite have low order colors, pyroxene, amphibole and chysolite have second or third order colors, while calcite, zircon and titanite have the high order colors. The stronger the double refraction the higher the colors. Levy and Lacroix's color chart is of much help in studying interference colors.

**Pleochroism** is the property which some doubly refracting crystals have of absorbing certain colored rays in certain directions and the result is, if viewed in transmitted light, they show different colors in different directions. Thus a crystal of iolite appears bluish in one direction and yellowish in another. Pleochroism may be observed by a dichroscope or by a polarizing microscope.

**Optical Properties of Crystals.**—There are three groups of crystals according to their optical properties: (1) the optically isotropic (isometric crystals), (2) the optically uniaxial (tetragonal and hexagonal crystals), and (3) the optically biaxial (orthorhombic, monoclinic and triclinic crystals). In the isotropic crystals every direction is a direction of single refraction, in uniaxial crystals there is one direction of single refraction, in biaxial crystals there are two directions of double refraction, all other directions being directions of double refraction in uniaxial and biaxial crystals.

**Optically Isotropic Crystals.**—In isotropic crystals, light is transmitted with equal velocity in all directions, so the optical structure may be represented by a sphere. Isotropic crystals may be recognized by remaining dark during complete rotation between crossed nicols of the polarizing microscope. Amorphous substances and isometric crystals are optically isotropic. All other crystals are anisotropic and do not remain dark between crossed nicols, but are dark every  $90^\circ$ , such positions being known as extinction directions.

**Optically Uniaxial Crystals.**—Crystals of the tetragonal and hexagonal systems are included in this class. The direction in which there is no double refraction is called the optic axis,

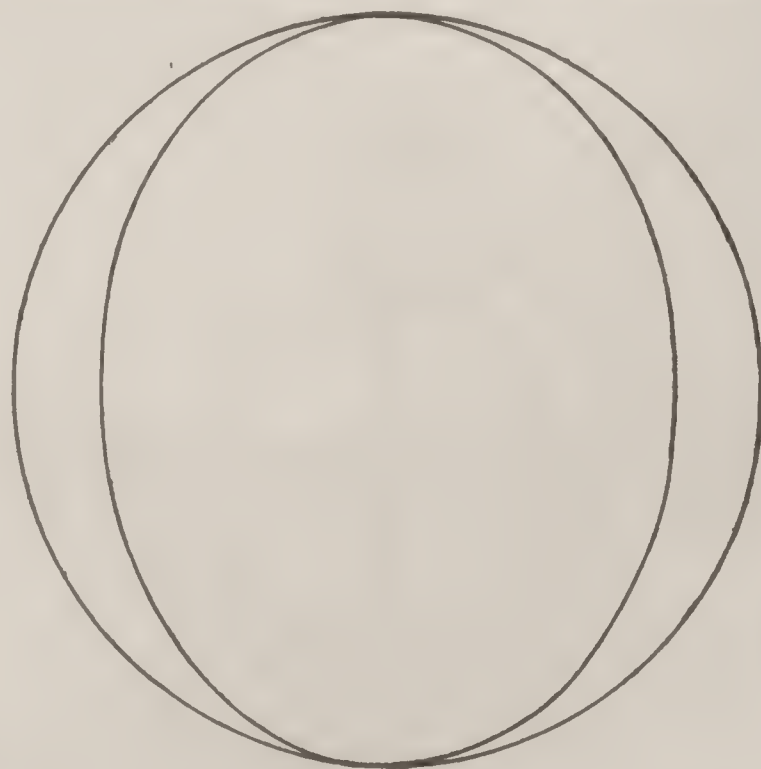


FIG. 11.

and coincides with the crystallographic axis *c*. All other directions exhibit double refraction. The maximum difference between the two rays is at right angles to the optic axes. Hence the optical structure may be represented by a double shell of a sphere and a spheroid. Now there are two classes of uniaxial crystals, one in which the sphere encloses the spheroid, and extraordinary ray is greater than the ordinary,—these are called positive (+), the other in which the



## PHYSICAL CRYSTALLOGRAPHY

spheroid encloses the sphere and the ordinary ray is greater than the extraordinary; these are called negative (—). Fig. 11 represents a section of the ray surface of a positive crystal, and Fig. 12 that of a negative crystal. Examples: Positive, quartz, zircon; Negative, calcite, tourmaline, apatite.

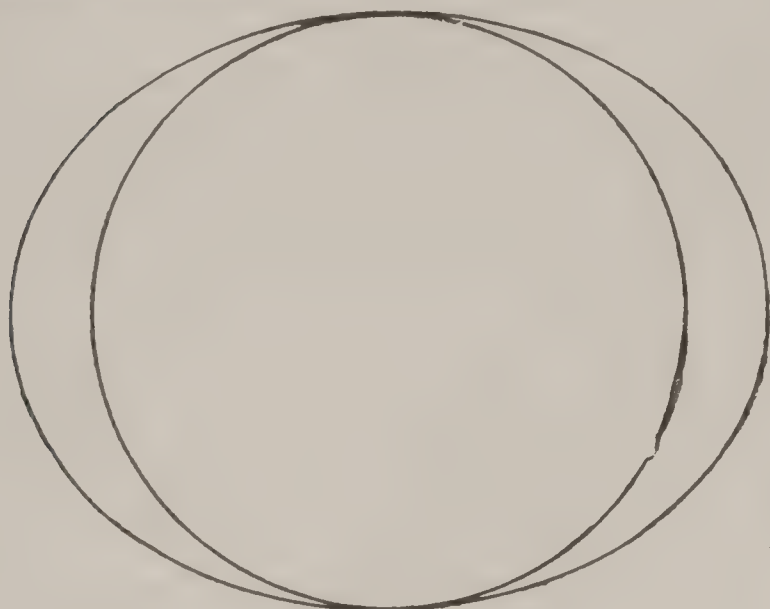


FIG. 12.

*Uniaxial Crystals in Polarized Light.*—Basal sections (at right angles to the vertical axis  $c$ ) suffer no double refraction, hence remain dark when revolved between crossed nicols. Other sections get dark and light every  $90^\circ$  (between crossed nicols) and give an interference color depending upon the substance, the orientation and the thickness. The crystals are dark when the crystallographic axis  $c$  is parallel to the cross wires, hence they have parallel extinction. The above effects are obtained with parallel light, but with convergent light (condenser close up to section, high power objective in, and eyepiece out) the beautiful effects known as inter-

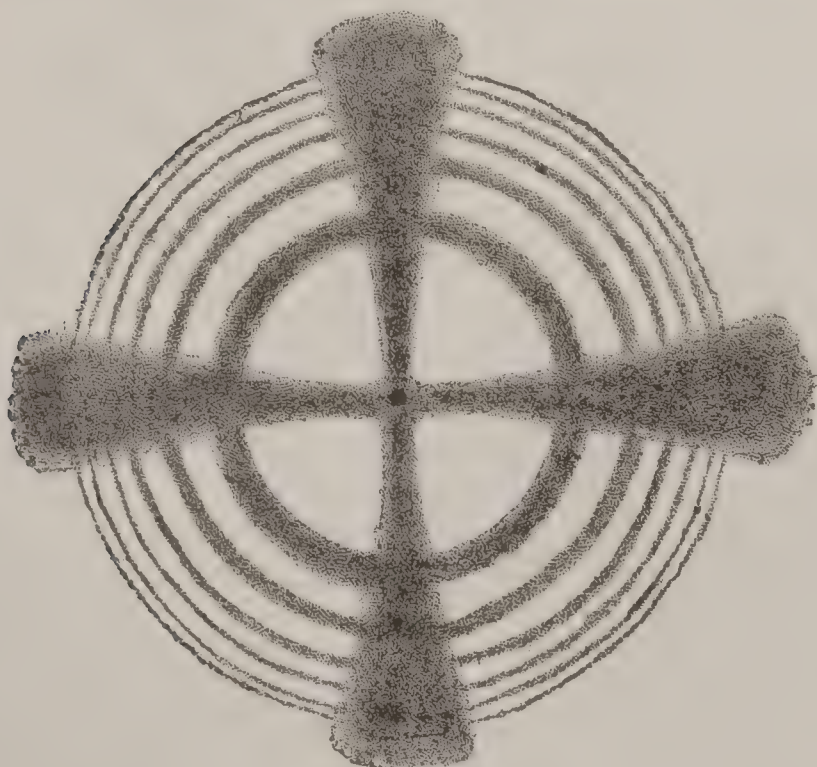


FIG. 13.

ference figures result. Basal sections of suitable thickness show a symmetrical black cross with a series of colored concentric rings (Fig. 13). The arms of the black cross correspond to the vibration planes of the two nicols, while the colored rings are the result of interference.

*Optically Biaxial Crystals.*—In biaxial crystals, which include orthorhombic, monoclinic

and triclinic crystals, there are two directions of single refraction, called optic axes, the angle between the two being the axial angle. The optical structure may be represented by a triaxial ellipsoid symmetrical to three planes at right angles to each other. These planes intersect in three axes of symmetry called principal vibration axes or sometimes axes of elasticity, which are denoted by  $a$  maximum,  $b$  intermediate and  $c$  minimum. The index of refraction of the ray with vibrations parallel to  $a$  is  $\alpha$ ,  $\beta$  corresponding to  $b$  and  $\gamma$  to  $c$ , ( $\alpha < \beta < \gamma$ ). The mean index of refraction is  $\frac{\alpha + \beta + \gamma}{3}$  and  $\lambda - \alpha$  is

a measure of the strength of the double refraction. The optic axes are always located in the plane of  $a$  and  $c$ , thus if the axial angle ( $2V$ ) be taken as less than  $90^\circ$  either  $a$  or  $c$  bisects it and is called the acute bisectrix. Accordingly we have two classes of biaxial crystals, positive and negative. In one case the  $a$  axis bisects the axial angle (usually stated  $Bx_a = a$ ); these constitute optically negative crystals. In the other case the  $c$  axis bisects the axial angle (or  $Bx_c = c$ ); these constitute optically positive crystals. Positive, topaz, barite, chrysolite; Negative, muscovite, orthoclase, hypersthene. Fig. 14 represents a section of the ray surface of a positive crystal and Fig. 15 that of a negative crystal.

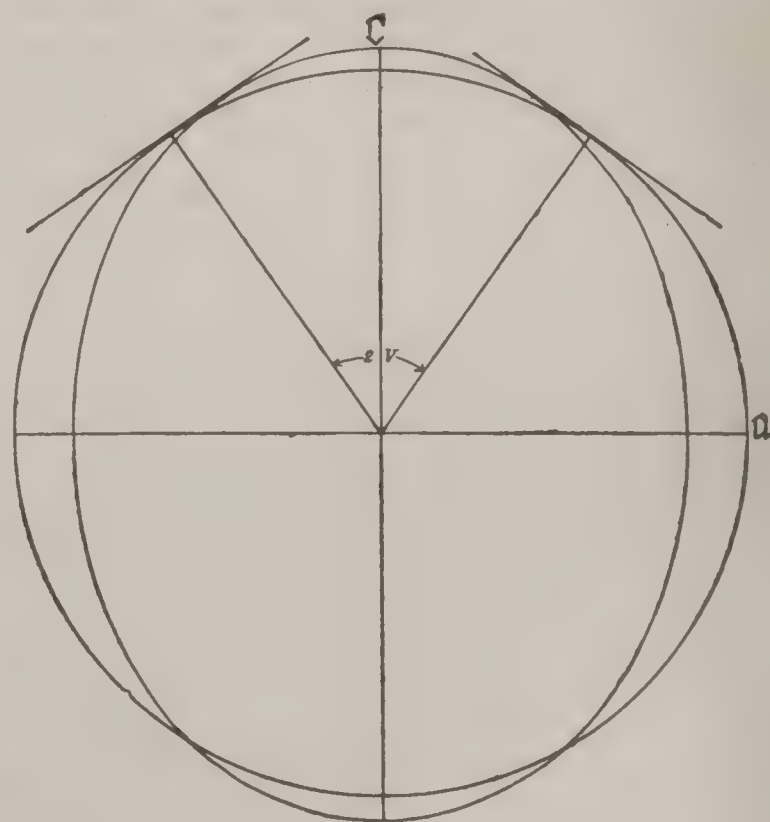


FIG. 14.

*Biaxial Crystals in Polarized Light.*—In orthorhombic crystals the vibration axes always coincide with the crystallographic axes. Hence between crossed nicols sections of orthorhombic crystals always have parallel extinction. In monoclinic crystals, the crystallographic axis  $b$  always coincides with one of the vibration directions, the others being in the plane of symmetry, but not fixed. Hence monoclinic sections parallel to the orthopinacoid (100) have parallel extinction, while other sections have oblique extinction, which is a maximum parallel to the clinopinacoid (010). In triclinic crystals there is no necessary relation between the vibration axes and the crystallographic outline. Sections of biaxial crystals normal to the acute bisectrix when examined in convergent polarized



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light exhibit an interference figure consisting of an unsymmetrical black cross with a series of colored ellipses passing into lemniscates (Fig. 16). The black cross as in the uniaxial crystals, represents the vibrations directions of the two nicols. The colored curves are due to interference. The distance apart of the centres of the ellipses indicates the value of the axial angle. If the section is revolved the black cross passes into two hyperbolæ. For such topics as the determination of the indices of refraction, positive or negative character, faster or slower ray, dispersion of the optic axes, dispersion of the bisectrices, circular polarization, effect of heat upon optical properties, optical anomalies, etc., reference must be made to textbooks, a list of which is given at the end of the article.

### THERMAL PROPERTIES OF CRYSTALS.

Heat rays differ from light rays in their relatively greater length, but are subject to the laws of reflection, refraction, absorption, double re-

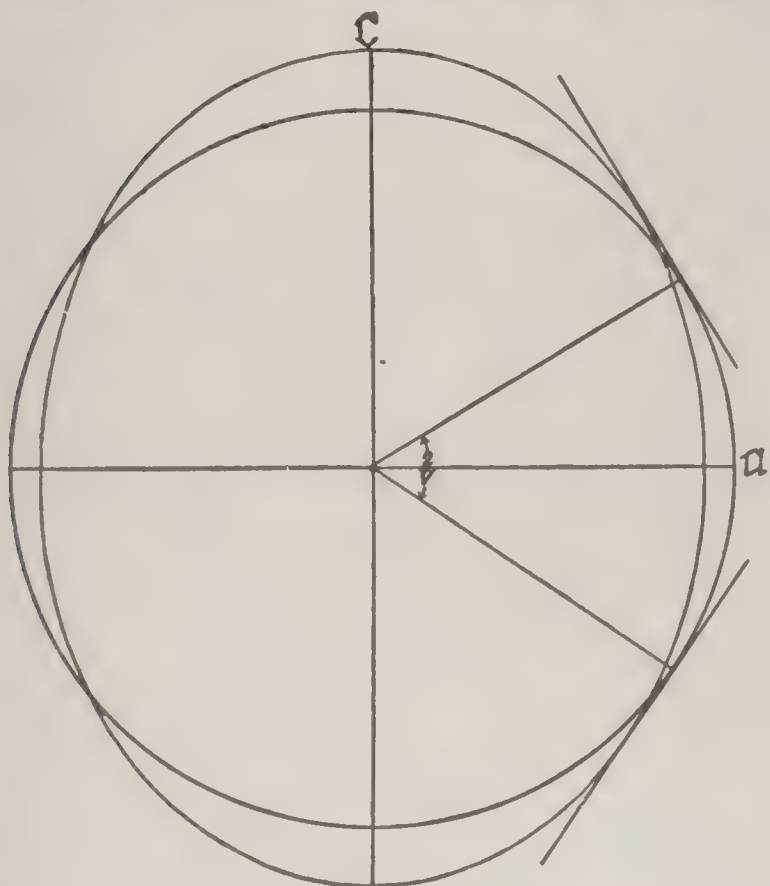


FIG. 15.

fraction, polarization and interference, just as light rays are, as has been shown by Knoblauch in the case of calcite. So we have the character *diathermancy*, which corresponds to transparency in light. Halite and fluorite allow heat rays to pass through and are said to be *diathermanous*. Selenite and alunite do not allow heat rays to pass through, hence are *athermanous*.

**Heat-Conductivity.**—The isothermal surface is determined from the surface conductivities. These may be determined by coating the faces with a film of wax and placing a hot wire thereon. The form of the figure melted is either a circle or an ellipse. In isometric crystals all sections are circles, hence the isothermal surface is a sphere. In tetragonal and hexagonal crystals basal sections give circles, all other sections, ellipses; hence the isothermal surface is a spheroid. In orthorhombic, monoclinic and triclinic crystals all sections are ellipses; hence the isothermal surface is an ellipsoid.

**Expansion.**—The increase of volume upon heating varies in crystals with the direction. There are the three same classes, a sphere becoming a sphere, spheroid, or ellipsoid.

### THE MAGNETIC PROPERTIES OF CRYSTALS.

All crystals and indeed all substances are to some extent either attracted or repelled when placed in the field of a powerful electro-magnet. Those that are attracted are paramagnetic, those repelled, diamagnetic. The strength of the magnetization varies with the direction in crystals. In isometric crystals it is alike in all directions. In uniaxial crystals there are directions of maximum and minimum magnetic induction at right angles to each other. Hence two classes, positive and negative, according as the direction of maximum or minimum magnetic induction coincides with the crystallographic axis *c*. In biaxial crystals the magnetic relations are analogous to the optical relations.

### ELECTRIC PROPERTIES OF CRYSTALS.

**Electric waves** are like light waves; they travel with the same velocity, exhibit the phenomena of reflection, refraction and polarization and differ only in much greater length. Bose has described an electric polariscope, with which it may be possible to test opaque crystals as we now test transparent crystals.

**Electric Conductivity.**—In the few minerals tested there has been found a dependence of

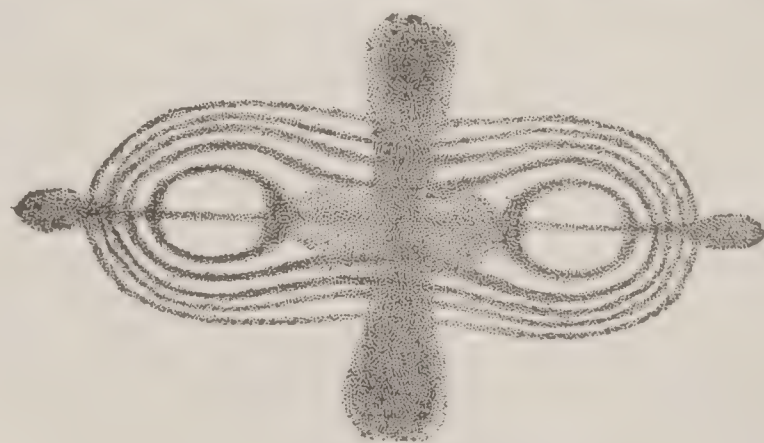


FIG. 16.

electric conductivity upon crystallographic direction, conforming to the thermal conductivity.

**Pyro-electricity.**—The name pyro-electricity has been given to the development of positive and negative crystals on different parts of crystals during a change of temperature. Thus if a mixture of powdered sulphur and minium is blown upon a cooling crystal of tourmaline, the sulphur collects at one end (the antilogue pole) and the minimum at the other end (the analogue pole). Some crystals develop electric charges by pressure. This is called piezo-electricity.

**X-rays.**—Doelter has found that some minerals as sulphur and pyrite are opaque, while diamond and graphite are transparent to Röntgen or X-rays. Thus diamond is easily distinguished from its imitations, which are opaque.

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## PHYSICAL CULTURE — PHYSICAL ECONOMICS

**Physical Culture**, a term of recent introduction and somewhat indefinite application, but generally accepted as signifying not only physical training, but everything that tends to refine and improve the physical system. It is made a cover for various forms of treatment, pursued by pretenders to physiological knowledge, and is also applied to methods and systems that are innocuous, and in some cases doubtless beneficial. The culture of the body is as necessary for true manhood and womanhood as the culture of the mind, and neglect of due attention to bodily cleanliness, which is physical culture in its simplest and most necessary form, is one of the primary signs of degeneracy. Savage races are, as a rule, very neglectful in this respect, and travelers in Africa mention black men who never wash themselves. As human beings advance in intelligence and self-respect, they become more careful in regard to ablutions, and both ancient and modern progress can be measured by public and private baths.

Physical culture, as already noted, takes in attention to the improvement and preservation of such physical attractions as nature has bestowed, and in this form it offers a profitable field to charlatans, who reap a rich harvest from feminine and also from masculine vanity. There are, however, schools of physical culture conducted by persons entirely competent to give sound and valuable lessons on the best methods of improving the appearance and developing the faculties. Anyone, however, by following the advice of a family physician, can be his or her own teacher in these respects, and the family doctor usually has the advantage of a reasonably accurate knowledge of the condition of the person seeking his advice, and can judge correctly as to the kind of physical culture that would suit that person's constitution. It would be prudent in all cases for anyone who desires to undertake a course of physical culture, or to receive any treatment of the kind usually coming within that description, to act under competent medical advice. See PHYSICAL TRAINING.

**Physical Economics.\*** With the desire of men of every age to ascertain the relative value of the things of this world we have the various standards now in use in every civilized country, such as that for length, mass, and time, and for the efficiency and earning ability of water, steam, electric, and animal power.

In man, however, in order to determine his relative value we need a mathematical formula for the normal earning ability of the body by which, with the requisite data, he may be either rated or his economic value may be ascertained, and damages to his body from injury or disease and an indemnity to be allowed therefor may be determined in a manner equitable to all concerned.

For the purpose of constructing a mathematical formula for the normal earning ability an analysis of the body must be made which shall include the principal elements employed as factors in developing that normal ability. It is self-

evident that man needs the normal physiologic functions of the body to develop his normal earning ability, and that, therefore, these must be considered his functional ability; and the first of these elements, or factors. It is also true that the training of these physiologic functions is absolutely necessary to give man knowledge and skill to perform his duties and that this education must constitute his technical ability, and the second of these factors. Lastly, it is equally as self-evident that it is the combination of the functional and the technical ability of a man that determines what he can do, and that these, together with the conditions and circumstances which surround him, give to him his competing ability in the world, which is the third of these factors. Therefore, the three factors needed for the normal earning ability of the body are: first, its functional; second, its technical; and third, its competing ability. This analysis of man includes everything he needs in performing all his duties and by a combination of these three elements, as factors, his normal earning ability may be obtained. The earning ability of man is divided into these three fundamental elements, as factors, solely, because by such an analysis it can be represented in a mathematical formula. Therefore, this analysis must be considered complete, for it comprises all that is needed in any vocation, and it is in accordance with the principles employed in the analysis of any physical force by which its efficiency is determined.

An examination of the method by which electricity is measured and its efficiency ascertained shows that an agreed analysis of it designates the unit of electro-motive force, a volt, and defines this to be equal to a current of one ampere with a resistance of one ohm. These units are not arbitrarily chosen, but are determined by experimental investigation. The value of electricity is obtained by using these three elements, as factors, and multiplying them, producing a composite quantity called watts, 746 of which make a horse-power. By using the first letter of each word this process is represented in the formula  $W = V A O$ . When, however, electricity is obtained by this standard of resistance, its efficiency is determined by multiplying volts by amperes, and the formula thus simplified is  $W = V A$ .

In a similar way, if we use the first letter of the prominent word in this analysis of man,  $F =$  the functional,  $T =$  the technical,  $C =$  the competing,  $E =$  the earning ability, hence  $E = F T C$ , the mathematical formula for the normal earning ability of the body. These three factors are not of equal value, although the efficiency of each is interdependent upon the other:  $F$  is of the first importance;  $T$  second in importance; whereas  $C$  is least important, because it depends upon the other two and the conditions of the labor market. The competing ability is composed of the same elements as  $F$  and is modified to a similar but less extent when  $F$  is impaired. It is also modified by  $T$ , and by the way employers consider the person, especially when damaged from injury or disease; therefore, to meet all these conditions,  $C$  is always placed under a radical in the formula, the index of which may be designated by an  $X$ , to indicate that it is to be determined in each instance, and the formula thus modified is  $E = F T \sqrt[X]{C}$ .

\* Comprising a mathematical formula for the normal earning ability of the body, based upon an analysis which considers its functional, its technical, and its competing ability, by which, with the requisite data, a person may be either rated or his economic value may be ascertained, and damages to his body from injury or disease, and an indemnity to be allowed therefor, may be determined in a manner equitable to all concerned.



## PHYSICAL ECONOMICS

To amplify the formula, F must be resolved into its component parts by selecting and grouping into the form of units such systems and organs as are so interdependent that each is needed to insure the functions of the other in its particular unit, and these systems and organs taken together form a unit that is absolutely indispensable to the functions of the body. These units are to be regarded as factors of F, which when multiplied together, and by the other two factors of the formula, produce the composite quantity E. As much as possible, systems and organs have been selected and grouped together as units in accordance with their development and associated functions, it being found necessary to have four such units for the whole body, which when designated by the first four letters of the alphabet are as follows:

$a =$	{ Osseous, articular, and muscular systems, consisting of	{ e, the bones, f, the joints, g, the muscles.
$b =$	{ Circulatory and respiratory systems, consisting of	{ h, the heart i, the vessels, j, the lungs and their accessory organs.
$c =$	{ Digestive and genito-urinary systems, consisting of	{ k, the alimentary canal, l, its accessory organs, m, the kidneys with the genital organs.
$d =$	{ Cerebro-Spi- nal systems, nerves and ganglia, con- sisting of	{ n, the brain, its membranes, and its nerves, o, the spinal cord, its membranes, its anterior motor, and its posterior sensory nerves, p, nerves and organs of special sense.

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Each of these units fulfills the requirements of our definition: it is composed of systems and organs so interdependent that each is needed to insure the functions of the other, and these taken together form a unit that is absolutely indispensable to the functions of the body. This being true, the value of the function of each unit may be obtained by a formula similar to that employed in determining the value of any physical force. In amplifying F, by resolving it into its component parts, as factors, a, b, c, d, each of these was resolved into its component parts, as factors, and  $a = e f g$ ;  $b = h i j$ ;  $c = k l m$ ; and  $d = n o p$ .

In any computation, if one of the factors becomes O, the product is O. In diseases of the bones, like osteomalacia, producing an inability to support the body, e would become O, then  $a = O$ ; in inflammation of the joints, like chronic articular rheumatism, causing a large number of stiff joints, f would become O, and  $a = O$ ; in diseases and injuries producing paralysis of the muscles, g would become O, then  $a = O$ , and finally, in diseases and injuries by which a large portion of the extremities were lost, a certainly would become O, and if  $a = O$  then  $F = O$ . In serious valvular and organic diseases of the heart, or vessels, h or i would become O, then  $b = O$ ; in serious diseases of the lungs and their accessory organs, j would become O, then  $b = O$ , and if  $b = O$ , then  $F = O$ . In the various serious diseases of the alimentary canal, its accessory organs, the kidneys with the genital organs, each of k, l, m, might become O, then  $c = O$ , and  $F = O$ ; and in the various serious diseases of the brain, spinal cord, and organs of special sense, each of n, o, p, might become O, then  $d = O$ , and

$F = O$ , and finally, if  $F = O$ , then  $E = O$ . Therefore the parts of each unit, as factors, bear the same relation to the unit, as the units, as factors, do to the whole body. Each part, as factor, is indispensable to the other, and each unit as factor is indispensable to the body. The units are always to be regarded as factors of F, and multiplied together and by the other two factors of the formula, if we are to conceive of the earning ability of the body as a whole which can be given a mathematical expression. Our formula represents, mathematically, the complete earning ability of the body in a healthy normal person, which is a composite quantity, resulting from the multiplication of factors; the same as was done in obtaining the efficiency of electricity.

As has already been shown, when F is resolved into its component parts, as factors, it is represented by (a b c d) and  $\sqrt[n]{C}$ , becomes  $\sqrt[n]{(a b c d)}$ , because C is composed of the same elements as F; hence the complete formula for the normal earning ability is  $E = (a b c d) T \sqrt[n]{(a b c d)}$ . Now in this formula the units, or factors, are not of equal value, and, hence, when damage to them has been ascertained by scientific standards of measurement they may be placed in the formula under a radical, the index of which will depend upon how much less it is desired the damaged units shall affect the formula than that given to them by scientific standards of measurement. The unit, d, representing the cerebro-spinal systems, nerves, and ganglia, would under almost all circumstances be placed in the formula at its full value, as determined by scientific standards of measurement, as any damage to it produces in the person thus affected proportional disability for all gainful occupations.

To ascertain the remaining value of a unit in a given case of damage, it must be compared with some scientific standard of measurement, and the remaining value given in the form of a fraction of the whole unit. This method, which permits of the mathematical determination of each unit of the bodily function, as a fraction of the normal unit must be considered complete, as it is in accordance with the principles laid down by the natural sciences in measuring the power of any physical force, one of which that of electricity has been given.

The four units of F, or their remaining value, after being damaged, must always be regarded as factors and multiplied. Their product is a composite quantity—the earning ability of the body. They must never be regarded as quantities to be added, for wrong practical deductions would be obtained, as the following will clearly show:

In the formula,  $E = (a b c d) T \sqrt[n]{(a b c d)}$ , let us suppose that from an injury a person was rendered blind and deaf, and that therefore the unit, d, becomes O. It is self-evident that a person in this condition would have no earning ability, and yet, if we add the remaining units, a, b, and c, which might be normal, we would obtain three fourths of the earning ability of the body, which results in a *reductio ad absurdum*. With a, b, c, d, of our formula regarded as factors, to be multiplied, however, when d, or any other factor, becomes O, the product is O, also, and no absurdity results, because in any



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computation, if one of the factors is O, the product will always be O. If a person has no technical ability, T would be O, and therefore  $E=O$ . This would be true in actual practice. Finally, if we decide that a person has no competing ability  $x=O$ , and  $E=O$ , and this would be true in the labor markets, notwithstanding the bodily functions might be normal and the technical ability might be of the highest order, yet if the person's services were not needed and he could not dispose of them at any price, his earning ability would be O. Therefore, in our mathematical formula for the normal earning ability of the body, if any one of the units as factors, becomes O, then  $E=O$ , and no absurdity results. We have, at some length, dwelt upon F, of our formula, because it is the most important factor in it. We now pass on to T, the next in importance.

The technical ability of a person is usually gained during adolescence, and is generally attained by the time the growth of the body is completed. The formula may be used as a guide during the years of growth and development and serve to rate the youth, taking into consideration the condition of the functional ability upon which the mental and technical ability so much depend but which has been heretofore practically ignored. As important as T is to the normal earning ability, and in rating a person, when that person's vocation becomes fixed, T may be considered as equal to one in estimating damages. The technical ability is not injured, but limited only in proportion to the damages to F, impairment of which will include these damages; therefore, T may be omitted, and the formula thus modified for determining damages to the earning ability of the body is  $E = \sqrt[4]{a b c d}$ .

We now come to C, the third, and last factor of our formula. The ability to compete is a condition which is affected by a variety of circumstances: first, by the person's functional ability; second, by his technical ability; and third, by the way employers consider these conditions. Therefore, when a person becomes disabled, the damage to his body acts immediately in two ways: first, by its direct impairment of the functional ability, according to the nature and extent of the damage by reason of which he will not be able to perform so much, and perhaps not so good work, as he did before; and, second, by the way employers consider these conditions. The damage to the body might be of such a nature as to affect the appearance of the person without interfering materially with his earning ability; such as in the unit a, loss of the auricles, or nose; in the unit d, a large scar of the cornea, or an injury to a blind eye causing it to become crossed. Disfigurements like these, although not interfering with a person's ability to work as well as he did before the damage was done, would seriously interfere with his chances to obtain employment, and should, therefore, be considered a serious obstacle to his competing ability. In case of damages, a person has a right to secure compensation, not only for the loss to his functional ability but also to his appearance, when it seriously interferes with his ability to obtain employment in the grade of work and command the wages to which he is entitled. The part of his ability to compete not represented in the per-

son himself, but in the way employers consider the damages we render in the number selected for the index of the radical of the competing ability. In general, if a person has no competing ability we would select 0; if it is seriously affected we would select 2 or 3; if only moderately affected 5 or 7; and if but slightly affected 10, for the index of the radical of the competing ability. By leaving this to the physicians who have ascertained the damages to F, and who are the most competent to judge what it shall be, disabilities of the body, and an indemnity to be allowed therefor, may be determined in a manner equitable to all concerned.

As the standards established by law and the commissioner of pensions of the United States are the most frequently used, involving the expenditure of millions, they will be examined and compared with what may be obtained by the mathematical formula for the normal earning ability, and thereby show the need of scientific methods.

One of the two standards of comparison, namely, a disability caused by ankylosis of a wrist or ankle joint for which \$8 per month is given is 1-9 of \$72, which is allowed for total disability. When 1-9 is reduced to percentage it is 11.11 1-9 per cent, and when subtracted from 100 per cent leaves a remaining earning ability of 88.89 per cent. As this standard is the one more frequently employed, we have for the sake of convenience, and of employing the scale of pensions for the disabilities specified by law and the commissioner of pensions, in our formula, adopted a standard of 10 per cent of the total disability for ankylosis of a wrist or ankle joint.

This disability involves the unit a, of the body: subtracting 10 per cent from 100 per cent leaves 90 per cent. Inserting this value in the formula and discarding all undamaged units,  $E = 0.90 \sqrt[4]{0.90 a}$ . If it is decided that the person's competing ability is but moderately affected with this disability and 7 is selected for the index of the radical of the competing ability,  $E = 0.90 \sqrt[7]{0.90 a} = 0.90 \times 0.9875 = 0.8887 \therefore E = 88.87$  per cent, which is almost identical with that obtained by subtracting 1-9 reduced to percentage from 100 per cent. Seven, however, is only one of several numbers that may be selected to meet the different conditions in the competing ability of persons in the various vocations. Herein lies one of the great advantages of the formula in that the competing ability may be adjusted in accordance with the character of the damage and the vocation of the person, for it will be readily seen that it would make a great difference in a person's competing ability, in many occupations, whether the ankle joint or the wrist joint was stiff.

The other standard of comparison used by the Bureau of Pensions is a disability equivalent to the loss of a hand or foot (third grade) for which \$24 per month is given. Twenty-four dollars is  $\frac{1}{3}$  of \$72, which when converted into our 10 per cent standard, subtracted from 100 per cent and introduced into the formula with all the undamaged units discarded, and with 7 for the index of the radical of the competing ability, gives  $E = 0.70 \sqrt[7]{0.70 a} = 0.70 \times 0.9535 = 0.6667 \therefore E = 66.67$  per cent, which, in this instance is identical with that obtained by sub-



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tracting  $33\frac{1}{3}$  per cent from 100 per cent:  $66.66\frac{2}{3}$  per cent of  $\$864 = \$576$ , which subtracted from  $\$864$ , and the remainder divided by 12, gives  $\$24$  per month. The pension specified by law for the loss of a hand or foot is  $\$30$  per month, whereas the standard for a disability equivalent to the loss of a hand or foot is  $\$24$  per month. Thirty dollars is  $5-12$  of  $\$72$ , which reduced to percentage and subtracted from 100 per cent leaves  $58\frac{1}{3}$  per cent, remaining earning ability of this unit. When  $41\frac{2}{3}$  per cent is converted into our 10 per cent standard, subtracted from 100 per cent, and its value introduced into the formula with all undamaged units discarded and with 7 for the index of the radical of the competing ability,  $E = 0.625 \sqrt[7]{0.625 a} = 0.625 \times 0.935 = 0.5843 \therefore E = 58.43$  per cent in this instance.

Assuming that  $\$30$  per month is an equitable pension for a person with a disability caused by the loss of a foot, and that 7 shall be the index of the radical of the competing ability, he would certainly have less competing ability with the loss of the left hand and still less with the loss of the right hand. In our formula the number for the index of the radical of the competing ability could be varied to meet these conditions. For the loss of the left hand we would select 3, and for the loss of the right hand 2 for the index of the radical of the competing ability because these disabilities are serious, hence,  $E = 0.625 \sqrt[3]{0.625 a} = 0.625 \times 0.855 = 0.534375 \therefore E = 53.43\frac{3}{4}$  per cent;  $53.43\frac{3}{4}$  per cent of  $\$864$  subtracted from it, and the remainder divided by 12 gives  $\$33.52$  per month for the loss of the left hand: and  $E = 0.625 \sqrt[2]{0.625 a} = 0.625 \times 0.79 = 0.49375 \therefore E = 49.37\frac{1}{2}$  per cent;  $49.37\frac{1}{2}$  per cent of  $\$864$ , subtracted from it, and the remainder divided by 12, gives  $\$36.45$  per month for the loss of the right hand, or  $\$2.92$  per month more for the loss of the right than for the loss of the left hand. For the loss of both hands we would select 0 for the index of the radical of the competing ability, and the formula would be,  $E = 0.25 \sqrt[0]{0.25} = 0.25 \times 0 = 0 \therefore E = 0$ . Nothing from  $\$864$  leaves  $\$864$ , which divided by 12 gives  $\$72$  per month for total disability, whereas the amount specified by law for this disability is  $\$100$  per month,  $38.8-9$  per cent more than that for total disability. This reveals an inconsistency that can be accounted for only on ultra-sentimental grounds, not consistent with other pensions for total disability, such as the loss of the sight of both eyes. A person with the loss of the sight of both eyes would certainly have less earning ability than one with the loss of both hands, and as large a pension should be given, even on sentimental grounds, for the one as for the other.

If  $\$30$  per month is an equitable pension for a disability caused by the loss of a hand or a foot,  $\$36$  per month for the loss of a hand and a foot as now specified by law would not be equitable. Let us see what the amount would be when scientific methods are employed to determine it. According to the standard when converted into our 10 per cent standard, and introduced into the formula, with 7 for the index of the radical of the competing ability,  $E = 0.25 \sqrt[7]{0.25 a} = 0.25 \times 0.82 = 0.2050 \therefore E = 20.5$  per cent; 20.5 per cent of  $\$864$  is  $\$177.12$ , which subtracted from  $\$864$  leaves  $\$686.88$ , and this di-

vided by 12 gives  $\$57.24$  per month, that should be given for the loss of a hand and a foot, instead of  $\$36$ , as now specified by law. This shows not only the inconsistency of empirical methods, but it shows that an injustice has been done a soldier or sailor, according to the standard of  $\$30$  per month for the loss of a hand or foot, even when 7 is used for the index of the radical of the competing ability, whereas with the loss of a hand and a foot the competing ability is seriously affected and it would be less than with the loss of either one alone, and the index of the radical should be less, namely, at least 3, which when used gives  $\$61$  per month for the disability caused by the loss of a hand and a foot. This brief consideration of the methods and rates for pensions employed by the Bureau of Pensions of the United States is sufficient to show that they are not only based upon empiricism but are full of inconsistencies and absurdities and do not meet the conditions in those who are pensionable, and therefore should be discarded for scientific methods which do meet the existing conditions in every case in a manner equitable to all concerned.

If it were a physician, 54 years of age, who had lost his left hand, and he had been in practice 28 years, and had earned  $\$70,000$  net, or an average of  $\$2,500$  a year, according to the American life mortality table, he would be expected to live 18 years more. Assuming that he would have practiced medicine 16 years more, and earned at least  $\$40,000$  net, which is a reasonable supposition, had he not lost his left hand, we find now according to these standards and our formula that his earning ability is  $53.43\frac{3}{4}$  per cent of  $\$40,000$ , or  $\$21,375$ , which subtracted from it leaves  $\$18,625$ , and this divided by 16, gives a yearly indemnity of  $\$1,164.0625$ , or  $\$97$  per month. If the party responsible for the damage to the physician wishes to settle in one payment, each yearly indemnity must be discounted by multiplying it by the fractional part of the present value of  $\$1$  at compound interest for the number of years before it would be paid. Discounting  $\$1,164.0625$  in this manner for 16 years, at 4 per cent, and adding the products together, we obtain  $\$13,572.40$ , which is the net amount the physician should receive when all the indemnities are made at once, in one payment. In consequence of this injury, the physician was totally disabled four months, for which he should receive one third of  $\$2,500$ , or  $\$833.33$ . His other expenses were  $\$166.67$ , which added to  $\$833.33$ , makes  $\$1,000$ , which should be added to  $\$13,572.40$ , making  $\$14,572.40$  that should be paid to the physician for total damages, loss of time, and expenses in consequence of the injury by which he lost his left hand. If the physician's income had been more, the party responsible for the injury would have to pay a proportional larger sum for the damage, and if it had been less the physician would have to accept a proportionally smaller sum.

If it had been the loss of the right hand the physician's earning ability would be  $49.37\frac{1}{2}$  per cent of  $\$40,000$ , which subtracted from it and divided by 16 gives  $\$1,265.62$  as a yearly indemnity, or  $\$105.46$  per month, or  $\$8.46$  more per month for the loss of the right than for the loss of the left hand. When made in one payment the physician should receive  $\$15,746.56$ , or  $\$1,174.16$  more for the loss of the right than for



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the loss of the left hand. If it had been the loss of both hands, the physician's earning ability would be 0, and he should receive an indemnity of \$2,500 a year, or \$208.33 per month, or when made at once, in one payment \$30,131, assuming that \$1,000 would be paid in addition to total disability.

All the disabilities that have been considered belong to the unit a. Our formula gives the same equity whether one or all of the units are damaged. For instance, if the physician had lost an eye, at the same time he lost his left hand, according to \$17 per month, the amount specified by the commissioner for this disability,  $E = 0.625 a \times 0.7875 d \sqrt[3]{0.625 a \times 0.7875 d} = 0.4921 \times 0.789 = 0.3882 \therefore E = 38.82$  per cent; 38.82 per cent of \$40,000 subtracted from it and divided by 16 gives \$1,529.50 for a yearly indemnity. If this is divided by 12 it gives \$127.45, or \$30.45 more per month for the additional loss of an eye. When \$1,529.50 is discounted at 4 per cent compound interest for 16 years, the sum is \$17,809.95, and with the \$1,000 added, makes \$18,809.95 that should be paid the physician for the loss of the left hand and an eye, or \$4,237.55 more when an eye is lost with the left hand.

Our formula can be so readily adjusted to the circumstances of every person whose earning ability has been damaged, that it may rightly be likened to cloth for a garment which is selected, cut, and made to fit all the existing conditions of every individual. There is, therefore, sufficient reason for its existence, and for its employment in ascertaining the economic value of a man and also in rating a person, and in determining damages to the body, and an indemnity to be allowed therefor, because it is based upon principles employed in ascertaining the efficiency of any physical force, and therefore is scientifically correct.

The higher mathematics involved in the extraction of the roots of the radicals are avoided by the construction of a chart by Prof. Hart of the University of Maine, by which geometric curves represent the different roots: the value of the abscissa being given at the top and bottom, and that of the ordinate on either side. By taking the remaining decimal value of the unit of the body, as abscissa, and tracing this line to the geometric curve representing the root sought, and from this point following the ordinate to its end on either side, the value of the root will be found. Inserting this value in the formula, the process of finding the remaining earning ability and thereby the damages to the body is one of simple computation, involving no more mathematics than an example in interest or partial payments.

Although it is true that scientific standards of measurement of all the parts of the units of the body have not been determined and agreed upon, nevertheless it is a self-evident fact that anything that is used must have a value placed upon it, and when this value has been measured, tested, compared, and estimated in a scientific manner, in a large number of normal healthy persons, and an average value ascertained, this average value becomes a scientific standard of measurement for that particular part of the unit of the body. It is in this way that all the scientific standards of measurement, now employed, have been determined and agreed upon,

and it is in this way that all the remaining ones must be established. Until this work is consummated we shall have to employ such standards as have been agreed upon, and by the same methods by which these have been obtained determine values for all the remaining systems and organs of the units of the body which will eventually be accepted as scientific standards of measurement.

If the history and examination of a person revealed the fact that a unit was not normal prior to the injury, for which damages are claimed, then the fact must be taken into consideration in determining the remaining value of the unit for the formula. In order to avoid disputes and litigations, every person should have an exhaustive examination, and carefully made case record of the conditions of his body. This would be of immense value to every person not only in case of an injury but in the treatment of any disease. The time is coming when physicians will be largely occupied in making these examinations and case records and thereby be preventing rather than curing diseases. To make these case records more complete and satisfactory they should be begun early and continued through school life.

In ascertaining damages to the body, a physician must first determine what the impairment of the function of the unit is, and then, by comparing this with the case record and the scientific standard of measurement for it, give the remaining value in the form of a fraction of the whole unit in the formula. The principles and process then are the same as those employed in determining the efficiency of any physical force. It will be seen that it is the damaged functions that the physician first seeks, and not necessarily the pathology of the damaged unit. To illustrate this, a physician might in examining the eyes find the sight seriously impaired, the fields markedly contracted, and the muscular movements badly deranged. He could determine the exact functional disability of each of these three units of the eyes by the scientific standards of measurement for them, and give the remaining value of each unit in the form of a fraction for the Magnus formula, and thereby ascertain the remaining earning ability of the eyes without even knowing the pathology of the disabilities. The exact nature of the disabilities could not be determined without instituting an examination which would reveal their pathology, and therefore the physician could not state whether the disabilities were temporary or permanent without such an examination. The pathology of a disability is necessary only to determine its character, whether transitory or permanent, serious or not, as the case may be, and should not be made the basis to determine the remaining earning ability of the body. The earning ability is a composite quantity made up of the physiological functions of the systems and organs of the units of the body, each of which is interdependent upon the other in making man the most wonderful product of nature.

In youth and the beginning of manhood, we can only rate a person according to his functional and his technical ability, but when that person has a fixed occupation we can, thereby, determine, by our formula, his earning ability and his economic power in the world as accurately as we can that of any physical force.



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We can determine his mental ability only so far as it is manifested in his vocation and the importance placed upon it as evidenced in the remuneration he receives for it. We can not figure upon possible prospects of advancement, nor change of occupation. We can only figure upon the actual conditions of life as they exist, and when accidents occur, causing damage, on the supposition that these conditions would continue for a length of time thereafter according to the basis upon which the American mortality table has been constructed and upon which has been established life insurance—the first business of the world.

The value of the functions of the body can not be determined, for health, like character, is priceless. Even the possession of health much below any economic value is priceless, and is clung to under all conditions of privation and suffering. This does not affect the purpose of our formula, which represents mathematically the normal earning ability of the body. This has solely to do with the individual's ability to perform certain services and to receive a specific compensation therefor for the remainder of a prospective working life. No life insurance company would consider a risk on a man's life for an amount his business or wealth did not warrant. A man who has no income whatever and could offer no collateral would be refused a loan of money from any person, or bank, and he could not obtain money except by reasons which are foreign to the rules of business. A person with good habits and a steady occupation with a specified income would be able to hire money on that alone, in proportion to his income, other things being equal. The time is coming when the earning ability of man will be rated and will be just as valuable in the labor market as is the rating of his financial ability to-day in the business marts of the world.

Then, indeed, would the scope, extent, and usefulness of our formula be realized, as a medium through which justice would be given in all transactions where the economic value of man is to be determined, confining every step of the process to the mathematical exactness upon which it is constructed, and thus solving the problem of medical expert testimony, and giving equity in courts of law, in insurance, and in the Bureau of Pensions of the United States; and in many of the troublesome, economic problems in the labor markets of the world.

ERASTUS EUGENE HOLT, M.D.

**Physical Force Party**, a term applied in British politics to the Irish party which in 1843 advocated physical force to secure the repeal of the union with Great Britain.

**Physical Geography**. See **PHYSIOGRAPHY**; **GEOGRAPHY**.

**Physical Optics**. See **LIGHT**.

**Physical Society, American**, a society affiliated with the American Association for the Advancement of Science (q.v.). It holds four meetings a year for the reading and discussion of papers on the subject of physics.

**Physical Society of London, The**, a learned organization established in 1874, having for its object the advancement of a knowledge of physics. The society publishes 'Proceedings' quarterly. Its headquarters are at Burlington House, London.

**Physical Training**, a term used to indicate the systematic development and maintenance of bodily power and health. While in the broad sense it includes gymnastic and athletic exercise, active sports, manual training and personal hygiene, there is an increasing tendency to use the term to designate systematic physical exercise, and as such it will be here considered.

Systematic training of the body has been followed in some form by probably every nation and race, savage and civilized. In the past it has taken the varied forms of training for warfare through exercise for developing endurance, strength and skill; recreative and competitive sports; gymnastic dances for religious, martial or recreative purposes, and remedial exercises for the cure of disease, often associated with religion and administered by the priesthood. The highest development in many ways that the subject has ever known was in ancient Greece, where athletic games held a place in the political, religious, intellectual and artistic life of the country that made them one of the greatest human institutions in history. (See **ATHLETICS**; **GAMES**.) The physical training of women in ancient Greece consisted mostly of dancing and ball-playing, though the women of Sparta were not allowed to marry until they had given a public exhibition of proficiency in gymnastics. After its decline in Greece physical training next arose to the dignity of an institution in the age of chivalry when physical strength and prowess were again apotheosized for noble uses. (See **GAMES**.) Following this, development of the body fell under the ban of an ascetic age, where it remained until early in the 19th century despite the protests of such philosophers and reformers as Rabelais, Montaigne, Rousseau, Pestalozzi, Luther, Milton and Locke. At the time mentioned began a renaissance of physical training out of which has grown, side by side with the continuance of athletic sports, the modern gymnasium, a wholly unique institution in its construction, equipment, and the kinds of exercise adapted to it. This exercise includes gymnastics proper, with and without apparatus, and of late a strong revival of games and gymnastic dancing. With the growth of cities, massing large numbers of people in limited space and curtailing facilities for outdoor exercise, the gymnasium has come to mean, not only a preparation for competitive sports, but, for thousands of people, the only opportunity for vigorous, all-over bodily exercise. At the same time there has developed a scientific and educational understanding and application of the subject in marked contrast to earlier methods. Exercise in its early forms, as inspired by considerations of religion, warfare or competitive sport, was used with a purely empirical knowledge of its effects. With the development of physiology, psychology and related sciences, has come a closer analysis and classification of exercises for their effects upon the physiological functions, a clearer knowledge of the relation of exercise to psychological and moral development, its adaptation to individual needs, and its use as an instrument of education. Germany and Sweden were pioneers in this modern advance of the subject, and the principles and methods there developed have had a profound influence upon the physical training of other European countries and America.



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German gymnastics have been developed in societies organized into the Turnerbund, which is the largest organization for gymnastic purposes that the world has ever known. It was founded about 1810 by Friedrich Ludwig Jahn (1778-1852), who invented the mode of exercise known as turning, and who is called the Father of German Gymnastics. The inspiring motive for Jahn's work was patriotism—the development of strong men for the protection of the fatherland. In 1896 the Turnerschaft (in Germany and Austria) numbered 554,757 members in 6,251 Turnvereine (separate societies). No institution of physical training since the days of ancient Greece has had such a popular following as the German Turnerbund. Indeed, it bears strong analogies to the Greek institution. Among these is the combination of intellectual, artistic and social interests with physical training. For children there are, in many Turnvereine, classes in drawing, modeling, needlework and literature. The adults have debating societies and choral and dramatic clubs. The social element is very strong. In both Germany and the United States the German turners have a meet or festival every four years, when thousands of participants from all parts of the country contest for honors in gymnastics, athletics, debating, singing, etc. Prizes of laurel or oak leaves, or diplomas, are awarded for these contests. Jahn and his pupils, building upon a collection of exercises made by GutsMuths (1759-1839) invented a number of pieces of apparatus and exercises to be performed upon them. Much of this German work calls for the sustaining of the weight of the body upon the arms, as in using the horizontal and parallel bars, traveling and flying rings. The vaulting horse and buck, balance boards, ladders and climbing poles are also prominent in German gymnastics. Freehand gymnastics (namely, without apparatus) and work with light, movable apparatus, such as wands, dumb-bells and Indian clubs, were developed and adapted to schools by Adolph Spiess (1810-58). The establishment of gymnasiums for secondary schools was decreed by the Prussian government in 1844, and for elementary schools for the people in 1860. The Royal Central Gymnastic Institute for training teachers of gymnastics for the army and the schools, was established by the government in 1877. Technically, as introduced in the United States, German gymnastics partake of the empirical character of earlier forms of exercise. The work is classified (see STECHER) as tactics, calisthenics, fancy steps, apparatus work, popular gymnastics, games and plays. Within these divisions further classification is according to external features, as, exercise on the upper side of the ladder, on the lower side, outer side, etc. The progressive arrangement of exercises is according to neuro-muscular skill, advancing from simple to complex movements. The capacity of pupils is also determined on the general lines indicated by their separation into classes of children, men, women, and old men. Almost all possible movements are permissible, and the ingenuity of teachers has resulted in a large and interesting variety of exercises. Indeed, interest and enjoyment—work under the guise of youthful happiness and sport—mark the general spirit of the turner gymnastics. Games for both adults and children are a prominent feature, and for women and chil-

dren, figure marching with dance steps and singing, called roundels or reigen. The method of teaching and conducting work is almost invariably imitative, the pupils' movements being largely reflex and automatic. This, with the use of apparatus, gives an objective trend to the mental attitude of pupils which reduces mental tension to a minimum. The musical genius of the German people is manifest in its gymnastics, not only in the frequent use of musical accompaniment, or, in the absence of music, of inspiring rhythms beaten out by the instructor, but, in a larger sense, in the artistic arrangement of drills or series of exercises. These are often constructed around a given exercise which serves as a theme on which variations are arranged, working up, as it were, to a climax, and returning at the close of the series to the initial movements. This artistic bent shows in *ensemble* effects, as when alternate lines work in opposite directions, or a programme is closed with a tableau or pyramid of performers.

Gymnastics in Sweden are also "the lengthened shadow of one man"—Peter Henry Ling (1776-1839). While never attracting a popular following like German gymnastics, those of Sweden are also under government auspices and are universally used in the schools and the army, while since 1814 a Royal Gymnastic Central Institute for the training of teachers has been maintained at Stockholm by the government. Ling put gymnastics into pedagogical, military, medical and æsthetic divisions. He brought the subject within the scientific trend of the century by a careful study of the effects upon the body of various positions and exercises, and their classification according to these effects. Developments in physiology have modified some of Ling's conclusions, but the underlying principles remain. He invented a number of pieces of fixed apparatus, notably the stall bars, Swedish horizontal bar (boom) and vaulting box. These pieces of apparatus admit of less freedom and variety of motion than the German apparatus, but lend themselves to more closely graded mechanical progression in the exercises. No light, movable, or so-called calisthenic, apparatus is used in the Swedish work, but much is made of free-hand gymnastics. All exercises are carefully selected for their effects upon the physiological functions or bodily posture. The latter is especially emphasized. No exercises are admitted which even temporarily constrict the chest, embarrass the respiration or "produce continuous pressure upon the large vascular or nerve trunks." Static contraction of the muscles is much used, however, in holding one part of the body in a given position (as bending the trunk forward) while another part (as the head or arms) is exercised. All Swedish gymnastics are taken to command, music being entirely eschewed. These commands are extremely analytical, practically nothing being left to the initiative of the pupil or to the sub-conscious processes of muscular co-ordination. Many Swedish instructors teach new exercises entirely from command or verbal description as distinguished from imitative methods of presentation.

As introduced in the United States Swedish gymnastics have been characterized by an arbitrary and minute classification of exercises and the arrangement of these in a "day's order" or



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lesson, as follows (Posse): (1) introductions, (2) archflexions, (3) heave movements, (4) balance movements, (5) shoulder blade movements, (6) abdominal exercises, (7) lateral trunk movements, (8) slow leg movements, (9) jumping and vaulting, (10) respiratory exercises. The idea of orderly progression in the use of exercises with regard to their physiological and mechanical difficulty is one of the most valuable contributions made to modern gymnastic practice. For instance, the effect upon circulation and respiration of exercise of the large muscular groups, as of the thigh and trunk, is much greater than of small groups, as of the arms or legs, and within reasonable limits this effect is intensified by overcoming resistance as in lifting the weight of the body in jumping or other precipitant exercises. Exercises for these muscular groups therefore bear a logical relation to one another. Muscular strength is similarly amenable to progressive development through the application of some of the laws of mechanics. For instance, work of the trunk muscles is increased by altering the leverage through positions of the arms, and balance exercises are made more difficult by narrowing the base and shifting the centre of gravity. The Swedish medical gymnastics, especially in orthopedic practice and in the form of massage, are widely used.

Physical training in the United States received its first popular impetus from Dr. Dio Lewis, about 1860. Dr. Lewis was not a scientific worker, but aiming to put the spirit of sport and play into gymnastics promulgated some good all-over exercise in free-hand movements and with dumb-bells, wands, Indian clubs, bean bags and some apparatus of his own devising—the “shoulder pusher” and “iron crown.” This work had an extended vogue throughout the country with both men and women, and was introduced into many schools. Since the Civil War, and especially in the last ten years of the 19th century, physical training has undergone a steady advancement in the United States, both in the extent to which it is used, and in the development of the subject itself.

In 1870 and later Dr. Dudley A. Sargent invented a series of pulley weight machines, some forty in number, which have since held a prominent place in gymnasium equipment. The best known of these is the chest weight machine. By means of these appliances exercise may be localized to given groups of muscles, thus developing weak or undeveloped parts of the body. Obviously measurement and general physical examination of pupils is an important factor in the thorough use of such a method.

In 1887-8 there swept over the country a popular fad for what was called the Delsarte system. François Delsarte (1811-71) was a native of France, whose work to establish laws of expression for the dramatic art probably led to the origination of certain forms of free-hand exercise, æsthetic in character, which have been developed by a number of American workers, though his daughter has expressly denied that he had anything to do with gymnastics. His work was approached entirely from a philosophical, as distinguished from a physiological, view point, and the mystic number three and its multiples governed the various modes of movement and expression. That every movement

and attitude of the body should express an emotion was a cardinal point. The cause of physical training was for a time retarded by the sentimental, languid and unscientific atmosphere which surrounded much of this work, but with the passing of the vogue it is found to have left two distinct types of exercise and certain principles of graceful motion which have permanent value. To make the body flexible, and to free it from habits of muscular tension, relaxing (devitalizing) exercises are used. These consist in making absolutely limp one part of the body after another, and finally the whole at once, by removing all tension from the articulations. These exercises are followed by a series of energizing or vitalizing movements, slow and rhythmic. Principles of grace embodied in these include the slow evolution of movement from one joint to the next, and the movement in opposition (opposite directions) of two parts moving simultaneously. Delsarte's expressional work is highly valued in dramatic training.

Swedish educational gymnastics were introduced into this country in 1888 by Baron Nils Posse, having been preceded many years by German gymnastics. These two schools or methods of work, differing radically, were each introduced with the handicap of the term “system,” implying fixed limits and arbitrary modes of procedure, as distinguished from flexible methods, capable of growth and adaptation, though each claimed the latter quality. A bitter rivalry ensued, extending over many years and hindering the development of the subject. This warring of systems has largely given place to a broader spirit which recognizes the fact that different methods of gymnastic procedure are fitted to produce different results suited to different conditions and temperaments. Certain principles have emerged which, in a more flexible guise than when first introduced to us, are more largely entering into all gymnastic work and may be said to serve as criteria of its quality. These principles include a careful consideration of the condition and needs of the individual, a purposeful selection of exercise with regard to its effects, a general, though not of necessity an uninterrupted, progression in its use, all-over body exercise in a given lesson, and its arrangement with reference to curves of effort—that is, the gradual approach to, and receding from, maximal heart effects. Awkward performance is giving way to the good form or finished execution that denotes definite training of the power of muscular co-ordination; cultivation of erect carriage and generally good posture are recognized as indispensable. Methods of teaching gymnastics are found to be as amenable to the laws of pedagogy as any other branch worthy to rank in the science of education, and recognition is being made of the training or use of psychological powers—the motor sense, the will, attention, etc. Indeed, physiological psychology and child study have contributed as much to physical training as has the physiological laboratory.

The professional training of teachers of gymnastics has done much to advance the cause of the subject which long suffered from the idea that agility of performance was a sufficient qualification for teaching. In 1903 there were in the United States 16 normal schools of physical



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training, offering courses of from ten months to four years in length. This number includes three of the nine universities and colleges which give some normal instruction in theory and practice of the subject. Fifty-one normal schools for class teachers train their students to conduct class exercises in gymnastics. In 1903 there were 15 summer schools of physical training. The subjects studied in normal schools of physical training include physics, chemistry, histology, physiology, anatomy, kinesiology, anthropometry, biology, symptomology, psychology, pedagogy, and the history of physical training, besides the various kinds of practice work in gymnastics, swimming, fencing, games, dancing, voice training, etc., and practice teaching.

The modern gymnasium requires expert knowledge for its design and construction. From 30 to 40 square feet of floor space should be allowed for each pupil exercising in a class. Trusses or ceiling beams should clear the floor 20 feet and a gallery for a running track should be 10 or 11 feet clear from the floor. Lockers, swimming tank, office and examining room for the director should be included. The finest building for physical training in the world as regards completeness of facilities was erected in 1903 by the Teachers' College, Columbia University, New York.

Anthropometry as used in connection with physical training consists mainly of the measurement of significant girths with a steel tape; depths, as of chest and abdomen, with calipers; standing and sitting heights with the stadiometer; strength tests of the various muscular groups with dynamometers, etc.; the measurement of lung capacity with the spirometer and the taking of weight. The testing of sight and hearing, and psychological tests for reaction, time, etc., are often included. To these are added examination of the heart, lungs, spine, etc., and a tabulation of facts of personal history bearing upon heredity and other significant influences. Such examination is made by the physical directors of practically all colleges and universities, secondary and normal schools, and Young Men's Christian Associations. From this data an individual may be compared with the mean, average, or normal type for his age and height, exercise prescribed according to his needs, and development noted from time to time. Physical examination of children in the public elementary schools has not yet become an established feature, though much of it has been done, notably by a commission in Sweden, and in the United States, by Dr. W. T. Porter in Saint Louis, and Dr. H. P. Bowditch in Boston. From these measurements have come a recognition of growth periods and laws of growth that form a valuable index to required exercise.

The representative organization of physical training in the United States is the American Physical Education Association (formerly The American Association for the Advancement of Physical Education), organized in 1885. In 1903 its membership numbered over 1,000, representing all systems and schools. The 'Proceedings' of this Association and its official organ, 'The American Physical Education Review' (quarterly), published since 1896, form the most valuable depository in English of the scientific and philosophical material on the subject.

The extent to which physical training, and especially gymnastic exercise, obtains in the United States may be judged from the following figures. In 1903 the Young Men's Christian Association reported 472 societies giving attention to physical training; 452 of these through gymnasiums, 303 through athletic games, sports and outings. This reached about 90,000 men and boys. They also reported 103 athletic fields and 125 swimming schools. The Association physical department equipment, including gymnasiums, baths, swimming pools, lockers, bowling alleys, athletic fields and out-door play grounds, was valued at \$505,186. The German-American interests, represented in the North American Gymnastic Union, reported, in 1903, 250 Turnvereine, with a total membership of 35,757 men, and an enrolment in classes for the year of 5,368 women and 30,000 children. Of these societies, 177 owned gymnasiums and club rooms valued in the aggregate at \$2,682,000. In 1901, 98 colleges and universities were reported as having organized physical training. The subject was required in 72 of these (63 men's, 7 women's and 2 co-educational) and about 20 per cent gave absolute credit for the same upon the diploma. In elementary schools systematic physical training under special directors and teachers is a part of the curriculum in practically all of the larger and many of the smaller cities. In several States this is required by State law. The number of private schools and gymnasiums is impossible to estimate. In 1903 the Amateur Athletic Union reported 84 athletic clubs having gymnasiums, with an equipment valued at \$219,582, and an enrolment of 3,931 gymnasts out of a club membership of 38,808. Thirty-seven of these clubs employed physical directors. Many athletic clubs having gymnasiums are not included in this list. A number of public indoor and outdoor gymnasiums have been opened, and the movement for playgrounds for children has included most large cities and many smaller ones.

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**Physician**, one who practises or is skilled in the art of healing and in methods of preserving and promoting health, especially one who prescribes remedies for diseases; specifically, one who is legally authorized to practise medicine. In the United States physicians qualify by compliance with State requirements. State examinations for ascertaining the fitness of candidates for this calling are now generally held, and to those who successfully pass them license to practise is granted. Usually a physician is not bound to attend any person who may call him; but having undertaken to treat a patient, he is liable to the penalties of malpractice in case of injury resulting from his own incompetence or neglect. As between physician and patient, relations are privileged and confidential, and a patient's secrets in the keeping of a physician are inviolable, the State not even requiring them to be made known in legal procedures. The relations of physicians to the legal fraternity and to the legal transactions of the State form part of the subject of medical jurisprudence (q.v.).

**Physicians, Royal College of, Edinburgh**, incorporated 26 Nov. 1681 by royal charter; a body empowered to make laws for promoting and regulating the practice of medicine within the city of Edinburgh, town of Leith, and districts of the Canongate, West Port, Pleasance, and Potterrow. No person was to be allowed to practise medicine within these limits without a warrant from the college, and all medicines sold within the same limits were made liable to be inspected by the officers of the college, who were authorized to throw out into the street all such as were found bad or unwholesome. A warrant from the college is no longer necessary to a practitioner; but the body is now represented in the general medical council established by the Medical Act of 1858.

**Physicians, Royal College of, London**, a body whose organization dates from 1518. In that year Thomas Linacre, the celebrated scholar and humanist, one of the physicians of Henry VIII., obtained from him, with the aid of Cardinal Wolsey, letters patent incorporating all men of the medical faculty in London as one body. Various privileges were accorded to them, chiefly that of prohibiting any one from practising as a physician in London, or within seven miles of it, unless he had first obtained a license from this corporation. A charter granted four years later confirmed the privileges of the body, except that graduates of Oxford and Cambridge were permitted to practise within the jurisdiction of the college without previously being examined by it. Various charters have been since granted to the college, but from the passing of the Medical Act of 1858 its license has not been necessary to those practising in London or within seven miles

round. At present the corporation consists of a president, fellows, and members.

**Physick**, fiz'ik, **Philip Syng**, American surgeon: b. Philadelphia 7 July 1768; d. there 15 Dec. 1837. He was graduated from the University of Pennsylvania in 1785, studied medicine abroad and became house surgeon at Saint George's Hospital, London, in 1790. He returned to Philadelphia in 1792 and began practice. In 1805 he was appointed professor of surgery in the University of Pennsylvania, and in 1819 became professor of anatomy there, which post he held till 1831. In 1824 he was elected president of the Philadelphia Medical Society. He has been styled "the father of American Surgery."

**Physics**. Physics may be defined as the science of energy, and of the transformation of energy. It is concerned with matter, but not generally, because it is matter, but because it is the vehicle for energy.

Under the title of natural philosophy was originally included all of the phenomena of nature that did not involve the principle of life. The content of the term was restricted from time to time by the exclusion of the subjects of chemistry, mineralogy, geology and meteorology, until, a half century ago, the title natural philosophy comprehended practically the same topics as are now more generally grouped under the title of physics.

The interconnections between physics and chemistry are so intimate that it is impossible to draw an exact line of separation. But in physics we are concerned with matter as a mass, as a substance retaining a fixed composition, though subject to changes of form, of state, of place. For instance, it is the province of physics to study and determine the conditions under which water will exist in the solid, the liquid, and the vaporous states, and the energy changes which accompany the changes of state. It is the province of chemistry to determine the elements which, by their combination, form water, and the properties of these elements. Changes which matter undergoes without altering the composition or destroying the identity of the body are physical changes, and are a part of the study of physics. Changes by which the identity of the body is changed, such as when hydrogen and oxygen combine to form water, are chemical changes, and do not belong to physics. At the same time, these chemical changes are often accompanied by energy changes, and therefore come, to that extent, into the province of the physicist. This gives a broad region that belongs for investigation both to the chemist and to the physicist, and which is called either physical chemistry or chemical physics.

Modern astronomy, also, has close affiliations with physics. The study of the bodies of the solar and stellar systems, not merely as masses of matter moving according to mathematical laws, but as bodies whose constitution is to be determined, whose life-history is to be studied, whose changes are to be noted and explained, whose influences, thermic, optic, magnetic, electric, are to be studied and quantitatively stated, has so combined the sciences of physics and astronomy as to make wise a new name, physical astronomy, or astro-physics or the new astronomy.

Modern physics is an inductive science. Like



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the other branches of natural philosophy, it is based on a belief in the "constancy of nature"; upon the belief that the same cause, operating under the same conditions, will produce the same effects. In order to ascertain the causes of physical phenomena, experiments are performed in which the conditions are under the control of the observer, and are varied in order to determine which conditions are essential and which are accidental. Then exact measurements are made to determine the quantitative relation between cause and effect. A generalization from a study of many phenomena occurring under varying conditions, gives a theory. A theory, modified and perfected by extended study of facts, tested by many and rigid experiments, strengthened by its use in suggesting or predicting new phenomena, becomes a law.

Physics, as the science of energy, has its basis in the modern doctrine of the conservation of energy. The statement of this, in the words of Maxwell, is: "The total energy of any material system is a quantity which can neither be increased nor diminished by any action between the parts of the system, though it may be transformed into any of the forms of which energy is susceptible." "The doctrine of the conservation of energy is the one generalized statement which is to be found consistent with fact, not in one physical science only, but in all. When once apprehended it furnishes to the physical inquirer a principle on which he may hang every known law relating to physical actions, and by which he may be put in the way to discover the relations of such actions in new branches of science." The importance of this doctrine, and its influence in unifying and in developing physics, cannot be overestimated. Not much more than a half century ago physics consisted of a large mass of facts, tied together rather loosely by theories that were themselves not strong. Just as the development of the doctrine of the conservation of matter unified chemistry and put into the hands of the chemist a rule for measuring his facts and for checking his theories, so the doctrine of the conservation of energy has become the basic law for connecting physical phenomena, for testing the accuracy of physical experiments, and for checking, modifying, extending physical theory.

Under physics are now generally included the following branches: mechanics and properties of matter, sound, heat, light, magnetism, electricity. These may be grouped under two heads, physics of matter, and physics of the ether. The first would include mechanics and sound; the second, heat, light, electricity and magnetism. Another grouping has given the term mass physics to mechanics and sound; molecular physics to heat, in part; physics of the ether to the remaining topics.

Detailed treatment of each topic and of the subdivisions of each topic will be found under the appropriate heading in this encyclopedia, and here will be given only brief outlines of the subject matter of each.

Mechanics may be defined as that branch of science which treats of the effects of forces on matter. It is variously subdivided, but a convenient division is into kinematics, which treats of motion in the abstract, motion without reference to the body moved or to the cause of the motion; and dynamics which treats of the prop-

erties of matter in motion and of forces as the cause of motion or of stress. Dynamics is divided into statics, which treats of forces in equilibrium, and kinetics, which treats of matter in motion, and of forces as producing motion.

Mechanics, in its applications in physics, may be divided into molecular mechanics and mass mechanics. Under molecular mechanics are included those phenomena which depend upon molecular forces, or upon the arrangement of molecules. Here belong, then, adhesion and cohesion and all the properties consequent upon these forces. This includes such properties as hardness, tenacity, malleability, ductility, compressibility, elasticity. Surface tension and capillarity belong here also. Effusion, diffusion and osmosis come under this head, though they belong more strictly to the domain of physical chemistry.

Under mass mechanics is included a large part of statics and kinetics, and especially the applications of these to the study of the phenomena of matter in its three states, the solid, the liquid and the gaseous. The properties of liquids may be grouped under the heads of hydrostatics and hydrodynamics; while the study of the properties and laws of gases may be called pneumatics.

The study of sound commonly begins with a study of wave motion, and then its application in the production and propagation of sound waves. This leads to a discussion of pitch, and of the theory of the musical scale. The laws of reflection, of refraction, and of interference of sound waves are next treated. The principles thus obtained are applied in a detailed study of the vibrations of strings, of rods, of plates and membranes, and of columns of a gas. The quality of a sound, as influenced by combinations of notes of different frequencies and as affected by wave form is usually discussed in considerable detail. The mode of production of vocal sounds, and the mechanism of audition also receive treatment.

Heat may be discussed under the heads of thermometry, expansion, calorimetry, change of state, transference of heat, thermo-dynamics. Thermometry includes a detailed study of forms of thermometers and thermoscopes, including liquid thermometers, gas and vapor-pressure thermometers, and pyrometers. Under expansion are studied the laws of change of size and form of bodies with variation of temperature. Calorimetry includes a study of the methods of determining specific heats, by melting ice, by mixtures, by cooling, by the steam calorimeter. The two specific heats of a gas, that at constant volume, and that at constant pressure, are usually treated in detail. The atomic and molecular thermal capacities are carefully studied, as is also the variation of specific heat with temperature. Under change of state are included the laws of fusion and evaporation. These include the determination of the temperature of change of state, the so-called latent heats of fusion and vaporization, the changes of volume during change of state, and the effects of pressure in modifying the conditions of change. Here, also, is usually included a study of the pressure of saturated vapors, and of the determination of vapor densities. The study of the continuity of state gives the distinction between gases and vapors, and furnishes criteria for deciding under



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what conditions gases may be liquefied. The transference of heat is studied under the heads of radiation, convection, and conduction. By radiation is meant the transference of energy by periodic disturbances of the ether, caused by molecular vibrations of the heated body, and transformable again into heat vibration; convection is the transfer of heat by the motion of molecules as in liquids and gases; conduction refers to the immediate communication of molecular vibrations from particle to particle of a body, or from two bodies in contact. Under the title of thermodynamics is usually included the mathematical discussion of the theory of heat and of the relations of heat energy to mechanical energy. Here are given the two laws of thermodynamics, which form the basis for the study of the applications of heat. The first law states that when work is spent in producing heat, the quantity of work spent is directly proportional to the quantity of heat generated, and conversely, that when heat is employed to do work a quantity of heat disappears which is equivalent to the work done. The second law, as stated by Lord Kelvin, is that "it is impossible by means of inanimate material agency to derive mechanical effect from any portion of matter by cooling it below the temperature of the coldest of the surrounding objects."

Light may be studied under the two divisions of geometrical optics and of physical optics. Geometrical optics treats of the phenomena whose laws may be determined and stated by the use of the ideas of rays, without any inquiry into the physical processes which explain the phenomena. Physical optics, on the other hand, is concerned with light as a wave motion in the ether, and inquires into the physical processes which determine the phenomena. Usually no attempt is made to keep distinct these two branches or methods, but geometrical or physical methods are used as may be more convenient.

In the study of light the proof of the approximate rectilinear propagation of light is followed by a determination of the laws of reflection from plane and curved surfaces, and of the character, size, and position of images formed by such reflections. The study of refraction in prisms and lenses leads to the determination of image-formation by lenses and by lens systems, and to the study of optical systems, such as the microscope and the telescope. The phenomena of dispersion lead to a study of the spectrum and of the applications in spectrum analysis. Physical optics, treating light as a periodic disturbance in the ether, analogous to a wave motion, gives physical reason for the laws of reflection, refraction, interference, and dispersion, and by showing that the rectilinear propagation of light is only approximate, explains diffraction. By means of the diffraction grating wave-lengths of lines of the spectrum may be determined, and by the use of suitable measuring instruments, the energy of any part of the visible or invisible spectrum may be quantitatively determined. Polarization phenomena show that light-waves are transverse to the direction of propagation, and this not only gives ready explanation to the facts of double refraction, of polarization, and of the rotation of the plane of polarization, but predicts such phenomena as that of conical polarization. Color is found to be dependent on wave-length, though

the explanation of color-sensation belongs to physiological optics. The electro-magnetic theory of light, first formulated by Maxwell, states that the periodic disturbances which constitute light are of the same nature as those produced in the ether by rapidly alternating electrical charges, and thus includes radiations of all kinds, heat, light, electricity, in one class. The mathematical analysis of Maxwell has been confirmed by the experimental researches of Hertz and others, while Drude has recently published a treatise on optics in which the equations of Maxwell are used to develop the mathematics of optics.

Magnetism treats of the attractions and repulsions between magnets and magnetic and diamagnetic bodies; of the methods of making magnets; of the properties of the magnetic field; of the mutual action between magnets and electrical currents; and of the action of moving magnetic fields in producing or in varying electric currents. The magnetic properties of iron and the laws of the magnetic circuit are carefully studied. Terrestrial magnetism, the declination and inclination of the magnetic needle, and the variation, daily, seasonal, annual, and secular, of the magnetic elements are also included.

Electricity is divided into electrostatics and electrokinetics. Under the head of electrostatics is included the study of the properties and the effects of electric charges at rest; while electrokinetics treats of the effects of moving charges, that is, of electric currents. Electrostatics treats of the so-called frictional electricity, and is the older branch of the subject. It includes a discussion of the methods of producing a charge, of the laws of attraction and repulsion of unlike and like charges, of the effect of a charge on the region surrounding it, of the forms, uses, and laws of condensers, of the energy of the charge, and of the electric waves set up by the charging and discharging of a condenser.

Electrokinetics treats of current electricity, and includes what was formerly known as galvanic or voltaic electricity. It discusses the forms of batteries, and the theories of their action; the effects of currents, heating, lighting, chemical, magnetic, physiological. The methods of measuring the electromotive force, the current strength, and the resistance of batteries, and the resistance of conductors. It includes a study of thermo-electricity, that is, electricity produced directly by heating the junction of two dissimilar conductors. The study of the inductive effects of currents on neighboring conductors leads to the dynamo and the motor, the most important way of obtaining a current and the most widely used method of applying it. The storage battery, in theory and in application, forms an important chapter. Included also, are the important applications of electricity, such as the telegraph, the telephone, and the use of electricity in the arts. Electric discharges through gases lead naturally to the study of the Roentgen and other rays. The phenomena and laws of alternating currents merit and are receiving increasingly large treatment, because of the growing importance of their applications.

*Historical.*—The knowledge of physics among the ancients was very slight, and their explanations of phenomena were usually crude, and too often influenced by metaphysical ideas.



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In hydrostatics they did some notable work; here the name of Archimedes occupies the most prominent place, and many of his discoveries and inventions are of the greatest importance. The Greeks and Romans were familiar with the properties of mirrors, both plane and curved, but their theories of the nature of light were far from being correct. The fact that amber, when rubbed, would attract light bodies was known to them, as well as the property possessed by the lodestone of attracting iron; but their knowledge of electrostatics and of magnetism scarcely went beyond this. In sound their knowledge was somewhat greater; they knew the relations existing between the length of a string and the pitch of the note given by it, as well as some other facts of musical theory, though their scale differed sensibly from the modern diatonic scale.

During the Middle Ages there was scarcely any advance in physics. In some things there was a less knowledge, or at least a less appreciation, than among the ancients. There were only a few workers of any importance, the most notable being Roger Bacon (1214-94) whose writings show a remarkably clear understanding of the value of experiment and of the inductive method.

With the Renaissance, which may be said to include the 15th and 16th centuries, there came in physics, as in other branches of learning, the stirrings of new things. The beginnings of the experimental method are found in the work of Galileo (1564-1642), who from the top of the leaning tower of Pisa dropped weights whose simultaneous fall established the laws of falling bodies. The work of Galileo was so extended and so important that he well deserves the title of founder of the science of mechanics. To this period, also, belongs the invention of the telescope which marks the beginnings of modern observational astronomy. William Gilbert (1540-1603) of England published in 1600 his great work 'De Magnete,' which made magnetism a recognized branch of science.

The 17th century witnessed the achievements of Torricelli (1608-47) in Italy, whose experiments on the weight and pressure of the air led to the barometer; of Guericke (1602-86) in Germany whose work along the same line led to the air-pump; of Boyle (1627-91) in England and Mariotte (1620-84) in France, who studied the laws of pressure and volume of gases; of Newton (1642-1727) in England, whose discovery of the law of gravitation was epoch-making, and whose studies in light were scarcely less important; of Huyghens (1629-95) native of The Hague, but dweller in Paris, who made important contributions to optics. This was essentially a century of experimental research, and is marked by more brilliant discoveries than the succeeding century.

In the 18th century the principal contributions in optics were in the perfecting of the telescope by the construction of achromatic lenses and by the construction of large reflectors; in heat by the construction of thermometers, the invention of the steam-engine, and Black's (1728-99) determinations of latent and specific heats. In electricity large advances were made. In electrostatics there came the discovery of the Leyden jar, which gave a great impetus to experimental work. Franklin's (1706-90)

extended experiments in atmospheric electricity, the experiments of Cavendish (1731-1810), and the quantitative work of Coulomb (1736-1806) gave a firm foundation to the subject. The beginnings of discovery in current electricity were made by Galvani (1737-98) and Volta (1745-1827), though the development of the subject belongs to the 19th century.

The first half of the 19th century is marked by the establishment on a firm basis of the dynamical theory of heat. The work of Davy (1778-1829), Rumford (1753-1814), Carnot (1796-1832), Clausius (1822-88), and Joule (1818-89) gave firm foundation to modern thermodynamics by overthrowing the material theory of heat. The latest and best determination of the mechanical equivalent of heat was made in 1879 by Rowland (1848-1901) of Baltimore. In optics the emission theory was replaced by the undulatory theory, largely by the researches and reasoning of Young (1773-1829) and Fresnel (1788-1827). The study of the solar spectrum, begun by Fraunhofer (1787-1826) was continued by Draper (1811-82) in America and by Kirchhoff (1824-87) in Germany, and in recent years has been brilliantly extended by Rowland and Langley (1834-), in the United States. Measurements of the velocity of light have been made by Newcomb (1835-) and Michelson (1852-), and the latter has made valuable contributions to our knowledge of light-waves. In sound the most notable work has been that of Helmholtz (1821-94), whose 'Sensations of Tone' contains contributions of the greatest value to the theory of sound, especially on the physiological side. Koenig of Paris (1832-1901) has made contributions of importance on the experimental side, and the work of Mayer (1836-97) of the United States has been valuable.

The early part of the century saw rapid increase in the knowledge of electricity. In England the experiments of Faraday (1791-1867) led to valuable results; Oersted (1777-1851) of Copenhagen discovered the magnetic action of the current; Ohm (1789-1854) of Germany discovered the law which bears his name. In the United States the work of Joseph Henry (1799-1878) was of fundamental importance. He did much work on the electro-magnet, studied induced currents of different orders, showed that the discharge of a Leyden jar is oscillatory, and devised the first electric telegraph. Morse (1791-1872), using the principles discovered by Henry and others, devised a practical form of telegraph, and through his efforts the first commercial line was constructed. The first induction coil was constructed by Page (1812-68) of Washington.

The last few decades have been especially noteworthy in electricity. The perfecting of the dynamo has made possible the commercial use of the electric current, and has resulted in placing the electrical industries among the most important in the world. In both theory and application of the dynamo and the motor, and in the development of electrical industries, the United States has held prominent place.

The recent discoveries and investigations in electricity which have brought out the "electron" theory of J. J. Thomson, and the study of radio-activity, as exhibited by radium and other substances, have raised questions of great im-



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portance, and may modify some of the generally accepted theories of matter and energy.

A noteworthy advance in the teaching of physics is the establishment of physical laboratories, and in this the United States has taken a prominent part. It is unquestionably true that the recent rapid advance in discovery in physics is, in large measure, the result of the laboratory method of teaching that has been increasingly prevalent during the past 40 years. The first physical laboratory in this country for students' use was established at the Massachusetts Institute of Technology in 1869, and was followed rapidly by laboratories at other institutions of higher learning. In recent years high schools and academies have been equipped for laboratory work, and the effect on the teaching of physics is becoming very marked. The near future may see the establishment of a great national physical laboratory, as the logical development of the recently created National Bureau of Standards.

*Bibliography.*—The literature of Physics, in its various branches, is so extensive that it is impossible to give here anything approaching a proper bibliography. The following lists, therefore, contain the names of only a few of the most recent and most important publications in English. *History*—Cajori, 'A History of Physics'; Mach, 'Science of Mechanics'; Mendenhall, 'A Century of Electricity'; Whewell, 'History of the Inductive Sciences.' *General Treatises*—Treatises or text-books by Ames, Anthony and Brackett, Barker, Carhart (two vols.), Daniels, Deschanel, Hastings and Beach, Nichols and Franklin (three vols.), Peddie, Watson. *Sound*—Helmholtz, 'The Sensations of Tone' (translation by Ellis); Poynting and Thomson, 'Sound'; Rayleigh, 'Theory of Sound' (two vols.); Tyndall, 'Sound'; Zahm, 'Sound and Music.' *Heat*—Buckingham, 'Theory of Thermodynamics'; Maxwell, 'Theory of Heat'; Preston, 'Theory of Heat'; Rowland, 'Physical Papers'; Stewart, 'Heat'; Tyndall, 'Heat as a Mode of Motion.' *Light*—Basset, 'Treatise on Physical Optics'; Drude, 'Theory of Optics' (translation by Mann and Millikan); Emtage, 'Light'; Glazebrook, 'Physical Optics'; Heath, 'Geometrical Optics'; Lommel, 'The Nature of Light'; Preston, 'Theory of Light'; Spottiswoode, 'Polarization of Light'; Tait, 'Light'; Thompson, 'Light, Visible and Invisible'; Wright, 'Light.' *Electricity and Magnetism*—Ayrton, 'Practical Electricity'; Bedell and Crehore, 'Alternating Currents'; Franklin and Williamson, 'Alternating Currents'; Gerard, 'Electricity' (translation by Duncan); Jackson, 'Alternating Currents'; Joubert, Foster, Atkinson, 'Electricity and Magnetism'; Lodge, 'Modern Views of Electricity'; Nipher, 'Electricity and Magnetism'; Perkins, 'Electricity and Magnetism'; Thomson, J. J., 'Elements of Electricity and Magnetism'; Thompson, 'Elementary Lessons in Electricity'; Webster, 'The Theory of Electricity and Magnetism.' *Laboratory Manuals*—The number of laboratory manuals is very large and is increasing at a rapid rate. Among the best are those of Ames and Bliss, Austin and Thwing, Carhart and Patterson, Loudon and McLennan, Nichols, Mann, Miller, Parr, Stewart and Gee, Whiting, Glazebrook and Shaw. *Periodicals*—'American Journal of Science';

'Astrophysical Journal'; 'Nature'; 'Physical Review'; 'Science'; 'Science Abstracts'; 'Scientific American'; 'Scientific American Supplement'; 'Terrestrial Magnetism.' Many journals are published devoted to the interests of some special branch of physics, particularly to the applications of physics.

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**Phys'ocratic School**, in political economy, a school in France headed by Quesnay and Gournay, who, in opposition to the Mercantile System, regarded agriculture as the great source of national well-being, and sought to regulate legislation accordingly. See **POLITICAL ECONOMY**.

**Physiog'nomy** (Greek, *physiognomonía*, literally, the judgment of bodily appearance), the art of judging character from the countenance. We are generally impressed at first sight favorably or unfavorably, in regard to the temper and talents of others, by the expression of their countenances. As the face is that part of the body in which the noblest external organs are united, by which men put themselves in contact with the world, and, for various reasons, shows most of their characteristic traits, it has been made the particular object of study by the physiognomist. Aristotle was the first known physiognomist. He observed that each animal has a special instinct; the fox cunning, the wolf ferocity, etc., and he concluded that men whose features resemble those of certain animals will have the qualities of those animals. Baptista della Porta, in his work 'De Humana Physiognomia' (1586), revived this theory and carried it out further. The French painter Lebrun, in the 17th century, executed a series of pictures founded on the resemblance between the human figure and that of animals; and his theory was also adopted and illustrated by Tischbein, a German painter of the 18th century. The physiologist Camper sought new data in a comparison of the heads of different types, and decided the degree of intelligence belonging to each from the facial angle. Lavater was the first to develop a complete system of physiognomy, which included all the relations between the physical and moral nature of man. (See **LAVATER**.) As the expression of the face depends very much upon the formation of the skull, physiognomy is connected with craniology. Among the chief points in physiognomy, Kant, in his anthropology, reckons—(1) the general formation of the face, particularly in the profile; (2) the individual features of the face; (3) the motions of the face, as far as they have become habitual; also the walk, etc. Kant and others think that physiognomy can never be elevated to a science. It is, however, a subject of great interest; but the student must be on his guard against a general application of its formulated rules. Even Lavater's system lasted but a short time, though he has collected valuable materials.

Consult: Camper, 'Dissertation sur les Differences réelles que présentent les Traits du Visage' (1791); Cross, 'An Attempt to Establish Physiognomy upon Scientific Principles' (1817); Mantegazza, 'Physiognomy and Expression' (1890); Stanton, 'Practical and Scientific Physiognomy' (1890); besides Lavater's works on the subject.



## PHYSIOGRAPHY—PHYSIOLOGY

**Physiog'raphy**, or **Physical Geography**, is that branch of geography which treats of the surface of the earth, of the atmosphere which surrounds it, of the substances which compose it, and of the organized bodies which it produces or supports. Physiography does not, however, enter into the minute details of natural science; it gives a general view of phenomena and their mutual relations, and leaves to the more rigorous sciences the classification of the substances of which they treat, borrowing from each its results, and connecting them into one whole. The figure of the earth and its relations to the other parts of the universe are determined by mathematical geography; physiography points out its natural divisions into land and water, continents, seas, oceans, etc., and treats of the external configuration of mountains, valleys, coasts, etc. From the surface, the interior may be predicated, but where possible, a close study is preferred. This study leads to geology (q.v.) and palæontology (q.v.). Mineralogy (q.v.) contributes by giving information about the substances of which the earth is composed. The department of hydrography points out its divisions into lakes, rivers, seas, oceans; determines the different natural qualities of water, its chemical properties, etc. (see OCEAN; WATER); and the nature, extent, and causes of those great fluctuations which it regularly undergoes. (See CURRENTS; TIDES.) The fluid which surrounds the globe may next be examined (see AIR; ATMOSPHERE; METEOROLOGY), its composition determined, and the curious phenomena of which it is the theatre, and the movements to which it is subject, be studied. After inorganic nature and the atmosphere (see CLIMATE), comes the study of the earth as the residence of organized living beings, which adorn its surface and feed upon its resources. Botany examines in detail the treasures of the vegetable world, while physiography marks the general relations, and traces the influence of climate, temperature, soil, atmosphere, etc., upon the progress and extent of vegetation, and the geographical distribution of plants. (See BOTANY.) Zoology (q.v.) is an aid in the study of physiography, and is aided in turn by this science; and a knowledge of ethnology (q.v.) is essential to an understanding of even the rudiments of physiography. Consult: Somerville, 'Physical Geography'; Humboldt, 'Cosmos'; Cooley, 'Physical Geography'; Johnston, 'Physical Geography'; Reclus, 'The Earth'; Berg-haus, 'Physical Atlas'; Bartholomew, 'Physical Atlas'; Tarr, 'Physical Geography.'

**Physiol'ogus**, an early Greek bestiary. See BESTIARIES.

**Physiology**. In biological and medical science the term physiology is applied to that department of inquiry which investigates the functions of living beings. In its broadest use the name covers the sum of what is known concerning living organisms. In the Aristotelian philosophy it signified, in a general sense, the entire knowledge of natural objects, including thus the modern sciences of natural philosophy or physics, natural history, etc. As limited at the present time, however, the science of physiology has for its aim the elucidation of the actions and processes incidental to and characteristic of the living state. In its wide sense, therefore, the living functions of both animals and plants

fail to be investigated by physiology, this division of the subject being comprehended under the terms comparative physiology and animal and plant physiology. When more specially applied to the investigation of the functions in man the science is called human physiology.

The knowledge of healthy functions is absolutely necessary for the perfect understanding of diseased conditions; and the science of pathology, dealing with the causes and progress of diseases, may in this way be said to arise from, and to depend upon, physiological inquiry in the first instance. Physiology in itself thus forms a link connecting together the various branches of natural history or biology and those sciences which are more specially included within a medical curriculum.

The different departments of physiology may be enumerated as comprehending the investigation of the three great functions which every living being performs. These include, first, the function of nutrition, under which head are investigated the nature and composition of foods and aliments; the processes of mastication, insalivation, deglutition, and digestion—the latter process of itself involving the consideration of the entire alimentary functions, whereby the food is subjected to the action of the various fluids furnished by the digestive glands, such as the liver, pancreas, etc. From digestion the passage is made to absorption, or that function whereby the food-products, now digested, are taken up or absorbed by the lymphatic vessels, and poured into the current of the blood-circulation. This leads to consideration of the blood itself, its circulation, its mode of nourishing the tissues and its return to be purified, loaded with tissue-waste, in the breathing-organs. Respiration and the composition of air next engage attention, and under this head is investigated the process of blood-purification, together with the important subject of the elimination from the system by the skin, kidneys, lungs, etc., of the products of the tissue-waste. Every function whereby the nutrition of the organism is effected, maintained, and subserved falls for investigation under this first head.

The second function is that of correlation, also called innervation. Under this head the functions of the nervous system are investigated and determined, these functions being the media through which, as it were, the organism is brought into relation with the world in which it lives, and through which it reacts upon the world. The last function is that of reproduction, under which are comprehended the generative acts that result in the production of a new being, and which thus repair the losses death and disease make in the species at large. The phenomena of development, or the changes evinced during the progress of the being from its young or embryonic to its mature or adult state, are also included in the study of the reproductive function.

Every living being, therefore, viewed physiologically, nourishes itself, reproduces its species, and possesses or appreciates through its nervous system certain relations with surrounding media. The mode in which it thus, through these three great functions, maintains its normal existence forms the study of the physiologist. And coincident with this study are found certain points



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bearing a general relation to these more special departments of inquiry. The primary question which thus meets the physiologist is connected with the investigation of the nature of life and vital phenomena; and he has thus first to determine if possible the nature of the vital principle, and thence proceeds to deal with its more obvious manifestations. In short, physiology deals with the living being in all its active functional aspects, beginning with its life, proceeding next to investigate its living mechanism, and finally tracing its growth through the earlier stages of development onward to maturity, decline, and death.

**Physiology, History of.** That life-phenomena in general were early attributed to a non-material essence or soul, inherent in the bodies of living men and animals, and departing therefrom soon after death, is clearly indicated by the burial ceremonies of many primitive peoples. But the study of the phenomena themselves was long delayed. For centuries after men had developed ethical principles, had aggregated into nations and instituted systems of government, had amassed wealth, acquired skill in many arts, and even systematized, in some degree, their knowledge of other natural phenomena, the phenomena presented by living things remained almost wholly uninvestigated. For a long time, even after the recording of the symptoms of human disease had become an established custom of civilized races, physiology remained unborn. But gradually those whose business in life consisted in the care of the sick and injured came to see the logical importance of a knowledge of normal structure and function for the comprehension of the nature of disease.

As early as the 15th century B.C. the Egyptians had accumulated some knowledge of clinical medicine and surgery, and were not averse to human dissection, yet their concepts of physiologic processes were extremely crude. They assumed that the body was composed of four elements and ruled by four demons. Hunger and thirst they regarded as "quasi-poisonous substances which forced themselves into the body and required to be neutralized by eating and drinking in order that they might not destroy it" (Baas). They considered that the heart gained in weight until the age of 50, and thereafter, by a loss in weight, finally caused death.

Much more advanced views are recorded in the sacred books of India, the Vedas; but the weight of evidence is opposed to the assertion that these views were held by the physicians of ancient India; indicating rather that the Vedas could not have originated prior to the latter part of the 3d century B.C., and that portions of them were written at much later dates.

The physiology of the early Greeks, as recorded in the Hippocratic writings, may be epitomized as follows: The source of life is an "innate heat," and is conveyed to all parts of the body by the "pneuma," which moves continually in the blood-vessels. By the peculiar warmth of the stomach and adjacent organs food is digested. Blood in the right-heart is cold, whereas blood in the left-heart is warm, having received the "pneuma" from the air by way of the lungs. Blood is prepared in the liver, which also prepares bile. The brain condenses the ascending vapors into nasal mucus. From the biologic

treatises of Aristotle (384-322 B.C.) it is not difficult to gather the principles of physiology as explained by him, of which the following is an outline: The efficient and fundamental cause of all vital phenomena is the soul, which, though immaterial, is not a something superadded to matter, but rather a power which becomes manifest whenever and wherever matter assumes that state designated as living; and as there are different degrees of development of living things, so there are different degrees of manifestation of the soul. Plants are capable of nutrition, growth, and propagation only, and therefore possess merely a "nutritive soul"; animals are capable not merely of nutrition, growth, and reproduction, but also of sensation and self-motion, and hence possess a "nutritive and sensitive soul"; man, in addition to these, possesses the power of reasoning; hence the soul of man is "nutritive, sensitive, and rational." The soul resides primarily in the "pneuma," which is the cause of animal heat, and the headquarters of which is the heart. The heart is the "vital centre" of the body, the seat of all sensations, feelings, and appetites, and the starting-place of all bodily motions, visible and invisible alike. Food, having been masticated, passes down the œsophagus to the stomach, where, by the action of the vital heat, it is prepared for absorption; its nutritive portion, having been reduced to a liquid state, is partly sucked up by and partly evaporates into the mesenteric blood-vessels; thence it reaches the heart, where it undergoes a further "coction" or heat-digestion, by means of which it is converted into blood. This blood, while in the heart, receives the "pneuma" from the inhaled air, and, thus vivified, penetrates by way of the blood-vessels to all vascular parts of the body, supplying them with warmth and nourishment; each part selects what it requires, and the non-utilizable portions of the blood, together with the refuse of body parts, are excreted as bile, urine, and sweat; any surplus of nutritive material is either converted into fat or generative secretion, or, escaping from the extremities of the blood-vessels, is deposited (as mud is deposited from a stream), forming the viscera, flesh, scales, hairs, feathers, etc. Meanwhile the non-nutritive portions of the ingested food pass along the intestine, and so out of the body. During respiration air is inspired and expired through the larynx and trachea, the epiglottis being raised the while; during deglutition the epiglottis is lowered so that neither food nor drink may enter the trachea; for should this occur, difficult breathing, choking, and coughing would result. The blood in the heart is cooled by the "pneuma" of the inspired air. The chief function of the brain—which is a bloodless organ and quite cold—is to "temper the heat of the heart." The brain is not the seat of sensation, nor does it initiate motion. Sensation is a change produced in the soul, initiated by the motion, or some other quality, of the object sensed acting upon the sense-organ. Touch, the lowest and most universal of the senses, is transmitted by the flesh—which is the most universal of body-constituents—to the heart, which is the organ of touch. Though the lowest, touch is not the simplest of the senses—for by it one detects heat and cold, solidity and fluidity, and other such contraries. Taste is a modified form of touch, and is conveyed by the flesh of the tongue.



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Smell is conveyed to the nostrils in the case of some animals by air, in the case of others by water. Sight is conveyed by water, for the eye is made of water. Sound is conveyed through the air of the auditory passages. Voice and speech are produced by the trachea, larynx, tongue, and teeth. In sexual reproduction the male semen merely excites into activity the menstrual fluid which supplies all the material for the development of the embryo, the male semen furnishing merely the "motive and plastic force." The heart is the first part of the developing animal to show signs of life; it may be seen to move in the embryo chick. Sleep is brought about as follows: The nutriment absorbed after a heavy meal, and the waste products of severe exercise are carried with the blood, or ascend in vapor form, to the brain, where they are chilled and thus precipitated (as watery vapor ascending through the atmosphere is, upon reaching a cold region, chilled and precipitated as rain); this precipitated material falls toward and cools the heart, sleep resulting, with its accompanying dulling of all the senses. Death—due usually to lack of nourishment—occurs when the "vital heat" of the heart is extinguished, and with it all power of sensation and motion. Though markedly defective in matters of fact, and from the present view-point highly theoretical, Aristotle's physiology was far in advance of that of any of his predecessors and undoubtedly was based upon observed and carefully collected data.

Praxagoras of Cos (about 350–335 B.C.) asserted that body heat is not innate but acquired; that there are two kinds of blood-vessels; namely, arteries, which ordinarily contain "animal spirits," but from which, when wounded during life, blood flows because, their contained animal spirits quickly escaping, they become filled with blood from surrounding parts; and veins, which contain only blood. The pulse is characteristic of arteries. Respiration strengthens the heart by forcing "animal spirits" into it. Nerves are the organs of sensation. (Aristotle was unacquainted with nerves, and Praxagoras confused nerves, tendons, and ligaments.)

Plistonicus, a disciple of Praxagoras, explained digestion as a process of putrefaction of the food within the stomach. Herophilus (Alexandria, about 307–280 B.C.), another pupil of Praxagoras, made a number of anatomic discoveries, and also contributed to physiology. He asserted that nerves arise from the brain, but failed to distinguish them clearly from tendons and ligaments; that arteries as well as veins contain blood; and that the pulse is communicated to the arterial walls from the heart. He is credited with the discovery of lacteals and lymphatics, but seems not to have understood their significance. He distinguished during respiration an inspiration, an expiration, and a pause. The seat of the soul he asserted to be the fourth ventricle of the brain.

Erasistratus (Alexandria, 300–260 B.C.) considered gastric digestion to consist in a trituration of the food, and body-nutrition to be maintained by the addition of new particles. He was acquainted with both lacteals and lymphatics, which he considered to contain air and milk alternately. The "pneuma" of the inhaled air, he asserted, enters the blood of the pulmonary veins, is conveyed to the heart, and thence propagated

along the arteries, occasioning the pulse. Between some arteries and veins there may be anastomoses—which at times are open—but most arteries and veins terminate by closed extremities. To account for the secretion of bile he assumed the existence in the liver of invisible canals. He made a careful study of the brain, designating the convolutions of the cerebrum and cerebellum as concerned in intellectual processes, and locating mental disease in the brain. Nerves he divided into sensory and motor.

Galen (131–201 A.D.) may be justly styled the first experimental physiologist, because he not only utilized the facts of anatomy, as revealed by dissection, for the interpretation of physiologic phenomena, but resorted to experiments upon living animals for crucially testing hypotheses. Following is an outline of his system of physiology: The life-giving principle or soul is, in the form of "pneuma" or "spiritus," derived from and supplied by the general world-soul. In the body it is transformed (1) in the brain (which it enters by way of the nasal cavities), into "animal spirits"; (2) in the arteries and heart, into "vital spirits"; (3) in the liver and renal veins, into "natural spirits." By these three forms of the "spiritus" the "animal," "vital," and "natural" body-functions are initiated and maintained. There are, however, besides these, certain subordinate special functions, such as "propulsive," "attractive," and "secretory." Food is digested in the stomach by a process of "coction," its nutritive portion absorbed into the mesenteric veins and carried to the liver, where, by a second "coction" process, it is converted into venous blood. From the liver, which is the centre of the venous system, this blood is transported by way of the veins to all parts of the body. The arteries also contain blood; for whenever, in a living animal, an artery is punctured, even by a fine needle, blood escapes from it; and that this blood is actually contained in it, and not merely taken in from the surrounding parts after the escape of the spirits (as the followers of Erasistratus contend), is readily proven by first tightly ligating an artery at two places and then puncturing it between the ligatures; for when this is done blood likewise escapes. Arterial blood is thinner, lighter in color, and warmer than venous blood. This difference is explained as follows: Venous blood from the liver reaches the right heart through the vena cava; in the right ventricle the useful blood is separated from the useless by means of the heat of the heart, and passes through the interventricular septum into the left ventricle, where the "pneuma" from the inspired air (brought to the left ventricle with the blood of the pulmonary veins) is incorporated with it, thus rendering it arterial blood. By way of the arteries this vivified blood is transported to all parts of the body. Each organ, therefore, is supplied with both arterial and venous blood; receiving from the former mainly its spiritual, and from the latter mainly its material, nutriment; both "spiritus" and nutrient matter passing through the vessel-walls into the body-substance. Between the terminal arteries and veins there are minute communicating passages, by means of which an interchange of "spiritus" and material can take place. By means of respiration not only is the vital heat maintained but the "smoky matter" of the blood is exhaled. The



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spirituous blood is drawn into the heart and arteries by their dilatation, and by their contraction the "fuliginous vapors" are expelled from the blood. The heart is the organ of passion and courage, the liver that of love. The brain is the seat of the rational soul, but it also secretes nasal mucus, and cools the heart. The heart-beat, respiration, and voice-formation are influenced through the vagus nerves; and respiration is also influenced through the spinal cord and intercostal nerves. The sensory nerves arise from the brain, the motor from the spinal cord. Light is perceived by the retina. The semen of both male and female contributes to the formation of the embryo.

So great was the influence of Galen that for more than 13 centuries after his death both anatomy and physiology were taught mainly by readings from, expositions of, and commentaries upon, his writings. It is true that early in the 14th century Mundino publicly demonstrated human anatomy at Bologna, and about two centuries later Carpi took up the work of Mundino and carried it somewhat farther. But until the middle of the 16th century the vast majority of students and teachers of anatomy and physiology were mere followers of Galen, receiving and transmitting the letter rather than the spirit of their master. But the revival of the study of human anatomy by means of dissection soon brought to light a number of facts not in accord with the Galenic doctrines, which some of the more independent workers now began to doubt. Thus Vesalius (1514-64) noted the pits on either side of the interventricular septum, but being unable to find any actual perforations, he doubted the existence of such; and Servetus, in 1553, boldly asserted the absence of such perforations. He also called attention to the fact that the amount of blood going to the lungs by way of the pulmonary arteries is greatly in excess of that required for their nutrition; and he finally came to the conclusion that the blood flows from the right ventricle through the pulmonary arteries to the lungs, and thence by way of the pulmonary veins back to the left auricle of the heart. A similar view was put forth by Columbo (1490?-1559), who claimed originality for it; but Servetus seems to have really originated it. Cæsalpinus, in two publications (1571 and 1593), clearly explained not only the mechanism of the cardiac valves, but also the significance of the heart-beat for the movement of the blood. He also asserted that the blood flows from the heart to the tissues only by way of the arteries, and from the tissues to the heart only by way of the veins, and clearly explained the pulmonary circulation as well. Cannanus, as early as 1547, had observed valves in veins; and in 1574 Fabricius accurately described them, though he failed to comprehend their physiological significance.

The labors of these 16th-century anatomists also furnished data for more accurate descriptions of the mechanical digestion processes, such as mastication, deglutition, stomach-contraction, and intestinal peristalsis. But the cause of the actual changes in the ingested food was still supposed to be the heat of the stomach and neighboring viscera. Fernel, whose *Universa Medicina* first appeared in 1558, taught that food is concocted in the stomach; then, passing into the small intestine, it is reduced to a uni-

form cream-like liquid, which is absorbed by the mesenteric veins and carried to the liver, where it undergoes a second concoction; and then it is carried with the blood to the tissues, where a third concoction occurs. During this century also the action of many individual muscles was roughly determined on the dead body, "the physiology of the brain and spinal cord was somewhat advanced" (Baas), and some slight additions to other sub-branches of physiology were made.

The greatest achievement for physiology during the 17th century was the establishment of the doctrine of the circulation of the blood, which was accomplished mainly by the work of William Harvey (1578-1657). Though many of the facts upon which Harvey's conclusions were based had been known for some time, their full significance had not been recognized. Having familiarized himself, by means of dissections, with the anatomy of the vascular system, he made a large number of carefully planned observations and experiments on the heart and blood-vessels, studying with especial care and diligence the heart-beat and the arterial pulse, both separately and in relation to each other. He studied the heart-beat of many animals from mollusks to mammals, and although he wrote, "I found the task so truly arduous, so full of difficulties, that I was almost tempted to think, with Fracastorius, that the motion of the heart was only to be comprehended by God," yet he finally succeeded not merely in unraveling that complex series of phenomena, but in explaining the meaning of each of its component elements. It became clear to him that during each heart-beat there is a period of contraction, or systole, followed by a period of relaxation, or diastole; the systole is really double, the auricles first contracting and forcing their contained blood into the ventricles; then immediately the ventricles contract, forcing this same blood into the arteries; then the whole heart relaxes, and rests until the auricles have again become filled with blood from the great veins, when they and the ventricles after them, again contract. During its systole the heart is smaller, paler and harder than during its diastole. The sudden forcing of the ventricular blood into the arteries distends them, and thus occasions the pulse, which is a distention, not a dilatation, of the arteries. The ventricular systole, in fact, forces the blood not merely into but through the arteries to the tissues, and thence into the veins and back to the auricles, by the systole of which it is again forced into the ventricles. Thus "the blood in the animal body is impelled in a circle, and is in a state of ceaseless motion"; and the main cause of this circular motion is the force of the cardiac systole. This doctrine he began to unfold in his lectures at the College of Physicians, London, as early as 1616, but his great work containing the theory in its complete form, with the evidence supporting it, *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus*, was not published until 1628. He was equally clear concerning the pulmonary and systemic circulations; and that the same blood that streamed from the heart through the arteries to the tissues returned to the heart again, he was satisfied; but by what means this blood passed from arteries to veins he did not know. In 1661 Malpighi actually observed not only the capillaries, but the capillary



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circulation, in the frog's lung; and Marchetti proved, by means of intravascular injections, the tubular continuity of arteries, capillaries, and veins. Thus the chain of evidence was complete, and the Harveian conception of the blood-circulation was established beyond doubt. See CIRCULATION.

The physiology of nutrition and secretion also received valuable contributions during the 17th century. Van Helmont, whose *'Ortus Medicinæ'* appeared in 1648, introduced the conception of "fermentation" to account for the transformation of food into blood and flesh. By fermentation he meant a process characterized by the evolution of "gas" (a word which he introduced into scientific nomenclature); and he described a sextuplet series of fermentations (or digestions) beginning in the stomach and ending in the body-tissues. In 1642 the pancreatic duct was discovered by Hoffmann in the fowl, and by Wirsung in man; in 1655 the submaxillary duct was discovered by Wharton; in 1661, the parotid duct by Stenson; and in 1664 De Graaf reported his observations (the first on record) on the collection and examination of pancreatic juice. Peyer in 1677 described those peculiar intestinal structures still known as "Peyer's patches," and "solitary glands"; and Brunner published in 1687 a description of the glands which still bear his name. By these discoveries, together with the brilliant researches of Glisson (1597-1677) on the structure of the liver, and of Malpighi (1628-94) on that of the liver, kidney, and spleen, a sound morphologic basis for the physiology of secretion and excretion (later developed) was laid. Even before the publication of Malpighi's work Bellini (1643-1703), a pupil of Borelli, had published his *'De Structura Renum'* (1662), which contains an account of the tubular structure of the kidney, and also of his mechanical theory of the secretion of urine.

The discovery (or re-discovery; see Herophilus and Erasistratus above) of the lacteals by Aselli in 1622, the tracing of these to the receptaculum chyli, and of the thoracic duct to its termination in the venous system, by Pecquet between 1647 and 1651, and the work of Rudbeck (1630-1702), van Horne (1621-70), and de Peiresc (1580-1637) not only greatly aided in the understanding of the means of absorption of some digestion-products, but cleared the way for the later establishment of the doctrine of the lymph-flow. In 1614 appeared that remarkable book, the *'Ars de statica Medicina'* of Santorinus, in which were given some of the results of those observations on the interrelations of ingested food, excrement, insensible perspiration, and body-weight which constituted the beginnings of the physiology of general metabolism. To the mechanics of bodily movements Borelli (1608-79) devoted years of labor, and in 1680-1 his great work *'De Motu Animalium'* was published. His doctrines were made the basis of the so-called Iatro-mechanical school (also called Iatro-mathematical school, and Iatro-physical school), to which was opposed the Iatro-chemical school, founded chiefly on the work of De le Boë (Sylvius), 1614-72. The physiology of respiration also received some very important contributions. Boyle (1627-91) showed that a constant supply of unrespired air is essential for the maintenance of life, and correctly explained

the mechanics of inspiration. Van Helmont pointed out the unfitness of "gas sylvestre" (carbon dioxide) as a respiratory substitute for air; Mayow (1645-79) proved the atmosphere to be compound, and showed that to one of its constituents, "spiritus nitro-aereus" (oxygen), is due its power of supporting both combustion and life; Lower (1631-91) observed the respiratory change in color of blood, and Mayow ascribed this change to the particles of air absorbed by the blood while passing through the lungs, and finally Hooke (1635-1703) demonstrated the practicability of maintaining animal life by artificial respiration. By the investigations of Willis (1622-75) and Malpighi a number of obscurities concerning the vascular supply of the brain were cleared up; Schneider (1614-80) demonstrated that the nasal mucosa, and not the brain (as formerly thought), secretes the nasal mucus; and it was during the 17th century that the theory of transmission of nerve-impressions by the movements of a hypothetical "nervous fluid" along the supposedly hollow nerves was developed, chiefly by Descartes (1596-1650), and gained such general credence.

The structure of the eye was carefully studied by Ruysch (1638-1731) and Leeuwenhoek (1632-1723); and such men as Kepler, Scheiner, Descartes, and Mariotte busied themselves with the study of vision, with the result that the fundamental principles of visual optics were firmly established, and some new points in the physiology of vision brought to light. The anatomy of the ear was advanced by the labors of Vieussens, Duverney, Schnellhammer, Glaser, Sylvius (De le Boë), Folli, Manfredi, Perrault, and others. The physiology of generation was placed on a firm basis. The observations of Fabricius and others on the eggs of fowl, made during the 16th century, were extended by Harvey, who, after some years of further study of the subject, published his famous work on *'The Generation of Animals'* (1651). In 1677 Von Hammen discovered spermatozoa, which Leeuwenhoek, his teacher, classified as "animalcules," and upon which as a basis he constructed a theory of generation quite opposed to that of Harvey. Two parties formed, the "Ovists" contending for the theory of Harvey, and the "Animalculists" for that of Leeuwenhoek. Highmore (1613-85) cleared up a number of doubtful points concerning the anatomy of the male generative organs; and the female organs of generation were studied by De Graaf, Swammerdam, Needham, Drelincourt, and Hoboken.

Early in the 18th century Boerhaave (1668-1738) performed valuable service by collecting and endeavoring to combine into a harmonious whole all that seemed trustworthy of the work of his predecessors. Réaumur (1683-1757) pointed out a new method for the study of digestion. He caused a tame kite (a bird which habitually regurgitates indigestible substances) to swallow small pieces of metal tubing, containing food or pieces of sponge, and covered at the ends by wire gauze or muslin. He thus collected gastric juice, and demonstrated not only that it dissolves meat, but that it does so by a process which is not putrefactive. His observations were reported in 1752. Twenty-five years later Stevens reported similar observations on gastric digestion in man, utilizing the services of a performer who swallowed and re-



gurgitated stones, and confirming the findings of Réaumur; and a few years later Spallanzani published the results of a long series of similar experiments on various animals, which conclusively proved not only the solvent power of gastric juice on meat and some other foods, but likewise its power of preventing putrefaction; both of which he demonstrated *in vitro*.

Hewson (1739-74) and John Hunter (1728-93) made extended studies of blood and lymph, and the former made permanent additions to the knowledge of blood-coagulation. Black (1728-99) re-discovered carbon dioxide, which he called "fixed air," and demonstrated its formation during combustion, respiration, and fermentation; Priestley (1733-1804) re-discovered oxygen and pointed out the similarity of combustion and respiration; Lavoisier (1743-94) explained both combustion and respiration as oxidation processes; and Lagrange (1736-1813) proposed the hypothesis that the oxygen of inspired air is absorbed by the blood, during the circulation of which it slowly combines with carbon and hydrogen, to form carbon dioxide and water respectively, which are exhaled by the lungs. The classic experiments of Hales (1677-1761) yielded the ground facts of circulatory dynamics; and he also shares with Whytt (1714-66) the credit of having established on experimental data the doctrine of reflex action.

In the early part of the century Petit (1664-1741) observed some of the effects of section of the cervical sympathetic nerve-trunk; and the famous researches of Galvani (1737-98), published late in the century, turned the attention of physiologists toward the effects of electric currents on muscle and nerve. Numerous theories contended for acceptance; of which the "anima" theory of Stahl, the mechanico-dynamic system of Friedrich Hoffmann, and the vital-force doctrine, elaborated chiefly by Reil, belong rather to the history of philosophy than of physiology, though each of these influenced the future progress of the latter. But the doctrine of "irritability," suggested by Glisson in the 17th century, and developed chiefly by Haller (1708-77) and his pupils in the 18th, was founded upon observation and experiment, and has markedly influenced the subsequent progress of the physiology of the muscle, nerve, and sense systems. Besides enriching physiology by numerous experimental researches, Haller, by the publication of the 'Elementa Physiologiae' (1757-65), did more than any other worker of the century to systematize the science, and earned the appellation "Father of Modern Physiology." It must be remembered also that the cell-doctrine, which has aided so much in the clarification of the science, was founded, though not developed, chiefly by the labors of C. F. Wolff (1735-94).

During the 19th century nearly the whole of present knowledge of the chemistry of digestion, secretion, and metabolism, of the mechanics of the circulation, and of muscle-nerve physiology, was acquired. Of the many scientific achievements of that century the extensive development of the cell-doctrine, and the establishment of the functional characteristics of, and functional localization in, the spinal cord, medulla oblongata, cerebrum, and cerebellum, are worthy examples. Not only were many of the physical and chemical changes, but also some

of the morphological changes, occurring in gland, nerve, and retinal cells during their normal activity, made clear. The physiology of sense-perception—vision in particular—was studied in detail; and the *modus operandi* of several of the self-regulating muscle-nerve mechanisms of the body—for example, the heart-beat, respiration, deglutition, gastric and intestinal peristalsis, and defecation—were explained. The physiology of reproduction and development also received valuable contributions. Of the value, for 20th century physiology, of the "neurone theory" and the doctrine of "internal secretions"—which were developed late in the 19th century—a just estimate cannot at this date be formed. The marked development of molecular physics, physical and organic chemistry, and cellular morphology, afforded 19th century physiology a degree of stability not apparent in that of previous centuries, which enabled it in turn so to develop as to constitute a sound foundation not only for scientific medicine, but for psychology as well. The number of workers by whose combined efforts these results have been attained is so large that to attempt, in so brief a summary their individual designation, would be unwise; and to select the names of a few would be unfair to the remaining many.

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JOHN C. CARDWELL, M.D.

**Physostig'ma.** See CALABAR BEAN.

**Phy''togeog'raphy.** See PLANT GEOGRAPHY.

**Phy''tolacca'ceæ.** See POKEWEED.

**Pi-Beseth, pē-bā'sēth.** See BUBASTIS.

**Pia Mater, pī'a mā'tēr,** the innermost of the three membranes investing the brain and spinal cord. See BRAIN; ARACHNOID MEMBRANE.

**Piacenza, pē-ä-chēn'zä** (ancient PLACENTIA), Italy, city, capital of the province of Piacenza; on the Po River; about 40 miles southeast of Milan and 33 miles northwest of Parma. It is a fortified city, and has always been considered of great strategic and commercial importance.



## PIAGGIA — PIANOFORTE

The fortifications are kept in repair and improved from time to time as new defense methods are introduced. The city was founded 219 B.C. by the Romans. About 20 years later it was destroyed by the Gauls. When the Via Æmilia, a Roman military road, was constructed, the western terminus was at Piacenza. The city entered the Lombard League in the 12th century, and in the 17th century, with Parma (q.v.) it became a duchy of the Farnese family.

Among the historic buildings of Piacenza is the ancient church, San Sisto, for which Raphael painted the Sistine Madonna. This picture was sold, in 1754, to Frederick Augustus of Saxony, and is now in the Dresden gallery. Other noted buildings are the cathedral (1122), in which there are paintings by Guercino, Carracci, and others. The church of Santa Maria della Campagna has fine frescoes by Pordenone; the square has some fine equestrian statues. The public library has about 140,000 volumes. It has modern theatres, hospitals, and educational institutions. It has considerable manufacturing interests, especially in silk, cotton, and woolen goods, pottery, wine, cheese, and machinery. In the vicinity are valuable marble quarries. Pop. commune (1901) 36,064.

**Piaggia, Carlo**, Italian explorer: b. Lucca, Italy, 1830; d. Sennaar 1882. He went to Egypt when young, was with Antinori in Bahr-el-Ghazal 1860; went with Gessi to the lakes of the Nile in 1876, and was the first European among the Nyam-Nyam.

**Pianis'simo**, the superlative of piano (Italian for soft and low); piano is used in music in contradistinction to forte. The symbols for these terms are pp. and p. See MUSIC.

**Piankishaw** (pī-ăn'kē-shâ) **Indians**, a small American tribe of the Algonquin family, originally a part of the Miamis (q.v.). The tribe never numbered over 1,000. They removed to the Indian Territory from Indiana and Illinois in 1867.

**Pianoforte**, a stringed musical instrument commonly known as a "piano," and essentially consists of a series of wires which are struck by felt-covered hammers by the operation of keys conveniently arranged in a keyboard. The term, "pianoforte," which is the correct term designating the instrument, is derived from the Italian "piano," soft + "forte," loud; while the term "piano," usually designated by p., is a sign used in music to denote softness, that is, the strain where the indication occurs is to be played with less than the average intensity. Similarly, pp., or ppp., abbreviations for "pianissimo," signifies very soft.

The pianoforte is probably the most extensively used of all musical instruments. It was evolved directly from the clavichord and harpsichord, which were undoubtedly elaborations of the monochord or pitch-carrier with one string, although even the approximate date or the name of the inventor who first put keys to a monochord and called it a clavicordium, is quite unknown. Virdung, in his 'Musica Getutscht,' published as long ago as 1511, states his inability to ascertain those facts, although it is well known that Pythagoras, in the 5th century, B.C., measured a vibrating string stretched between raised bridges on a resonance box, and by shifting those bridges he accurately deter-

mined the intervals of the Greek diatonic scale. It is supposed that Pythagoras obtained the monochord embodying the principle of the stopped string upon a finger-board from Egypt where it had been known for ages before his time. After Pythagoras, the monochord became, in Greece and Europe, the canon or rule for the measurement of musical sound intervals, and continued to be so employed up to the 11th century, A.D., when it was transformed into a polychord of four strings, to facilitate the melodic division of the Gregorian tones—the Plain-Song of the Church as used in the Ritual, and were known under a great variety of names such as clavichord, clavicordium, spinet, virginal and regal.

The early clavichords had a compass of four octaves. The natural keys were made of citron wood and the sharps of ebony. The damper was a narrow band of felt attached with glue to the hitch-pin block, opposite to the wrest-pin block. The berry-bridge was of the curved or spinet-type. As they were strung with wires in equal lengths, they were for a long time regarded as sets of monochords, the scaling being effected by the line of the tangents attached to the keys on the left-hand side of the player, while the three or more sounding-board bridges rested upon the narrow belly on the right. Owing to the length of the scale the longer instruments were not capable of being turned higher, giving them a weak but delicate tone which responded to the gradations of the player's touch. The tangents were upright blades of brass fastened into the keys and beaten out at the top so as to touch equally the one string or the two or three unison strings forming a note. The tangents thus constituted a series of bridges or sound exciters, and each of the little groups of strings thus formed was acted upon by two or sometimes three or four tangents to obtain as many notes. The damping was contrived with a cloth interwoven among the strings behind the line of tangents. This cloth instantly dampens the vibration of the strings when the finger releases the key and the tangent quits the string.

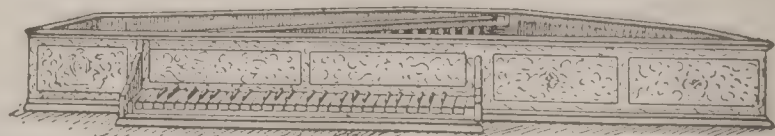


FIG. 1.—Queen Elizabeth's Virginal, South Kensington Museum, London.

Clavichords with pedals are mentioned by Virdung and Reynvaan, and are also particularly described by Adlung, indicating that some of the instruments had two octaves and a note of pedals attached to a separate clavichord pedalier and "fretted," there being three strings in the lower, and four in the upper range for each pedal note. The terms virginal or spinet, generally indicate one and the same instrument without regard to form of construction, but practically limited to a plectrum (jack) clavier with one string only to each note (see Fig. 1). Its earliest recorded name is the clavicymbolum, occurring in the rules of the Minnesingers under the date of 1404. It is the Latin for Psaltery, an instrument of the dulcimer kind to which a keyboard was added, and suggests an ecclesiastical or monastic origin. Virginal was the English name of the spinet and was so called probably



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on account of its appropriateness for girls as compared to the contemporary lute which was a more difficult and manly instrument, rather than the assumption that Queen Elizabeth was a skilful performer on it, especially as the name was current in the reign of her grandfather, Henry VII. According to Scaliger, who wrote in the latter part of the 15th century, the name spinet is derived from the little quill point or plectra, as an improvement upon the instruments previously known as monochordum and harpsichordium, a form of keyboard psaltery of a harp-shaped disposition. On the other hand, the Italian expert, Signor Ponsicchi, attributes it to a Venetian maker, who signed and dated an instrument of this kind "Ioannes Spinetus, Venetus Fecit; A.D. 1503." The vir-

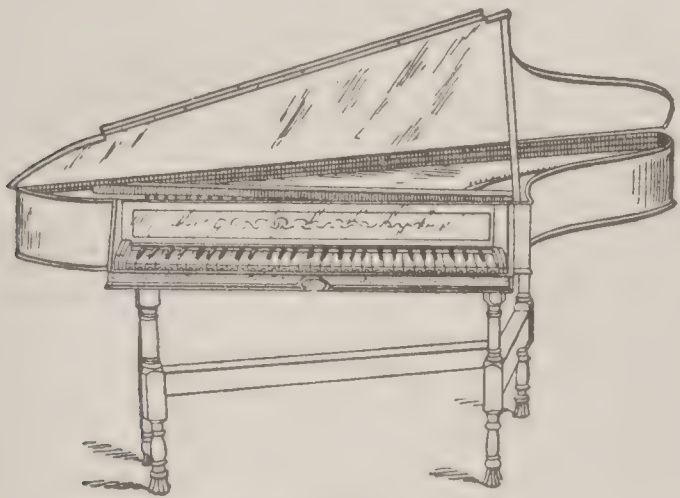


FIG. 2.—Spinet — 1710.

ginal that is associated with Queen Elizabeth is now in the South Kensington Museum, London, and may be described as an Italian pentagonal spinet (see Fig. 2). Italian spinets were made of cypress wood, and as the utmost vibration was sought for by the makers, both case and belly were constructed of that material. They consisted of two cases—the inner rough, but possessing a free and satisfying quality of tone, while the outer received great care in workmanship and was often beautifully decorated. The pentagonal or heptagonal spinets had false cases like the clavicumboli or harpsichords, from which they could be removed when required for performance, while the oblong Italian makes were inseparable from the outer case like the modern pianos. Until the middle

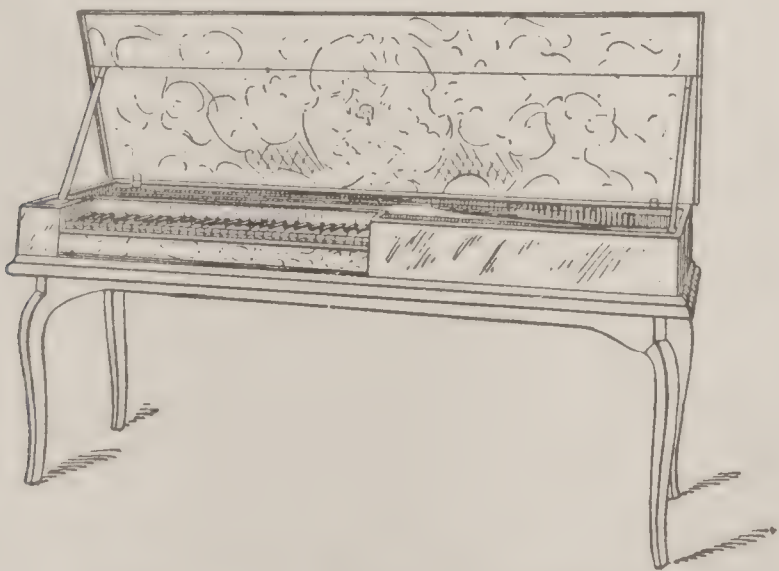


FIG. 3.—Clavichord, Taphouse Collection, Oxford.

of the 16th century, the keyboard was an external addition to the case, when Rosso, a Milanese maker, set it back in the body of the in-

strument, a recessing which was generally copied afterward (see Fig. 3).

The harpsichord is a double, treble or quadruple spinet, the sounds being excited by a jack and quill plectrum, as in the case of the virginal or spinet. More exactly stated, instead of having one string to a note, as in the virginal or spinet, it has two, three and sometimes four strings to a note, which, with the exception of the common features of the case, sound-board, wire strings and keyboard, it differs entirely in sound, excitement and effect from the clavichord. It has an individuality of tone not possessed by the pianoforte, and a brilliancy of effect beyond the capacity of the clavichord, but in expressiveness depending upon touch, its power is much less than either.

The importance of the harpsichord during the 16th and 17th centuries was very great, occupying the place now filled by the grand piano, and while not so much a solo instrument, it was of considerable importance in the orchestra, its player generally assuming the responsibility of conductor. The complex character of its mechanism required a larger and differently shaped case to that of the spinet, and prefigured that of the grand piano, the wing-shape giving rise to the German name *flügel*, also *kielflügel*, from the plectrum (*kiel*, quill) producing the sound. With the Italians—it was known as the *clavicembolo*, while the French called it *clavecin*. In the English term *harpsichord*, the harp disposition is recognized in contrast to the trapeze shape of the spinet, which appeared about the same time—the earlier part of the 15th century.

The description of a very fine example of a Roman harpsichord in the South Kensington Museum, London, inscribed and dated "Hieronymus Bononiensis Facietat Romae, MDXXIX.," will serve to illustrate the general character of the instruments of that time. It has one keyboard, and two unison strings to each note; boxwood natural keys, with an apparent compass of nearly four octaves, E to  $d^3$ , which by a short octave in the bass becomes C to  $d^3$ . In the Italian instruments no change of power was attainable by stops, while the pedals, as in the Trasuntino harpsichords, controlling a *sordino* for muting, were a very late addition (see Fig. 4). The highest credit for excellence in

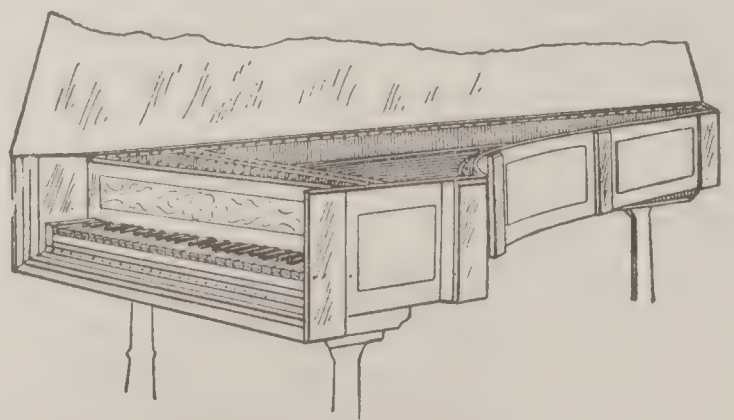


FIG. 4.—Trasuntino Harpsichord — 1531.

the manufacture of harpsichords belongs to the famous Ruckers family of Antwerp. The earliest instruments made by them bear the date of 1590, and the latest 1659, a short period of splendid work, very nearly coinciding with the glorious epoch of Flemish painting, in which the masterpieces of Rubens and Vandyck culminated



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in the Antwerp School of Art. Of their instruments there are 70 existing specimens, including some of great beauty of decoration, but they have all been subjected to one or more alterations of scale and keyboard compass. It is claimed that Hans Ruckers the elder, added the octave register, and steel wire instead of brass for the treble notes, designed a second keyboard in imitation of the organ, and increased the number of keys from E to C<sup>3</sup> to C-c<sup>3</sup>, thus making the short octave in the bass a long or chromatic one down to the lowest notes. The most famous harpsichord makers of the 18th century were Burkat Shudi (Burkhardt Techudi), and Jacob Kirckman (Kirchmann) in London, and Taskin in Paris. Burkat Shudi began business, in 1732, in the house still occupied by his descendants, the Broadwoods, 33, Great Pulteney Street, Golden Square, London; while Kirchmann continues to be represented by his descendants in a first-class London pianoforte manufactory.

About this time, makers, more or less controlled by the prevailing style of domestic furniture, substituted the more rigid cases of walnut and Spanish mahogany for those of resonant cypress, cedar, and pine, and thus obtained a greater power and majesty of tone, while a greater variety of tone was derived by a freer use of the stops. To the three shifting registers of jacks of the octave and first and second unisons, Van Blankenburg's lute stop was added, which by plucking the strings in the lower and medium divisions of the scale, close to the bridge and much nearer the treble, produced a charmingly delicate, reedy tone quality very much like that of the mandolin. Finally, to obtain "crescendo" and "diminuendo," a swell was introduced, which consisted in gradually raising a hinged portion of the cover with a pedal. This invention of Roger Plenius was probably suggested to him by the nascent pianoforte which appears to have been first made by him in England.

Although references to the pianoforte occur in the correspondence of musical instrument makers during the latter part of the 16th century, as for example, in the letters written by Hippolito Cricia or Paliarmo, dated 27 June and 31 Dec. 1598, and addressed to Alfonso II., Duke of Modena, the first true pianoforte as now understood by that term, was invented by Bartolommeo Cristofori, a Paduan harpsichord maker, in Florence about 1709. At that time, kings and princes well disposed toward music, were accustomed to keep large collections of musical instruments to be used in connection with their domestic and courtly festivals, and to keep such instruments in playing order it was necessary to employ men possessing the requisite ability. It is of record that Cristofori was engaged in that capacity by Prince Ferdinand dei Medici, and while thus employed, invented and produced the pianoforte. The record of this invention is given by the Marchese Scipione Maffei, under the date of 1711, in a description which appeared in the 'Giornale dei letterati d'Italia,' a publication conducted by Apostolo Zeno. It gives the information that in 1709 Cristofori had completed four "gravecembali col piano e forte"—keyed psalteries with soft and loud, three of them hav-

ing the long or harpsichord form. There are two grand pianos still in existence, made by Cristofori, and dated respectively 1720 and 1726. They are of a very perfect construction, and embody all the essentials of piano movement. The first belonged to the Signora Ernesta Mocenni Martelli, of Florence, and was acquired by Mrs. J. Crosby Brown, of New York, in 1895, for presentation to the Metropolitan Museum of Art of that city. It has a compass of four and a half octaves, C-f<sup>3</sup>. The second belongs to the Commendatore Alessandro Kraus, of Florence. Their actions are similar, and show that Cristofori succeeded in satisfactorily solving the problem of escapement, and had also provided for repetition without a double escapement. Fig.

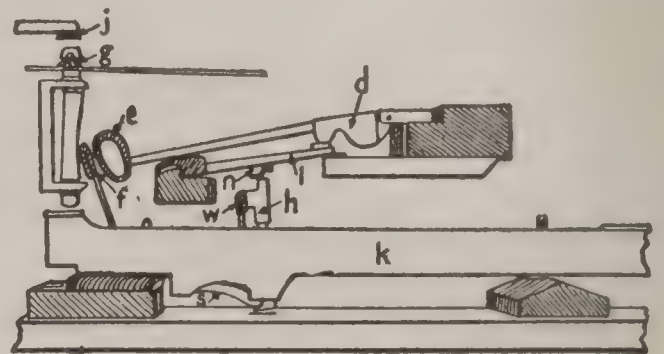


FIG. 5.—Cristofori's Action.

5 is a complete diagram of this action: (k) is the key; (h) the hopper or movable tongue; (n) the notch for the hopper beneath an underhammer or escapement lever (i), which being covered with leather upon the end, operates to raise the hammer butt (d); (e) is the hammer-head; (s) the spring regulating the play of the hopper or distance between it and the string, and regulated by a small hopper check (w); (f) hammer check; (g) damper, and (j) damper stop. It appears that in this action, Cristofori retained the shallow measure of an Italian harpsichord, and consequently inverted his wrest-plank, (the block in which the tuning-pins are held) which had to be much stronger than in the harpsichord, owing to the increased thickness of the strings which were required to stand the impact of the hammers, and attached the strings beneath. The pins pierced the wrest-plank so that the tuning was accomplished harp fashion. His instruments ranged in compass from four to four and a half octaves. The essential features of Cristofori's action were adopted by Gottfried Silbermann, the great organ builder and clavichord maker of Dresden. He made two pianofortes, which he submitted to J. S. Bach, who disapproved of them on account of their weak treble and heavy action. Recognizing that he had not attained the requisite skill to reproduce the excellent quality of his models, he devoted several years to experiments and finally submitted another to Bach, which met with the great composer's approval. It is a fact, however, that the elder Bach never really adopted the pianoforte, and that all of J. S. Bach's compositions for the clavichord and harpsichord, no less than those for the organ, have to be virtually transcribed in the rendering when transferred to the pianoforte. This fact is very clearly shown in Czerny's edition of the 'Forty-eight Preludes and Fugues.'

The Seven Years' War (1755-62) terminated Saxon pianoforte making, and scattered the workmen, some of whom found their way to



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England and made a fresh start in the business. Up to 1760, all pianos had been built in the shape of the modern grand, horizontal or upright; but, between 1760-65, Johann Zumpe, a former workman in Shudi's establishment, introduced the English square piano. The action although almost rudimentary was efficient, and contained what was called the "old man's head," a metal pin with a leather knob on the top to raise the hammer, and the "mop-stick" damper raised by a simple jack. The compass was five octaves from F-f<sup>4</sup>. Zumpe's success was immediate. The instruments sold rapidly, and the form increased in popularity. Other makers started establishments, and in the last decade of the century, London became the centre of the world's pianoforte trade, with not less than 30 square piano making establishments, English and German, in active operation.

Between 1780 and 1790, John Broadwood recognized the fact that when the string was struck at a certain point, it yielded a fuller tone. He, therefore, adjusted the hammers so as to obtain this result, and also transferred the wrest-plank to the back of the case, and introduced the two pedals—one to raise all of the dampers, and the other to soften the tone by dropping a piece of cloth over the strings. The change in the place of the wrest-plank enabled him to reduce the inordinate length of the unused wire, and also to straighten the keys, which had been hitherto left more or less twisted, as in the clavichord, but in connection with the crank damper, he did not get beyond the "old man's head" device that lifted the hammer, and the merit of introducing in the square piano the "hopper"—a jack with a spring working in a notch forming the front part of a lever, technically known as the "under-hammer" belongs to John Geib, who took out a patent for the improvement in 1786, and first applied it to the square pianos he made for Longman and Broderip, music publishers in Cheapside.

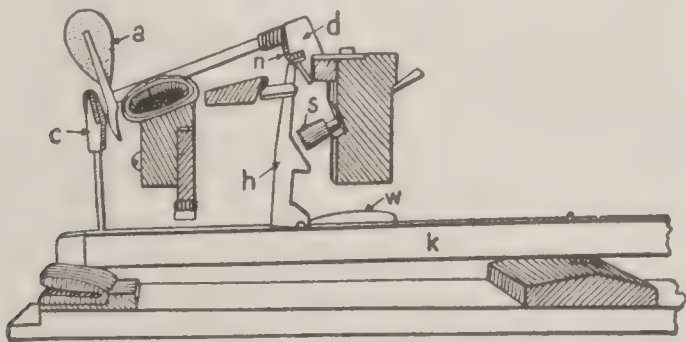


FIG. 6.—Broadwood's English Action.

Fig. 6 shows the Broadwood grand piano action, commonly known as the "English direct lever action," in which the key (k) on being depressed, raises the hopper (h) which strikes in the notch (n) cut in the butt of the hammer (d), the play of the hopper against the notch determining the velocity of the hammer and the individuality of the player's touch; (a) is the hammer-head, and (c) the check which is raised when the key is depressed and arrests the hammer in its fall. It is the first simple contrivance for repetition, that is, the possibility to repeat the blow of the hammer before it returns to its original position or equipoise. The key not only raises the hopper and check, but also the damper, so as to allow the string forming the note to continue the vibration, and the

escapement depends upon that space between the hammer when raised without impetus and the strings, to allow the hammer to clear them under a blow either soft or loud, and thus prevent the strings stifling the vibration before it has had time to become a musical note. The screw (s) is employed to regulate the lever so as to determine the "set-off"—the distance of the escapement and the strings, while a wire spring (w) controls the return of the hopper to its place. This action was invented about 1772, and was further developed and perfected by Broadwood with the assistance of Backus and Stodart, until it became the best single escapement action.

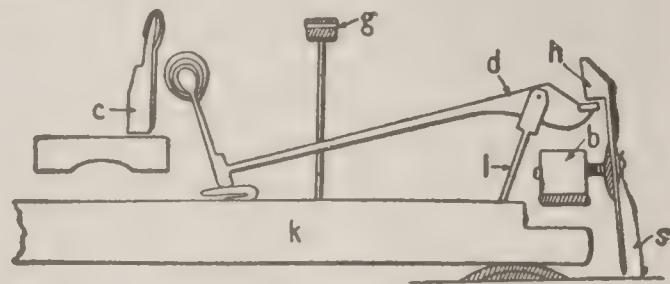


FIG. 7.—Streicher-Viennese Action.

About this time (1777), the German manufacturers produced another kind of escapement, which was considered favorably by prominent pianists for many years. It was invented by Stein, a pupil of Silbermann, but was carried to its highest state of perfection under the joint efforts of his daughter Nannette and son-in-law Andreas Streicher, about 1794. Fig. 7 shows the construction of this action: (k) is the key, (h) the hopper, (s) the hopper spring, (l) the standard in which the hammer butt (d) is centred, (b) the set-off button, (c) the check and (g) the damper. This action differs from the Cristofori (English) action, in that the hammer is directly attached to the rear end of the key itself, instead of being fixed to a lever independent of the key. This arrangement caused a change of axis of the hammer when the key was struck, thus giving the extreme lightness of touch which enabled easier execution and brilliant playing, although less capable than the English of producing its tone varieties. Up to 1777, the French imported their pianos chiefly from England, when Erard (Erhardt), a German piano maker, produced the first piano made in France. Having been driven to London by the Revolution, he familiarized himself with the English methods, and incorporated the English principles in his first instrument. Subse-

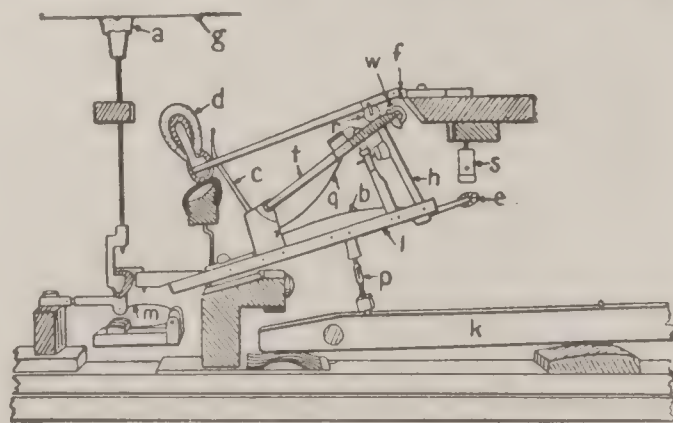


FIG. 8.—Erard's French Action.

quently he adopted the Stein principle, and afterward developed his own action, illustrated by Fig. 8, in which, when the key (k) is depressed, the lever (l) is raised by the pilot (p),



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and the hopper (h) escapes forward when it has delivered its blow to the roller (r) beneath the hammer fork (f). Similar to the notch of the English action, the roller transmits to the hammer the player's intention and individuality. A prolongation of the hopper forms the escapement lever (e) which controls the set-off from the strings by the screw and button (s). The wire hopper spring (b) maintains the hopper in position, and together with the hammer-head (d) and the check (c), completes the single escapement action. The repetition or second escapement is obtained by the roller resting upon the hinged repetition lever (t) which rises when the wire spring (q) is bent by the depression of the key, the rise of the lever being controlled by the screw (w), which acts on the point of the lever.

Under this arrangement, no matter how slowly the key is depressed, the action produces sound, and also enables the hopper to repeat a blow with a partially risen key. The damper (a) is beneath the string (g) and is pushed up by the spring (m). This double escapement action was invented by Sebastian Erard, and patented by his nephew Pierre Erard in 1821, but did not succeed in obtaining public recognition until after 1835. While not demanding as high a finger movement as the English action, it is uniform in the variety and directness of blow.

The Herz-Erard repetition action shown in Fig. 9 is a simplified form of the Erard action

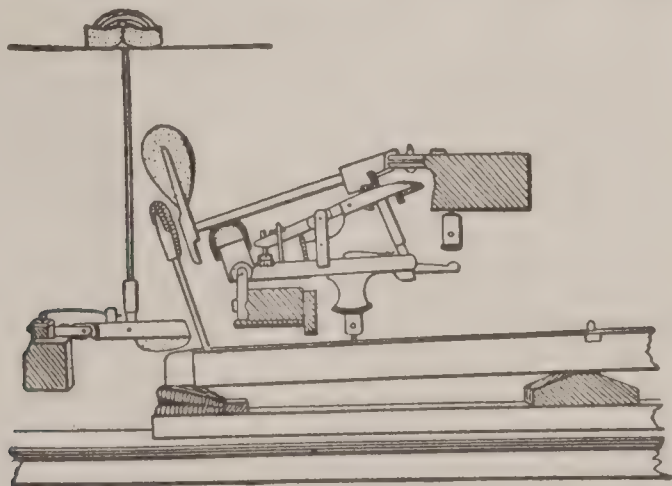


FIG. 9.—Herz-Erard Action.

just described. It was first employed in the grand pianos of Henry Herz of Paris, but, owing to its economy and efficiency, has been adopted with slight modifications by many of the most prominent pianoforte makers. Next to Erard, the most prominent piano manufacture in France, was Pape, a native of Hanover. In 1827 he invented a down striking action, where the action is above the strings. During the latter part of the 18th century, the desire to save space originated the idea of making musical instruments of this class, in an upright form. The first attempts were merely to turn the horizontal pianos, spinets, and harpsichords into a vertical position on a stand. In the year 1800, however, John Isaac Hawkins, an Englishman, living at that time in Philadelphia, Pa., invented the first genuine upright piano and patented it in the United States and England. He called it the Portable Grand Pianoforte, and it is remarkable as containing most of the features characteristic to the modern upright. The idea was further developed and improved by Southwell in 1807, who produced the now obso-

lete but beautiful toned "Cabinet," and by Wornum, who produced a low upright with diagonal strings, in 1811, and one with vertical strings in 1813.

Fig. 10 shows the Wornum upright piano-

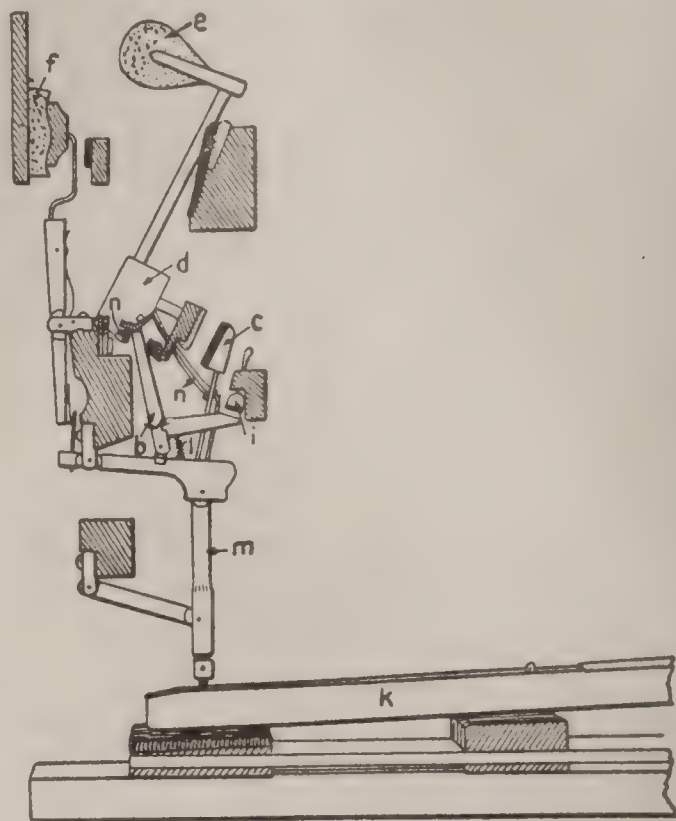


FIG. 10.—Wornum's Upright Action.

forte action, as made by Broadwood; (k) is the key, (h) the hopper, (n) the notch, (d) the hammer-butt, holding the shank of the hammer-head (e); (c) is the check, (f) the damper, (i) the set-off button, (l) the spiral hopper spring invented by Bord, (m) the pilot, employed to raise the hopper and its crank to the height required for their service, and the tape (n), which, being tightened by the rise of the hammer when the key is struck, pulls the hammer back when the key returns and thus assists the repetition.

A modern pianoforte consists of the following parts: (1) The "case," made of rosewood, mahogany, walnut, cherry, or other hard wood, and, according to its form, classifying pianos as grand, square, and upright. The grand pianos are triangular in shape, and are built in various sizes, from the full concert grand, 8 feet 10 inches in length, to the baby grand, 6 feet long, and adapted to parlor use. The square form is no longer built, having been entirely superseded by the upright for use in private houses. The outer side of a piano case is usually veneered over the solid wood. Some makers build their piano cases of material made of several thicknesses of wood, under the supposition that it assists the resonant qualities. Some cases are very elaborately carved, and others expensively inlaid. Special instruments have been made costing as high as \$50,000. (2) The "frame," now almost universally made of iron or steel, held within the case and inseparable from it. (3) The "string-plate," attached to the rear end of the frame, and to which the strings are fastened. (4) The "wrest-plank," attached to the front end of the frame, and holding the tuning pins, around which one end of the strings is wound, so that their tension is regulated by turning the pins. The wrest-plank has to be made very solid to insure the rigidity necessary to withstand the enormous strain of



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the strings, a tension amounting to several tons. (5) The "belly" or "sounding-board," a thin piece of wood placed under the strings to increase the sound produced by their vibrations. Owing to their slender diameter, and consequent limited contact with the air, the sound produced by strings vibrating freely is so weak that a resonance factor is necessary. This factor is supplied by the belly upon which hardwood bridges are glued, which transmit the vibrations of the strings to the belly and thus creates sympathetic vibrations of the woody substance so as to adequately increase the sound. (6) The "strings," made of steel wire, one end of each being fastened to the string-plate, and the other coiled around tuning-pins in the wrest-plank. They increase in length and thickness from the treble to the bass. In the bass, in order to make the rate of vibration slower, they are over-spun or wound around with fine copper or mixed-metal wire. For the lowest tones ( $A_3$ - $F_2$ ) only one wire is employed; for each tone ( $G_2$ - $C$ ) two strings; and above that, three strings. One of the most remarkable differences between the modern and old pianos, is due to the vast increase in the tensile strength of piano wire drawn under modern methods. The breaking strength of English piano wire ranges from 225 pounds for No. 12 music wire, 0.029 inch diameter, to 650 pounds for No. 22, 0.052 inch diameter; giving an ultimate tensile strength of 340,000 pounds to the square inch, about five times that of the best old hand-drawn wire. (7) The "actions," the principal varieties of which have already been carefully described, and which consist of the entire mechanical device by which the hammers are propelled against the strings, including the keyboard and its row of keys, which are manipulated by the fingers. The keyboard of a modern piano has a compass of seven octaves, A-A, or seven octaves and a minor third, A-C, the extreme notes of which are very near the limits of the power of the average human ear to distinguish musical sounds.

Cristofori's pianos were four octave instruments. The keys corresponding to the natural tones and called "naturals" are made of ivory, and those corresponding to the chromatically altered notes, and called "sharps" are made of ebony. They are shorter than the naturals, and are raised above them. When a key is pressed down, its rear end rises and lifts the "jack," which throws the hammer against the strings. The hammers are attached to shanks of light wood, such as pear wood, hickory or white beech, sufficiently tenacious not to fracture under the hardest blow, and yet elastic enough to rebound. The wooden hammer-head is covered with felt, of compressed sheep's wool, cut from one piece, and increasing in thickness from treble to bass. The texture of the felt should be neither too hard nor too soft. A hammer with a hard surface leaves the strings immediately after contact with it and allows the very dissonant upper partial tones to run their course, while a hammer with a soft surface clings slightly to the string, or at least long enough to damp such discordant partials. Simultaneously with the throw of the hammer, the "damper" is raised, thus allowing the string to vibrate freely, but by a "check" which prevents its rebound, the damper remains raised as long

as the key is pressed down and the string continues to vibrate. (8) The "pedals," a set of levers, usually two in number, which are pressed down by the feet. They are called the "piano" and "forte" pedals; some makers add a third called a tone-sustaining pedal. The left foot presses upon the "piano" or soft pedal, which either throws all of the hammers nearer to the strings so that the striking distance is lessened by one half, or by shifting the keyboard action bodily, removes the stroke of the hammer from three to two strings, one being left unstruck, but not silent, since it vibrates in sympathy with the sounding strings with which it is in tune. This sympathetic vibration gives a beautiful æolian tone quality that has been recognized by modern composers from Chopin to Liszt with much advantage. The "forte" or loud pedal is pressed by the right foot and raises all the dampers so that the strings struck continue to vibrate even after the keys are released. The "tone-sustaining" pedal although not invented by the Steinways is often found in their grand pianos. It is an arrangement that instead of raising all of the dampers, allows the player to prolong any note or group of notes by keeping raised only such dampers as are raised by the keys when the pedal is down. In many upright pianos a soft pedal (Celeste) is applied by mechanically interposing a strip of thin felt between the hammers and the strings, thus materially diminishing the sound, and affording a great convenience in practising.

As previously stated, the pianoforte immediately upon its appearance did not supersede the harpsichord, or the virginal or spinet, which continued to be made throughout the 18th century, and composers continued to write for them. The earliest compositions for the pianoforte, however, appear in a volume entitled 'Sonate da Cimbalo di Piano e Forte, detto volgarmente di Martellatti.' Dedicato a Sua Altezza Reale. Il serenissimo D. Antonio Infante Di Portogallo, e Composto da D. Lodovico Giustini di Pistoia. Opera Prima, Firenze, 1732, the year after Cristofori died. Another composition apparently written for the pianoforte appeared in 1771, entitled 'Duetto fuer zwey Claviere, zwey Fortepianos, oder zwey Fluegel', composed by Muethel. In both of these, however, the technique is not different from that of the harpsichord. The first compositions which showed a technique characteristic of the pianoforte are the three sonatas by Muzio Clementi, published in 1773. From that date the composers studied the new instrument and employed the proper technique, with the result, as in the case of Beethoven's magnificent pianoforte compositions, that they went beyond the capabilities of the instruments of that time, and stimulated the piano makers to increase both the compass and the power of the instruments. Increase in the power of tone demanded strings of greater thickness, while the extension of scale called for an increased number of strings, and consequently, an enormous increase in the tension strain on the frame. These conditions led to the use of metal for frames, and beginning with the hollow metal tube framing patented by Allen and Thom in 1820, followed by cast iron frame of Babcock of Boston, in 1825, and the improvements of Chickering in 1837, and Steinway in 1859, the modern pianoforte was developed to



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its present state of perfection and power (see Fig. 11).

Of the many inventions made in connection with the pianoforte, the most important are



FIG. 11.—Small Grand Pianoforte.

the following: The "æolian attachment," by which a current of air is directed against the strings to reinforce the vibrations. Considerable increase in the volume and duration of the tone is thus obtained. The "electric piano," invented in 1891, by Eisenmann of Berlin, also accomplishes the same purpose, by means of electromagnets attached to the strings. The pressing down of the keys closes an electric circuit, and the action of the magnets enhances and sustains the vibration of the strings. Under the electric



FIG. 12.—Pianola in operation.

action alone, the tone of the piano resembles that of the stringed instruments.

Of the many devices designed for automatic piano playing, the most successful is the "pianola" (see Fig. 12). It is not attached to the piano mechanically, but is so placed that its "pneumatic fingers," 65 in number, will

strike the keys of that instrument. It is operated by means of pedals, levers, the tempo regulator, pneumatic action, and perforated music rolls. It possesses the great advantage in that the player can exercise a certain control over expressive interpretation of musical work, by automatically developing the phrasing indicated in the score, which is to music what punctuation is to literary work. To this capacity is added that of fine dynamic shading and variations in tempo, productive of tone-color and accent. The touch of the pianola is produced by the action of jets of compressed air, which act on the keys of the piano, and is as nearly like that of the human fingers as it is possible to obtain by mechanical means. The air being exhausted with greater or less suddenness furnishes a pliant and resilient quality that affords a range—from the soft velvety legato to a blow as powerful as that exerted by Liszt or Rubinstein. The tempo-indicator is used in accordance with the system of markings on the perforated roll music, so that the piece is played exactly in the time intended by the composer. The time-shading of the various passages being prescribed by the metronome, perfect time is obtained by simply moving the tempo-lever back and forth upon a dial marked from 0 to 130, to accelerate or retard the movement. It is also equipped with a forte-lever, to still further sustain and control expression.

Of devices embodying dumb keyboards for practising purposes, the "digitorium" or dumb piano, consisting of a portable box equipped with five keys supported on springs, and the "practice clavier" invented by Virgil of New York, in 1883, are the most modern representatives of a very old idea. The use of the former has been severely condemned by good musicians; but, the latter, which possesses a complete keyboard, is of great use in the practice of a legato touch. The mechanical arrangement affords two audible clicks—one when a key is pressed down, and the other when it is released, so that the only observation required of the performer is to note that the two clicks caused by the depression of one key and the release of the next, coincide. The apparatus may be so adjusted that the action can be regulated at will, from the lightest, 2 ounces, pianoforte touch, up to a touch exerting a pressure of 20 ounces. Its use is of great advantage in acquiring strength of the fingers, and for purely technical exercises.

*Bibliography.*—For further modern information consult: Spillane, 'History of the American Pianoforte' (New York 1890); Hipkins, 'History of the Pianoforte' (London 1896); Rimbault, 'History of the Pianoforte' (London 1860); Paul, 'Geschichte des Klaviers' (Leipsic 1868); Gontershausen, 'Der Klavierbau' (Frankfort 1870); Bie, 'History of the Pianoforte and Pianoforte Players' (London 1899); Ponsicchi, 'Il Pianoforte, sua origine e sviluppo' (Florence 1876); Bluethner and Gretscher, 'Lehrbuch des Pianofortebaues' (Weimar 1886); and for information of the earlier type, consult: Schlick, 'Spiegel der Orgelmacher' (Mainz 1511, Berlin reprint, 1869); Virdung, 'Musica Getuscht und ausgezogen' (Basel 1511, Berlin reprint, 1882).

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## PIANOLAS — PICA

**Piano'las.** See PIANOFORTE.

**Pi'arist**, member of a religious order, known as "Patres Piarum Scholarum," and devoted especially to the education of the young. The order was founded in 1607 by a Spanish nobleman, Joseph Galasanza (Saint Joseph Galasanctius) (1556-1648). In 1821 the order was approved of by Gregory XV., and endowed by Innocent XII. with all the privileges of a mendicant order (1690). Much of the work of the Piarists was accomplished in Poland and Austria, where there are still flourishing several Piarist schools. The members of the order number some 2,000 and they manage about 200 educational establishments. See ORDERS, RELIGIOUS.

**Piatt**, pi'at, **Donn**, American lawyer and journalist: b. Cincinnati, Ohio, 28 June 1819; d. Cleveland, Ohio, 12 Nov. 1891. He was educated at St. Xavier's College, Cincinnati, studied law and in 1851 was appointed judge of the court of common pleas of Hamilton County, Ohio. He was secretary of legation at Paris under President Pierce's administration, acting as *chargé d'affaires* for nearly a year of that time. On the outbreak of the Civil War he entered the Union army as a private, attained the rank of colonel, and was assistant adjutant-general on the staff of General Schenck. He resigned in 1864, entered journalism in Washington, D. C., founded and edited the Washington 'Capital,' and later returned to Ohio, where he engaged in literature and farming. He wrote the poem 'The Lone Grave of the Shenandoah' (1888), and also published 'Memoirs of the Men Who saved the Union' (1887). Consult Miller, 'Life of Donn Piatt' (1893).

**Piatt**, John James, American poet: b. James' Mill, Dearborn County, Ind., 1 March 1835. He was educated at Capitol University (Columbus, Ohio), and Kenyon College (Gambier, Ohio), was clerk in the United States treasury department in 1861-7, librarian of the United States House of Representatives 1871-5, consul at Cork, Ireland, in 1882-93, and consul at Dublin April-September 1893. In 1868-9 he was editorially connected with the Cincinnati *Chronicle*, and in 1869-78 with the *Commercial*. He has attained considerable recognition among American minor poets. His works include: 'Poems by Two Friends' (1860), with W. D. Howells; 'The Nests at Washington' (1863), with S. M. B. Piatt (q.v.); 'Poems in Sunshine and Firelight' (1866); 'Western Windows' (1868); 'Idyls and Lyrics of the Ohio Valley' (1884); 'At the Holy Well' (1887); 'The Ghost's Entry, and Other Poems' (1895); 'Odes in Ohio, and Other Poems' (1897); 'The Hesperian Tree' (1900).

**Piatt**, Sarah Morgan Bryan, American poet: b. Lexington, Ky., 11 Aug. 1836. She was graduated from Henry Female College, Newcastle, Ky., and was married in 1861 to J. J. Piatt (q.v.), with whom she published 'The Nests at Washington and Other Poems' (1864). Among her other volumes of verse may be cited 'A Woman's Poems' (1871); 'A Voyage to the Fortunate Isles' (1874); 'Poems in Company with Children' (1877); 'Dramatic Persons and Moods' (1880); 'The Witch in the Glass' (1888); 'An Enchanted Castle' (1893). A complete edition of her poems appeared in 2

vols. in 1894. Her work is often strongly dramatic in tone, is nearly always musical and in quality much above the average.

**Piauhy**, pē-ow-ē', or **Piauihi**, a state of southern Brazil, bounded on the north by the Atlantic (for only 16 miles), on the east by Ceará and Pernambuco, on the south by Bahia, and on the west by Maranhão, the boundary being the Parnahyba River, into which all the streams of the state flow. The only one of any importance is the Piauhy, which gives its name to the state, rises in a range also called Piauhy, about 350 miles from its junction with the Parnahyba, and is scarcely ever navigable because of the scant rains. The state has mountain ranges on its eastern and southeastern borders, and river-pierced plateaus elsewhere. The area is officially given as 301,797 qkm.; probably it is one fifth less. The climate is unhealthy; the rainy season often lasts only a few weeks and occasionally, as in 1877 and 1880, does not come at all. Then famine and typhus follow. The vegetation is poor. The capital city is Therezina, with 31,523 inhabitants in 1890 and some trade in cotton and cattle. The population of the state is scanty and includes some independent Indian tribes in the southwestern part; in 1890 it was 267,609.

**Piazza**, in architecture, a portico, or covered walk, supported by arches. It properly signifies a square, or open place of any shape, in a city, and has derived its architectural meaning from the fact that in warm countries such open places are in very many instances surrounded by covered walks.

**Piazzi**, Giuseppe, joo-sēp'pē pē-āt'sē, Italian astronomer: b. Ponte, Italy, 16 July 1746; d. Naples, Italy, 22 July 1826. He was educated in Milan, Turin, and Rome, and appointed professor of mathematics at the university of Malta in 1770, where he remained until its abolition in 1780. In 1781 he accepted the chair of mathematics at Palermo, where, through his efforts, an observatory was established in 1789. Here he made important investigations, the results of which were published in 1792, and in 1801 discovered the first of the planetoids known to science, which he named Ceres. Though it was visible for but a short time his observations were sufficient to compute its orbit so that it was found in the following year. In 1803 he completed his first catalogue of the fixed stars, which contained 6,784 stars, and received a prize from the Institute at Paris, to which it was dedicated. His second catalogue containing 7,646 was completed in 1814 and also received recognition from the Institute at Paris. This catalogue has been of great and lasting value and Piazzi's observations are now being used in a new computation by modern methods. He also made valuable discoveries concerning comets, and in 1817 was appointed chief director of the government observatory at Naples. His most important work after his catalogue was: 'Lezioni elementarii di Astronomia' (1817).

**Pi'ca**, a genus of the Crow family; the magpie (q.v.).

**Pica**, the former name of a size of printing type now known as 12-point. It was used as a base or standard for all type measurement.



## PICA — PICCINI

Six picas square equaled one square inch. It was the double of nonpareil, which is now called 6-point. See also PRINTING.

**Pica**, a perverted or morbid appetite for substances unfit for food, or incapable of digestion. It is most common in chlorosis and in pregnant and hysterical women. Some insane persons and idiots are subject to it, introducing into the stomach such articles as string, paper, and cocoanut fibre. The perverted appetite causes persons having it to eat, with apparent relish, chalk, slate-pencils, coal, plaster, earth, clay pipes, stones, and even filth. Dirt and clay eating (geophagia) exists not only among savages, but also in certain sections of the civilized world, mainly among the lower classes, although sometimes educated people indulge in it. Physicians incline to regard the vitiated tendency of the appetite as a neurosis connected with the digestive system. It may in some instances be the outcome of habit resulting from the silly desire for notoriety; it may depend on a disordered condition of the brain; may be caused by bad and insufficient diet and chloro-anæmia; by inflammation of the mesentery or "the presence in the duodenum of numerous nematoid parasites." It has been supposed that some of the substances eaten supply a deficiency in some of the ingredients of the ordinary food. Horned cattle and sheep are also subjects of pica. Prolonged eating of dirt, clay, and other unusual substances usually produces emaciation, a protuberant abdomen, and a sallow complexion. Sometimes there are serous effusions and hypertrophied liver and spleen. The treatment consists in removal of the cause and the substitution of proper diet.

**Picard**, pīk'ard, **George Henry**, American novelist: b. Berea, Ohio, 3 Aug. 1850. He was graduated from Baldwin University, Berea, in 1869, and from the Cincinnati Medical College in 1877. He has published 'A Matter of Taste' (1887); 'A Mission Flower' (1887); 'Old Boniface' (1888); 'Madame Noel' (1900).

**Picard**, Jean, zhōñ pē-kār, French astronomer: b. Paris 21 July 1620; d. there 12 Oct. 1682. He took orders, and became prior of Rillé in Anjou. He aided Gassendi in the observation of the solar eclipse of 25 Aug. 1645, and in 1655 succeeded to Gassendi's chair in the Collège de France. In 1666 he became one of the original members of the Academy of Sciences. He was the first to apply the telescope to the measurement of angles; improved instruments and methods; founded the 'Connaissance des Temps,' an astronomical annual; and by his efforts secured the establishment of the University of Paris. But his principal achievement was the first exact measurement of a degree of the meridian, made in 1669-71 between Amiens and Malvoisine. On 11 Jan. 1672 Oldenburg read before the Royal Society of London a letter from Paris describing Picard's method and the length of a degree as determined by him. It is probable that it was Newton's knowledge of this measurement that led him to regard his original conjecture of gravitation as satisfactorily established. See NEWTON, SIR ISAAC.

**Picard**, Louis Benoit, loo-ē bē-nwä, French dramatist: b. Paris, France, 29 July 1769; d. there 31 Dec. 1828. He began writing for the stage at 20 and in 1791 his play 'Encore

des Ménechmes' gained for him reputation as a playwright. He acted in several of his plays, was for several years a theatre director, became a member of the French Academy, and was appointed director of the Imperial Academy of Music. He was assisted by collaborators in some of his minor plays and his complete works were published in Paris (10 vols. 1821-2). Among his best dramas are: 'Médiocre et Rampant' (1797); 'Les Marionnettes' (1807); 'L'Intrigant Maladroit' (1820).

**Pic'ard**, a modification of Beghard; see BÉGUINES; RELIGIOUS SECTS.

**Pica'riæ**, a group of families of birds, variously limited by ornithological systematists. In its later significance, as established by Nitsch (1820) and substantially adopted by Sclater and the more recent writers, it included the rollers, hoopoes, kingfishers, cuckoos, parrots, trogons, woodpeckers, nightjars, owls, swifts, hummingbirds, and their immediate allies, which consequently are known as "picarian" birds. The still more modern group *Coraciiformes* nearly conforms with it but omits the parrots and cuckoos. The group embraces more than 1,800 species, mainly tropical—most of the families being exclusively so. The group is fully discussed by Stejneger, 'Standard Natural History,' Vol. IV. (1885), and by Evans, 'Cambridge Natural History,' Vol. IX. (1900).

**Picayune**, pīk-a-yoon', a name derived from the Carib language, and used in Louisiana for a small coin worth 6¼ cents, current in the United States before 1857, and known in different States by various names (fourpence, fippence, fip, sixpence, etc.). The word picayune has long been used, especially in the Southern States, in a slang sense.

**Piccadilly**, pīk'a-dīl-ī, in London, a famous street extending for a mile between the Haymarket and Hyde Park corner. In one part of Piccadilly are many fashionable residences, while another portion contains many handsome shops and stores. Many articles of wearing apparel have been named after Piccadilly, from having been first offered for sale by haberdashers in this thoroughfare.

**Piccini**, pēt-chē'nē, **Niccolo**, Italian musical composer: b. Bari, Italy, 16 Jan. 1728; d. Passy, near Paris, France, 7 May 1800. He studied at the conservatory of San Onofrio at Naples, and began to compose comic and serious operas, chiefly for the stages of Rome and Naples, with such success that for many years he was without a rival in Italy. In 15 years he wrote 130 operatic works. In 1776 he accepted an invitation from the French court, and went to Paris. There he brought out the 'Roland of Quinault' (1778), which, notwithstanding the opposition of Gluck (q.v.) and his friends, was successful. Although Gluck and Piccini were personally reconciled, yet the war between their respective admirers continued, and in order to compare their merits, the two rivals composed the same subject, 'Iphigenia in Tauris'; in this contest Gluck had the advantage. Piccini was appointed teacher of vocal music in the Royal Singing School in 1784, but the revolution deprived him of his appointments, and he returned to Naples. In 1794 he was made kapellmeister in the Spanish church at Rome; but having been subjected to persecution in Italy because of his



supposed revolutionary views, returned to France.

**Picciola**, pēt'chō-lä ("poor little one"), a story by Saintine (Joseph Xavier Boniface), a French author, born in Paris 10 July 1798, and who died there 21 Jan. 1865. It was published in 1836, ran through numerous editions, was translated into many languages, and received from the Academy the Montyon prize. The tale is a simple and touching recital of the loving care bestowed by a prisoner of Napoleon's time upon a plant growing between the stones of his cell, and from his tender naming of which the sketch takes its title. An infusion of it restores him from dangerous illness, and when he is released and leaves it the plant droops and dies.

**Pic'colo**, a small flute having the same compass as the ordinary orchestral flute, but its sounds are one octave higher than the notes as they are written; it is also called the octave flute. Piccolo is also the name of an organ stop of two feet length; the pipes are of wood and the tones bright and piercing. A small upright piano, about three and a half feet high, is also called piccolo; it is used for certain brilliant effects.

**Piccolomini**, pĭk-kō-lōm'ē-nē, Italian family of Sienna. The two most celebrated members are: 1. ÆNEAS SYLVIVS BARTHOLOMÆUS, afterward Pope Pius II. (See PIUS II.) 2. OCTAVIO, grand-nephew of the first: b. Amalfi 1599; d. Vienna 10 Aug. 1656. He served in the armies of the German emperor, and became one of the distinguished generals in the Thirty Years' war. He was a favorite of Wallenstein, who entrusted him with a knowledge of his projects, when he purposed to attack the emperor. Nevertheless he made himself the chief instrument of Wallenstein's overthrow, and after the latter's assassination (1634) was rewarded with a portion of his estates. After the battle of Nördlingen (1634), in which the Swedes were greatly weakened, he advanced with Isolani through Würtemberg, over the Main. In the following year he was sent to aid the king of Spain against the French, and delivered the Netherlands from the hands of the latter. His further successful campaigns in the Thirty Years' war induced Philip IV. of Spain to beg the emperor to allow him to lead the Spanish armies. The request was granted, and as a Spanish general Piccolomini again distinguished himself in the Netherlands, against both the French and the Dutch. The king of Spain rewarded him for his services with the Duchy of Amalfi. During the victorious advance of the Swedes in 1648 he was recalled by the emperor, and appointed, with the title of field-marshal, to the command of the troops destined to oppose them. His military career was concluded after a short campaign in the same year by the Peace of Westphalia. He is one of the principal characters in Schiller's trilogy of 'Wallenstein,' to the second part of which he gives the title. Consult Weyhe-Eimke, 'Ottavio Piccolomini' (1871).

**Pice**, pīs, a small East Indian coin, value about three quarters of a cent.

**Pichegru**, Charles, shärl pēsh-grü, French general: b. Arbois, department of Jura, 16 Feb. 1761; d. Paris April 1804. He was for some time a tutor at the College of Brienne, but soon exchanged this profession for that of a soldier and served with a French artillery regiment in

America. He was chosen the commander of a body of volunteers from Besançon to join the army of the Rhine. He was rapidly advanced, and in October 1793 was appointed general-in-chief of the same army. In 1794 he was selected as the fittest man to command the Army of the North, then beaten and demoralized. He defeated the enemy at Courtrai, Menin, Hoogelede, reduced to subjection Bruges, Ghent, Antwerp, Hertogenbosch, Venloo, and Nijmegen, crossed the Maas and the Waal on the ice in the winter of 1794-5, subjugated Holland, and entered Amsterdam in January 1795. Then he returned to Paris to enjoy his triumph. He was now at the height of his fame, and was honored by the Convention with the title of savior of his country. Soon after he set out to take the command of the army of the Rhine and Moselle, but in this post displayed none of his former energy, and entering into negotiations with the Bourbons was deprived of his command under suspicion of treason (1796). Having secured his election to the Council of Five Hundred, he was chosen its president (March 1797), and became the soul of the party hostile to the Revolution. He was proscribed and transported to Cayenne, but managed to make his escape the year following. In 1803 he was in London, and there he allied himself with George Cadoudal in a conspiracy to assassinate Napoleon. Having gone to Paris for the purpose, he was captured by the police (1804) and committed to the Temple prison, where he was found strangled 5 April. Consult the 'Life' by Bouziers (1870); also Daudet, 'La Conjuration de Pichegru' (1901).

**Pich'icia'go**, or **Pichy-ciego**. See ARMADILLO.

**Pichincha**, pē-chēn'chä, (1) a volcano in Ecuador in the western Cordillera, northwest of the city of Quito, which it destroyed in 1660 by an eruption. The mountain has five peaks, the highest measuring 15,918 feet above the sea; the crater is nearly a mile across and is 2,500 feet deep — one of the deepest in the world. (2) A province of Ecuador, including the plateau of Quito and the Andean slopes, named from the volcano. Pichincha is said to signify "boiling mountain." The province is watered by the Peruchó, which empties into the Pacific, and by the head-waters of the Napo. Area, 8,300 square miles; pop. (est.) 205,000. Principal products, sugar, maize, indigo, cotton, and fruit. Capital, Quito.

**Pichuric Acid**. See LAURIC ACID.

**Picidæ**, pīs'ī-dē, the family name of the woodpeckers (q.v.); the typical sub-family is *Picinae*; and the typical genus *Picus*.

**Pick**, Bernhard, American Lutheran clergyman: b. Kempen, Prussia, 19 Dec. 1842. He studied in Berlin and was graduated from the Union Theological Seminary in New York in 1868. He was ordained in the Presbyterian ministry in that year, and held various important charges, but in 1884 joined the Lutheran denomination, in which he has since officiated. He is a learned Hebrew and rabbinical scholar, a contributor to McClintock and Strong's, Schaff-Herzog, and the Jewish encyclopædias; has made numerous translations, and is author of: 'Luther as a Hymnist' (1875); 'Historical



## PICKENS — PICKERING

Sketch of the Jews' (1887); 'The Talmud: what it is and what it says about Jesus and the Christians' (1887); 'The Extra-Canonical Life of Christ' (1903); etc.

**Pickens, pĭk'ēnz, Andrew**, American soldier: b. Paxton, Pa., 19 Sept. 1739; d. Tomassee, S. C., 17 Aug. 1817. He removed with his parents to the Waxhaw Settlement, S. C., in 1752, was engaged in the Cherokee war of 1761, and at the outbreak of the American Revolution was appointed a captain of militia, from which rank he rose to be brigadier-general. He defeated General Boyd at Kettle Creek in 1779, was engaged in the battle at Stone Ferry in the same year, routed the Cherokees at Tomassee, and in 1781 so distinguished himself at the battle of Cowpens that Congress voted him a sword. He compelled the surrender of the British forts at Augusta, Ga., fought under General Greene in the campaign of Ninety-six, and by a successful expedition against the Cherokees in 1782 gained from them a large strip of territory, which later became a part of Georgia. In 1783-94 he was a member of the South Carolina legislature, and in 1793-5 served in Congress. He was a member of the State constitutional convention, a commissioner in many important treaties with the Indians, and was again member of the legislature in 1801 and 1812.

**Pickens, Francis Wilkinson**, American legislator and diplomat: b. Togadoo, S. C., 7 April 1805; d. Edgefield, S. C., 25 Jan. 1869. He was educated at the South Carolina College, admitted to the bar in 1829 and in 1832 elected to the state legislature. He was a member of the Nullification party and an advocate of extreme state rights. In 1834-44 he was a member of Congress, from 1858-60 was United States minister to Russia, and in the latter year was elected governor of South Carolina. He was prominent in the secession movement, demanded the surrender of Fort Sumter and erected the batteries which caused the reduction of that fort. He retired from public life in 1862.

**Pickens, Fort.** See FORT PICKENS.

**Pick'ereĭ**, a small pike (q.v.).

**Pikerel-frog.** See FROG.

**Pickering, pĭk'ēr-ĭng, Charles**, American naturalist and physician; grandson of Timothy Pickering (q.v.): b. Starucca Creek, Pa., 10 Nov. 1805; d. Boston, Mass., 17 March 1878. He was graduated from Harvard in 1823, from its medical department in 1826 and established a practice in Philadelphia. In 1838-42 he was naturalist in the United States Exploring Expedition under Lieutenant Charles Wilkes. In 1843-5 he traveled through Egypt, Arabia, East Africa, and India, engaged in scientific research. He was a prominent member in the leading scientific societies of America and wrote: 'The Races of Man and their Geographical Distribution' (1848); 'Chronological History of Plants; Man's Record of His Own Existence Illustrated Through Their Names, Uses and Companionship' (1879); etc.

**Pickering, Edward Charles**, American astronomer: b. Boston, Mass., 19 July 1846. He was graduated from Harvard in 1865, was instructor in mathematics at the Lawrence Scientific School there in 1865-7, accepted the chair of

physics at the Massachusetts Institute of Technology in 1867, where he remained until 1877, since when he has been professor of astronomy at Harvard and director of the Harvard Observatory. He established the first physical laboratory in the United States and was the founder of an auxiliary station in Arequipa, Peru. He has made a specialty of the study of the light and spectra of the stars, and besides various reports of the Harvard Observatory has published: 'Elements of Physical Manipulation' (1874-6).

**Pickering, John**, American linguist and lexicographer, son of Timothy Pickering (q.v.): b. Salem, Mass., 7 Feb. 1777; d. Boston, Mass., 5 May 1846. He was graduated from Harvard in 1796, studied law, was secretary of legation at Lisbon in 1797 and in 1799 was private secretary to Rufus King, United States minister to England. He returned to the United States in 1801 and after admission to the bar practised law in Salem until 1827 and then removed to Boston, where he was city solicitor in 1827-46. He served six terms in the Massachusetts legislature, was president of the American Academy of Science and first president of the American Oriental Society. He possessed a wide knowledge of European, Asian, Egyptian, and American Indian languages and published: 'Adoption of a Uniform Orthography for the Indian Languages' (1820); 'Vocabulary of Words and Phrases Peculiar to the United States' (1816); 'A Comprehensive Dictionary of the Greek Language' (1826); etc. Consult M. O. Pickering, 'Life of John Pickering' (1887).

**Pickering, Timothy**, American statesman: b. Salem, Mass., 17 July 1745; d. there 29 Jan. 1829. He was graduated at Harvard in 1763, was admitted to the bar, became register of deeds for Salem County, and displayed so great interest in military matters that he was commissioned lieutenant of militia in 1766 and became colonel in 1775. He was a prominent and active patriot, drew up the pamphlet called 'State of the Rights of the Colonists' in 1773, and drafted the Salem protest against the Boston Port Bill. In 1775 he wrote 'An Easy Plan of Discipline for the Militia,' an able manual much used in Massachusetts and for the whole Continental army; and in December 1776 joined the Revolutionary army meeting Washington in February 1777 and becoming adjutant-general. He fought at Brandywine and Germantown, was quartermaster general 1780-5, and was present at Yorktown. At the close of the war he settled in the Wyoming Valley, where he organized Luzerne County. Pickering concluded a treaty with the Six Nations in 1791, was appointed postmaster-general in that year and secretary of war in 1795, founded the U. S. Military Academy at West Point, and did much for the upbuilding of the navy. He was secretary of state from December 1795 to May 1800, and after his retirement lived in some destitution on his property in Pennsylvania, whence he returned to Massachusetts. In 1803 he was elected United States senator and in that capacity as in his office of secretary of state roused popular hatred by his extreme Federalist position. From 1812 to 1814 he was again out of public life, but was elected to Congress in the latter year and to the Massachusetts Executive Council in 1817. In the second war with England



## PICKERING — PICKWICK CLUB

he was a leader of the New England opposition and favored the Hartford Convention (q.v.). Consult the biography by Octavius Pickering, his son, and C. W. Upham (1867-73).

**Pickering, William**, English publisher: b. 1796; d. Turnham Green, Middlesex, 27 April 1854. He was apprenticed to a bookseller at 14; was himself a bookseller 1820-3; and in 1821 began to publish the famous *Diamond Classics* in 48mo. Of these there were 24 volumes, including Shakespeare's Works, Walton's 'Lives' and 'Angler,' Milton's 'Paradise Lost,' the Greek Testament and Homer (in the first diamond Greek type), Horace, Virgil, Catullus, Dante, Tasso, and Petrarch, all being printed by Charles Corrall. His other notable reprints were the 'Book of Common Prayer' (1844), Aldine edition of the English poets, etc. He was publisher to Coleridge, Alexander Dyce, Sir Harris Nicolas and others. Pickering introduced the use of cloth covers instead of paper boards, about 1825. He used the Aldine emblem with the motto "Aldi Discip. Anglvs," as well as other emblems. He was financially ruined by standing security for a friend, and died in want.

**Pickering, William Henry**, American astronomer, brother of E. C. Pickering (q.v.): b. Boston, Mass., 15 Feb. 1858; d. August 1907. He was graduated from the Massachusetts Institute of Technology in 1879 and was appointed assistant professor at the Harvard Observatory. He was in charge of the expedition to observe the solar eclipses in Colorado in 1878 and in the West Indies in 1886. He established the Arequipa station in Peru for Harvard College in 1891, led the expedition for the observation of the solar eclipse in Georgia in 1900, and in that year established an astronomical station at Mandeville, Jamaica, W. I. He published: 'Investigations in Astronomical Photography' (1895); 'An Atlas of the Moon' (1903); 'The Moon' (1903); etc.

**Picket**, the name given a wooden stake with a sharpened end, used in laying off ground for fortifications. Also a stake sharpened at both ends; one driven into the ground and the other acting as an obstacle to the advance of the enemy. Also a guard posted in front of an army to give notice of the approach of the enemy; an outlying picket.

**Picketing**, a term used in labor troubles. See STRIKE.

**Pickett, pik'ët, George Edward**, American military officer: b. Richmond, Va., 25 Jan. 1825; d. Norfolk, Va., 30 July 1875. He was graduated from West Point in 1846, served in the Mexican War, especially distinguishing himself at Contreras, Churubusco, and Chapultepec, and was promoted to the rank of brevet captain in 1847. He served later on the frontier in Washington Territory, and in 1856 occupied San Juan Island, where he prevented the landing of British troops and received the thanks of Congress for his services. In 1861 he resigned from the Federal army and joined the Confederate forces, becoming major-general in 1862. At Fredericksburg his division held the centre of Lee's line, and at Gettysburg in 1863 he made the gallant assault of Cemetery Ridge, famous as "Pickett's charge." (See GETTYSBURG.) He later commanded the department of North Carolina, successfully defended Petersburg in 1864, and per-

formed excellent service at Dinwiddie Court House and Five Forks. He engaged in business in Richmond after the War.

**Pick'ing, Henry Forry**, American naval officer: b. Somerset County, Pa., January 1840; d. Charlestown, Mass., 8 Sept. 1899. He was graduated from the United States Naval Academy in 1861 and was assigned to the North Atlantic blockading squadron. He participated in the sinking of the Confederate *Petrel*, was engaged in the Monitor-Merrimac engagement, served in the East Gulf and the South Atlantic blockading squadrons, was promoted lieutenant in 1862, and in 1865 placed in command of the *Nahant*. After the War he continued in the service, became rear-admiral in 1898, and died while commandant of the navy yard at Charlestown.

**Pickles**, a general term applied to vegetables preserved in vinegar. They are prepared by first washing the parts in clean water, then soaking for a few days in brine, afterward drying them with a cloth or draining them, and finally putting them into the vessel in which they are intended to be preserved, and pouring in boiling vinegar until the vessel is quite full. Before the vinegar is poured in, spices are added. When the vegetables that are to be pickled are naturally soft the vinegar is sometimes poured in cold. To preserve the color of vegetables that are naturally green, the best means is to steep vine, cabbage, spinach, or parsley leaves in the vinegar. In many cases this is effected with much less trouble by boiling the vinegar in copper vessels, and thus forming an acetate of copper, or by directly adding that salt, which is green; but this practice is a very injurious one, as the acetate of copper is poisonous. The vegetables most often pickled are cabbage, cauliflower, gherkins (young cucumbers), French beans, onions, walnuts, mushrooms, and nasturtiums. Chile peppers and sweet peppers, olives, and capers are the most common kinds of imported pickles, and mangoes are occasionally used.

**Picknell, pik'něl, William Lamb**, American painter: b. Hinesburg, Vt., 30 Oct. 1854; d. Marblehead, Mass., 9 Aug. 1897. He went to Europe in 1874, where he studied with George Inness at Rome, and later at the Ecole des Beaux Arts under Gérôme. He settled at Pont Aven, Brittany, where he worked for five years under Robert Wylie and painted 'Route de Concarneau,' a picture that established his position as an artist, won an honorable mention in the Salon of 1880, and now hangs in the Corcoran Art Gallery. His later life was spent in Annisquam, Mass., and France. He was a landscape painter of poetic qualities, with a feeling for atmospheric effects. Subjects found along the coast chiefly attracted him. His pictures are to be found in the galleries of Boston, New York, Brooklyn, Pittsburg, and the Luxembourg, Paris.

**Pickwick (pik'wik) Club, The Posthumous Papers of the**, a novel by Charles Dickens, published in 1837. Aided by the clever illustrations of Hablot Brown, or "Phiz," it attained immediate success and laid the foundations of its author's fame. The types illustrated are caricatures, but nevertheless they are types. Although the whole book is exaggerated comedy, there is scarcely any other that has furnished



## PICO — PICQUART

more characters universally known, or given to common English speech more current phrases.

**Pico**, pē'kō, an island of the Azores (q.v.) group; area, 254 square miles. It is crossed by a volcanic ridge which terminates in the peak, El Pico, 7,613 feet in height. Smoke and lava are frequently emitted. The island is well wooded and fertile; but earth had to be brought from Fayal to cover or enrich the lava. Now the slopes are covered with vegetation, especially vines, and the island exports an excellent wine. The chief town is Villa-di-Laguna. Pop. (1902) 24,425.

**Pico Della Mirandola, Giovanni**, jō-vän'nē pē'kō dēl'lā mē-rän'dō-lā, Count of Mirandola, surnamed "the Phoenix," Italian humanist: b. Mirandola 24 Feb. 1463; d. Florence 17 Nov. 1494. He undertook the course in canon law at Bologna, but repugnance to the study, and an inclination to philosophical and scientific subjects, led him to visit the different parts of Italy and France for the purpose of observation, and to attend the lectures of the most distinguished professors. In 1484 he went to Florence, where he became a member of the Platonist group known as the "Academy." In 1486 he proposed 900 theses on all subjects, which he declared himself ready to defend, according to the custom of the times, in public. No one ventured to appear against him, and the envious endeavored to implicate him in a charge of heresy. Innocent VIII. forbade the reading of the propositions, and Pico withdrew to France. He was absolved, however, from any suspicion of heresy by Alexander VI. Having next applied himself to the study of Biblical literature he published the fruits in 'Heptaplus,' a mystical or cabalistic explanation of the history of the creation, in which he derives Plato's doctrines from Moses. Two years after he published a treatise — 'De Ente et Uno' — in which he aimed to unite the opinions of Plato and Aristotle. Both works are much inferior to what might have been expected from one who enjoyed so great a reputation among his contemporaries; but his reputation seems rather to have been due to the extraordinary splendor of his attainments than to their solid worth. A collection of his works, almost all in Latin, was published at Venice in 1498. He is introduced as one of the characters in Alfred Austin's drama, 'Savonarola.' Consult: Dreydorff, 'Das System des Johannes Pico von Mirandola und Concordia' (1858); Pater, 'Studies in the History of the Renaissance' (1873).

**Pico de Teide**, pē'kō dā tā'ē-thē. See TENERIFFE, PEAK OF.

**Pic'oline**, in chemistry, a base  $C_6H_7N$ , isomeric with aniline and closely related to pyridine, obtained from bone oil, coal-tar, naphtha, etc., the name being derived from Latin, *pix*, pitch, and *oleum*, oil. It is a colorless, mobile, very pungently odorous liquid, with an alkaline reaction and a boiling point of  $135^\circ$  C. The first variety, discovered by Unverdorben, is now distinguished from two other varieties (discovered by Weidel and styled  $\alpha$ - and  $\beta$ -picolines) by being called  $\gamma$ -picoline;  $\alpha$ -picoline boils at  $133.9^\circ$ ,  $\beta$  at  $140^\circ$ , and  $\gamma$  as has been said at  $135^\circ$ . The three are also distinguished by the crystal form of certain of their salts. In modern nomenclature they are styled orthomethylpyridine,

metamethylpyridine, and paramethylpyridine respectively. The last of these (the  $\gamma$ -picoline) is very corrosive, with choking vapors; it quiets the excited nerve centres if used as a hypodermic injection.

**Picot, François**, frän-swä pē-kō, French painter: b. Paris 1786; d. there 15 March 1868. He was a pupil of Vincent and his early reputation was won by his large picture 'Cupid and Psyche'; which was followed by 'Raphael and La Fornarina'; and an 'Evening Landscape.' His 'Death of Sapphira,' also an early work, is in the Church of Saint Severin at Paris. The French government purchased for the Luxembourg Gallery his 'Orestes Sleeping in the Arms of Electra.' He painted a 'Madonna' for the Church of Loretto at Paris, and in the Louvre executed two ceiling pictures, 'Egypt and Greece,' and the 'Fall of Pompeii and Herculaneum.' His colossal figure of 'Christ' in the Church of Saint Vincent de Paul at Paris is in the Byzantine style. He, however, met with much greater success as a teacher of painting than as a painter.

**Picot, Georges**, zhörzh pē-kō, French historian and jurist: b. Paris, France, 24 Dec. 1838. He studied law, was appointed a judge in the Seine tribunal in 1865, and in 1877 accepted a post in the Ministry of Justice. He was editor of 'Le Parlement' and in 1878 succeeded Thiers at the Academy of Moral and Political Sciences, where he became permanent secretary in 1896. Among his publications are: 'Recherches sur la Mise en Liberté sans Caution' (1863); 'Histoire des Etats généraux' (1872); 'La Réforme judiciaire' (1881); 'Décentralisation et ses différents Aspects' (1897); etc.

**Pic'pus, Society or Congregation of**, a religious association founded in Paris, 1805, by Pierre Coudrin, priest. The associates were to devote themselves, as a protest against the prevailing unbelief, to the perpetual adoration of the Blessed Sacrament; they were also to prepare candidates for the priesthood and for service in the foreign mission. The mother house was the conventual building of the original Congregation of Picpus, a Franciscan fraternity. They had charge of seminaries in various parts of France. In 1825 they sent six of their priests to the mission in the isles of the Pacific, and those islands have ever since been the field of their missionary labors.

**Picquart, Georges**, zhörzh pē-kär, French soldier, prominent in "the Dreyfus case": b. Strasburg 6 Sept. 1854. He entered St. Cyr in 1872, and, after two years there, spent two more in the Ecole d'Etat-major, from which he was graduated in 1876 with the second rank in his class. From the General Staff School he entered the infantry; became captain in 1880 and major in 1888 upon his return to France from three years in Tonkin; in 1890-3 was professor at the Superior Military School; was promoted lieutenant-colonel in 1896; and in the year before became head of the Department of Information. In May 1896 he obtained possession of a telegram card, the famous *petit bleu*, addressed to Esterhazy, which prompted him to inquire into that officer's record and way of life. The result was that he found Esterhazy's writing was clearly that of the famous bordereau; it was identified as such by Bertillon of the Paris police



## PICQUET — PICTONES

and by Du Paty de Clam. His investigations were soon interfered with by his superiors; he was disgraced and sent to Tunis 16 Nov. 1896, the Department of Intelligence being entrusted to Col. Henry, who concealed the truth so far as he could and later committed suicide, when his dishonesty had been disclosed. Picquart, apparently had been sent to Tunis in the hope that he would be killed in battle. This not happening, in May 1897 he was accused of forging the *petit bleu*, which had roused suspicion against Esterhazy. His bold action in repelling this charge hastened the revision of the case. He was retired from the army February 1898, having been arrested by the military authorities a month before. On 14 July he was again imprisoned in a civil prison; and 20 September was charged with forgery and with tampering with the Esterhazy telegram card. After a long imprisonment in the Cherche-Midi he was released and was the most prominent witness in the Rennes trial of 1899. At the retrial of the case 19 June — 12 July 1906, he was acquitted of all charges, subsequently promoted Brigadier-General and in October 1906 became Minister of War in the cabinet of M. Clemenceau. See DREYFUS.

**Picquet.** See PIQUET.

**Pic'rate.** See PICRIC ACID.

**Pic'ric (or Carbazotic) Acid**, a symmetric trinitrophenol, with the formula  $C_6H_2(NO_2)_3OH$ , much used as a dye and in the manufacture of explosives. It was first prepared by Woulfe in 1771 by the action of azotic acid on indigo. To Laurent is due the modern method of preparation, in which phenol and nitric acid are boiled and concentrated, and the crystallized picric acid in yellow, laminal crystals then separates from the solution; the crystals are not soluble in cold water, slightly so in hot water, and very soluble in alcohol. Other means of preparation are from silk, aloes, benzoin, wool, leather, etc., by the action of strong nitric acid. The bitter taste of its solutions gives it the name picric (Greek *πικρός*, bitter). It is an excellent bright yellow dye for animal fibres, and admixtures of blue give beautiful greens. Vegetable fibres, on the other hand, are not colored by it; hence it is used to detect cotton, hemp, or flax in "woolen" goods. Pharmaceutically it is largely used in France as a soothing antiseptic; a concentrated solution is an excellent cure for burns. But picric acid is not commonly used for dyes nowadays, and its use as an antiseptic has never spread beyond France, but as an explosive it plays a considerable part in the preparation of lyddite and melinite. The acid itself is slightly explosive, much more its picrate of potassium, and the latter was successfully used by Turpin about 1885 in the manufacture of melinite (q.v.). In general picrate explosives are too liable to explosion to be used in propelling a shell; for the charge of a shell they are very deadly. The ammoniac picrate is used in fireworks. To the theoretical chemist picric acid is a remarkable phenol as being more acid than carbonic acid, probably because of its trinitro-group; this property explains the formation of picrates by the separation of the alkali metals from the carbonates. See EXPLOSIVES.

**Picromerite**, a monoclinic mineral occurring as crystals and crystalline incrustations. It is found in the crater of Vesuvius, and also

in the salt mines of Stassfurt. Compound of hydrous sulphate of magnesium and potassium.

**Picrotox'in**, a poison,  $C_{30}H_{34}O_{13}$  (or possibly  $C_{12}H_{14}O_5$ ), extracted from the Indian berry, the fruit of the East Indian *Anamirta cocculus* or *paniculata*, by treating with hot alcohol the powdered seed. The alcohol is distilled, the residue boiled with water to which the acetate of lead has been added, and the solution then evaporated. The crystals, white or transparent prisms or rays grouped in star-like forms, are very bitter to the taste, are odorless, inalterable in the air, insoluble in the essential oils, but soluble in cold water (150 times its bulk), boiling water (25 volumes), alcohol (3 volumes), or ether ( $2\frac{1}{2}$  volumes), and are one of the most violent convulsive poisons known, closely resembling strychnine in their action. The poison brings death by asphyxiation after severe convulsion, and is bulbo-medullary and not cerebral in its action. Morphine and chloral hydrate are the antidotes, but neither seems to have antidotic force if the original dose is much above the mortal minimum. In therapeutics picrotoxin is practically unused, though it is valuable in epilepsy, chorea, chronic constipation, etc.

**Pictet**, pēk-tā, or pē-tā, **Adolphe**, Swiss scholar and linguist: b. Geneva 11 Sept. 1799; d. there 20 Dec. 1875. He studied in Paris, Scotland, and Germany; in 1838 became professor of æsthetics and philology in the University of Geneva; and wrote 'Du Beau dans la Nature, l'Art, et la Poésie' (1856), 'Les Origines indo-européennes' (1859-63), and on the relation of Celtic to Sanskrit. He invented a percussion howitzer shell used by the Austrian army.

**Pictet**, Raoul, Swiss physicist: b. Geneva June 1842. He was professor in Geneva for a time, but now lives in Berlin. In 1877 he liquefied oxygen, nitrogen, and hydrogen; published a memoir on that subject in 1878; and also wrote 'Synthèse de la Chaleur' (1879), 'Nouvelles Machines frigorifiques' (1885), 'Le Matérialisme et le Spiritualisme par la Physique expérimentale' (1896), 'L'Acétylène' (1896), and other important monographs, on low temperatures and liquefaction of gases, especially.

**Picton**, pīk'tōn, **Sir Thomas**, English military officer: b. Poyston, Pembrokeshire, Wales, August 1758; d. Waterloo, Belgium, 18 June 1815. He entered the army at 13, served at Gibraltar, and in 1794 went to the West Indies, where he distinguished himself at St. Lucia, St. Vincent, Martinique, and Trinidad, and in 1797 was appointed governor-general of the last named island. In 1801 he became its civil governor and was promoted brigadier-general. He served in the Peninsular war under Wellington, received rank as lieutenant-general in 1813, was engaged with Ney at Quatre Bras in 1815 and was killed while leading a charge at Waterloo.

**Picton**, Canada, town in Prince Edward County, Province of Ontario, on an arm of the Bay of Quinte; about 36 miles southwest of Kingston. Pop. (1891) 3,287; (1901) 3,698.

**Pictones**, pīk'tōn-ēz, or **Pictavi** (*Pictōnes*, *Pictāvi*), the ancient inhabitants of a region in Aquitanian Gaul, the French province of Poitou, which is now for the most part comprised in the Department of Vienne; the chief town of the Pictones was Pictava, modern Poitiers; before



## PICTOR — PIEDMONT

the Roman conquest of Aquitania its name was, as rendered by the Latins, Limonum.

**Pic'tor.** See EQUULEUS.

**Pictou,** pĭk-too', Canada, a port of entry and capital of a county of the same name, Nova Scotia, 85 miles northeast of Halifax, on a branch line of the Intercolonial Railway. The town was settled in 1763 and occupies the site of an Indian village. Pictou Academy, organized in 1818, is its chief institution. The harbor is safe and commodious and an active export trade is carried on in the coal, and building stone, of neighboring mines and quarries, in agricultural produce, and fish. Pop. (1901) 3,235.

**Picts.** See SCOTLAND.

**Pictured Rocks,** in Michigan, sandstone cliffs about 300 feet in height, extending along the coast of Alger County, on the south shore of Lake Superior; about 43 miles east of Marquette. They are varied in color and form, quaint designs have been carved upon them by the elements, and a number of waterfalls still continue the work of change. The cliffs are about five miles long. Longfellow, in his Indian tale of Hiawatha, locates the wigwam of Nokomis at Munising Harbor, among the Pictured Rocks.

**Pictures of Travel** (Reisebilder), the most famous of the prose works of Heinrich Heine. It was published in four parts, 1826-31, and the appearance of the first book of these sketches marked an epoch in the development of German literature. It was read with avidity by the public, and so strong was its influence that it gave the first serious check to a prevailing tendency in the world of letters,—the romantic tendency. The power of the Romantic School was broken by the vivid realism of Heine's 'Hartz Journey.' The keen observation of the great lyricist and satirist, his brilliant searching criticisms of men and institutions, his stinging sarcasms poured out on existing conditions, were entirely opposed to the spirit of Romanticism, and its author attained at once to almost as widespread a recognition as he was ever to reach among his countrymen. The brilliancy and bitterness, the sweetness and the mockery, of his strange nature, are all brought into play in this, his first prose work of significance.

**Picu'da,** a fish. See BARRACUDA.

**Pic'ul,** a Chinese weight of 133⅓ pounds. It is divided into 100 catties, or 1,600 taels.

**Picus,** pĭ'kŭs (Lat., the woodpecker), in the most ancient mythology of the Sabines, Latins and Etrurians, the sacred bird of the god of the upper atmosphere, of the land and agriculture, sender of rain, giver of fertility. This god was Mars, Mavors, or Marspiter (*Mars pater*, father Mars), who afterward was supplanted by the more than half-Grecian god Jupiter (father Jove), while Mars or Mavors was assimilated to the Grecian god of war, Ares. The Latin god Mavors gave oracles by means of the noises made by the woodpecker tapping on the trees. In the confusion of the diverse mythologies, Sabine, Roman, Latin, Etrurian, the woodpecker, Picus became a form of the god himself, or son of the god and a famous hero, king of Latium, and father of Faunus.

**Pidavro.** See EPIDAUROS.

**Piddig,** pē-dēg', Philippines, pueblo, province of Ilocos Norte, Luzón; on the Guisi River, near its junction with the Pagsán; 9 miles east of Laoag, the provincial capital. It is connected with Laoag and other towns by wagon road. Pop. 10,850.

**Pid'dock,** the British name for certain edible species of mollusks of the genus *Pholas*. See DATE-SHELL.

**Pidgin,** pĭj'in, **Charles Felton,** American statistician and novelist: b. Roxbury, Mass., 1 Nov. 1844. He was in mercantile employment in Boston 1863-73 becoming in the latter year chief clerk of the Massachusetts bureau of statistics of labor. He has invented several machines for the mechanical tabulation of statistics, among them the electric adding and multiplying machine, addition register, and type-writer tabulator. He has published: 'Practical Statistics' (1888); 'Quincy Adams Sawyer' and 'Mason's Corner Folks' (1900); 'Blennerhassett' (1901); 'Stephen Holton' (1902); 'The Climax' (1902); 'Little Burr' (1905). He has also composed several musical works, among them 'Cambyzes,' a grand opera, and 'Peck's Bad Boy,' a musical comedy.

**Pidgin, or Pigeon, English,** a form of "business English"; a conglomeration of English and Portuguese words wrapped in a Chinese idiom, used by English and American residents in China in their intercourse with the natives.

**Pied** (pĭd) **Piper of Hamelin, The,** according to a legend a magician who promised to rid the town of Hamelin from rats for a stipulated sum of money. He performed his task by playing on his pipe as he walked to the river and the rats, following the music, were consequently drowned. On the citizens then refusing to pay the money the piper took up his pipe once more and led the way out of the town followed by 130 children. On arriving at a hill known as the Koppenberg they all entered the hill and vanished from sight. In the Hamelin Rathaus the event is recorded and it was long supposed to be historical. Browning's poem, 'The Pied Piper of Hamelin' (1842), is based on this tale.

**Piedmont,** pēd'mōnt (Italian, *Piemonte*, "Country at the Foot of the Mountains"), Italy, a compartment including the provinces of Cuneo, Alessandria, Novara, and Turin. It is separated from France and Switzerland by the Alps. It was a part of France from 1797 to 1814, and was at one time the chief part of the kingdom of Sardinia (q.v.). The area is 11,389 square miles; pop. (1900) 3,398,794. See ITALY.

**Piedmont, Battle of.** After the battle of New Market (q.v.), 15 May 1864, Gen. Sigel was relieved, and 21 May Gen. Hunter was assigned to the command of the Union forces in the Shenandoah Valley. The command in the field consisted of Gen. J. C. Sullivan's division of infantry, two brigades, under Cols. Moor and Thoburn; Gen. J. Stahel's division of cavalry, two brigades, under Cols. Tibbits and Wynkoop, and five batteries of artillery. With this force of 8,500 men and 21 guns, Hunter broke camp on Cedar Creek on the 26th to move on Staunton and Lynchburg, marched to Woodstock, and thence to Harrisonburg, where, 2 June, he learned that Gen. Imboden was at Mt. Crawford, eight miles distant, barring the direct road to Staunton. He avoided Imboden by passing



## PIEDMONT PLAIN — PIER

his right by way of Port Republic. From his camp one mile south of Port Republic he advanced early on the morning of the 5th on the Staunton road, met the Confederate cavalry at 6 A.M., and drove them after a sharp skirmish, with a loss of 75 men killed, wounded, and missing. At Piedmont, seven miles southwest of Port Republic, Hunter found Gen. W. E. Jones with a Confederate force of 6,000 men and 12 guns, strongly posted, his left resting on Middle River, a tributary of the Shenandoah. Line was formed, Moor's brigade on the right, Thoburn's on the left, Wynkoop's cavalry massed in rear of Moor. Hunter's artillery opened at 9 A.M., and after a fire of less than two hours Moor attacked the Confederate left and drove the first line back on the second, which was on a curving ridge of heavily wooded hills, and on reaching which Moor was checked and fell back with some loss, the Confederates following, but soon checked in turn by Moor, aided by the cross-fire of three batteries. Meanwhile Thoburn had crossed a ravine to gain the Confederate right flank. Securing an advantageous position, he made a charge on the woods and heights, there was a fierce struggle, in which bayonets and clubbed muskets were used on both sides; Moor and Wynkoop co-operated in the attack; and the Confederates abandoned their position in great disorder, leaving Gen. Jones dead on the field, with more than 1,000 prisoners, including 60 officers. In killed and wounded the Confederate loss was about 600. The next day Hunter captured 400 sick and wounded. Three guns, several battle-flags, and a large number of small arms were captured. Hunter's loss was 420 killed and wounded. Gen. Vaughn, who succeeded Jones in command, fled with not over 3,000 effective men to Waynesboro, and abandoned Staunton. Hunter marched to Staunton on the 6th, where he was joined on the 8th by Gens. Crook and Averell, who had marched from West Virginia, with 10,000 men, raising his force to 18,000 men, with 30 guns. He destroyed much public property in Staunton, broke the railroad several miles east and west of it, and on the morning of the 10th marched for Lynchburg. Consult: 'Official Records,' Vol. XXXVIII.; Pond, 'The Shenandoah Valley in 1864'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

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**Piedmont Plain**, the name given to that part of the Atlantic coastal plain, in the United States, which lies between the Appalachian highland and the coastal plain proper. This plain is well defined in the Southern States, but not so distinct in New England. It is nearest to the ocean in New York; in North Carolina it is about 300 miles wide. It is crossed by deep river-valleys, and is seamed with rugged gorges, and water beds. The rock is harder and older than in the coastal plain proper. The "fall line," or escarpment over which the Atlantic rivers fall and form cascades and rapids, marks the change from the hard to softer rock formations.

**Pieds Puidreaux**, pē-a pwē-drō. See **PIEPOWDER COURT**.

**Piegan** (pē'gan) **Indians**, an American tribe of the Algonquin family. Some 2,000 of them reside on the Blackfoot Reservation in northern Montana. They are members of the Siksika confederacy, being associated with the

Siksikas, Bloods, and other tribes. They are a very peaceable people and crime is almost unknown among them.

**Piehl**, pēl, **Karl**, Swedish Egyptologist: b. Stockholm 30 March 1853. He was educated at Upsala, where he became docent of Egyptian languages in 1888, and in 1893 professor upon a special grant by the Riksdag. He published 'Inscriptions hiéroglyphiques' (1884-99), 'Petites Etudes égyptologiques' (1881), 'Dictionnaire du Papyrus Harris Nr. 1' (1882), and many contributions to archæological periodicals. In 1896 he became editor of 'Le Sphinx,' an Egyptological journal.

**Pieng-an**, pyëng-än, or **Ping-Yang**, pīng yäng, Korea, the capital of the province of South Phyöng-an on the Ta-tong river about 40 miles above its mouth, and about 120 miles north of Seoul. The city extends for two and a half miles along the river bank, is surrounded by fortified walls 20 feet high, and is considered of great strategic importance, being called the "Key of Korea." Ping-Yang is open to foreign settlement and is the seat of several Christian missions. Ping-Yang is said to date from 1122 B.C., when the historic Ki-Tse or Kija, ancestor of Confucius, landed here from China, and laid the foundations of Korean civilization. His tomb is one of the city's sacred shrines. Among the important incidents of the city's history are the defeats of the Chinese here by the Japanese in 1593, and again on 16 Sept. 1894. Pop. estimated from 60,000 to 100,000.

**Pien'o** (Ital., meaning full), a term often used in music as equivalent to *tutti*, *grande*, or *grossi*, to signify employment of all the instruments of an orchestra; sometimes it is used with *coro*, as *pieno coro*, full chorus.

**Pieper**, Franz August Otto, American Lutheran theologian: b. Carwitz, Pomerania, Germany, 27 June 1852. Coming to the United States, he was graduated from Northwestern University, Watertown, Wis., in 1872, and from Concordia Seminary in 1875. He held a Lutheran pastorate at Manitowoc, Wis., 1875-8, was professor of theology at Concordia Seminary 1878-87, and president of the latter institution since the year last named. Among his many published works in German are: 'Lehre von der Rechtfertigung' (1889); 'Wie studiert man Theologie?' (1898); 'Lage der Kirche am Anfang des 20. Jahrhunderts' (1901).

**Piepowder** (pī'pow-dër) **Court**, or **Pierpoudre Court**, a court formerly set up at fairs and markets in England for the summary administration of justice in cases arising there. It is also called the Court of Dusty Foot, which has the same meaning as piepowder (a corruption of the French *pied poudreux*), and probably got its name from the fact of its being chiefly resorted to by peddlers and wayfaring persons, to whom the name of *pieds puidreaux* was given in Old French.

**Pier**, pēr, **Arthur**, Stanwood, American novelist: b. Pittsburg 21 April 1874. He was graduated from Harvard in 1895, and has been an assistant editor of the 'Youth's Companion' from 1896. He has published: 'The Pedagogues' (1899); 'The Sentimentalists' (1901); 'The Triumph' (1903).



## PIER — PIERCE

**Pier**, in engineering, a mole or jetty extending out from the land into the water, adapted to form a landing place for passengers or merchandise from ships which float in the deep water alongside the pier or wharf. They are variously constructed. Some are founded on piles, with cross timbers, braces, and sheathing; floor timbers afford a road for the traffic. The wooden structure is sometimes filled up with stone, like a dike; at other times it is of the nature of trestle work. See DOCK; MOLE; WHARF.

**Pierce, Franklin**, 14th president of the United States: b. Hillsboro, N. H., 23 Nov. 1804; d. Concord, N. H., 8 Oct. 1869. He was graduated from Bowdoin College in 1824; studied law in the office of Levi Woodbury at Portsmouth, and later at the law school in Northampton, Mass., and was admitted to the bar in 1827. He began practice at Hillsboro, and after some discouragements attained marked success. He early turned his attention to politics, and in the election of 1828 warmly supported Jackson for the Presidency. In 1829 he was elected to the lower house of the New Hampshire legislature, where he served for four years, and in the last two years was chosen speaker. In 1832 he was elected a member of Congress, and re-elected in 1834; he served on the judiciary and other important committees, but did not attain distinction in debate. He was known, however, as a faithful supporter of the Democratic administration. He sustained Jackson's opposition to the internal improvement system, and made a speech against the bill authorizing an appropriation for the military academy at West Point, to which institution he was long opposed. On the question of slavery he sided with the South, and opposed anti-slavery measures in every shape. In 1836 he was elected to the United States Senate, of which he was the youngest member when he took his seat. He was a member of the Senate committee appointed to consider the petitions for the abolition of slavery in the District of Columbia, which reported that such petitions should not receive consideration. In 1842 he resigned his seat in the Senate, and resumed the practice of law in Concord, N. H.; he soon became distinguished as a lawyer and established a large practice. In 1846 President Polk offered him the post of United States attorney-general, which he declined. He also declined to be a candidate for governor of the State, but accepted the position of United States district attorney for New Hampshire; and he still continued to manifest an interest in politics. In 1847, when the State of New Hampshire was called upon to furnish troops for the Mexican War, he enrolled himself a member of one of the first volunteer companies of Concord; he soon received the appointment of colonel of the Ninth regiment, shortly after was commissioned brigadier-general of the army, and was ordered to Vera Cruz. From there he led his men to join the main body of the army under General Scott at Puebla, which he reached 7 August after a hard march and several sharp engagements with guerrillas. In the battle of Contreras he was severely hurt by the falling of his horse, but continued during the day at the head of his brigade. In the battle of Churubusco, while leading his men against

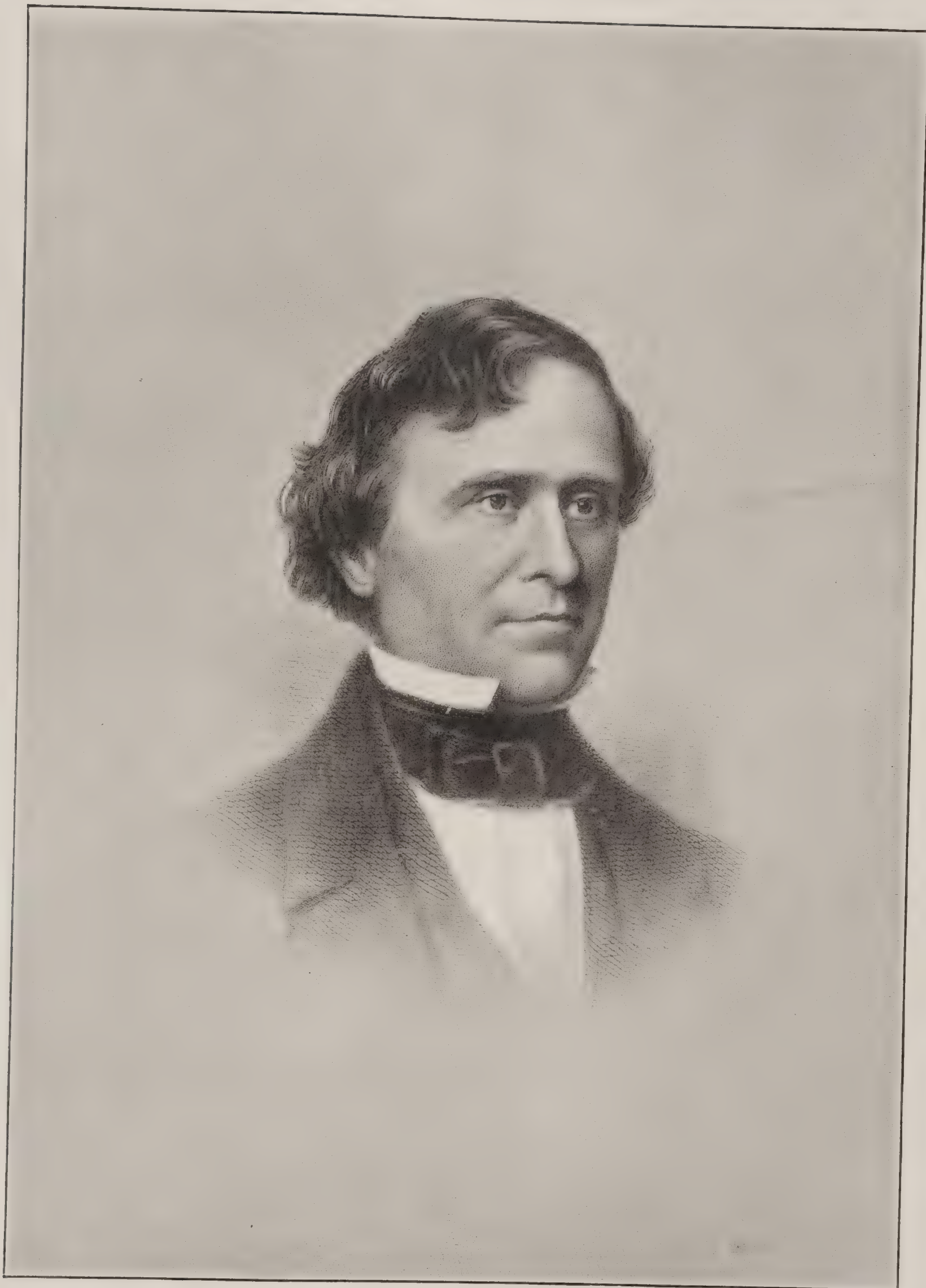
the enemy, he fell fainting from the pain of his injuries, but refused to quit the field. He was also present at the battles of Molino del Rey and Chapultepec, and remained till December in the City of Mexico, after its capitulation.

In 1850 he was elected a member of the convention to revise the State Constitution of New Hampshire and was chosen president of the convention by an almost unanimous vote; in this position he exerted himself to procure the removal from the constitution of the tests by which Catholics were excluded from certain offices, and the abolition of property qualifications. In the Democratic National Convention of 1852 he was nominated for the Presidency on the 49th ballot, and in November was elected President of the United States, receiving 254 electoral votes. His selection of his cabinet officers was eminently wise, and no change was made in the cabinet while he was President. Among the more important events of his administration were the Gadsden Purchase (q.v.), the publication of the Ostend Manifesto (q.v.), the settlement of the boundary dispute with Mexico, the signing of treaties with Japan and Great Britain, the bombardment of Greytown, Nicaragua, and Walker's filibustering expedition to Nicaragua; bills providing for the reorganization of the consular and diplomatic service, and for the organization of the court of claims were also passed and signed by the President. The passage of the Kansas-Nebraska bill, repealing the Missouri Compromise, outranked in importance all other events in Pierce's administration; it resulted in constant strife between free-State and slavery elements in Kansas, and in corresponding ill-feeling and discord between the North and South. (See KANSAS; KANSAS-NEBRASKA BILL.) Pierce approved and gave his support to the Kansas-Nebraska bill, and used his influence in favor of the pro-slavery forces; his special message to Congress in 1856 represented the formation of a free-State government in Kansas as an act of rebellion. His attitude in this matter roused considerable opposition in the North, and alienated from him the support of a considerable element, especially in New England. In 1856 he was again a candidate for the Presidency, but did not obtain the nomination, though receiving a large vote on the first ballot. At the close of his administration he traveled extensively in Europe, returning in 1860. He took no further active part in politics, but in April 1861 made a speech to a mass meeting at Concord, N. H., in which he declared himself in favor of the Union against the Southern Confederacy, and urged the people to give to the national administration a cordial and vigorous support.

Consult: Bartlett, 'The Life of Pierce' (1852); Hawthorne, 'Life of Franklin Pierce' (1852); Carroll, 'Review of Pierce's Administration' (1856); Irelan, 'History of the Life, Administration and Times of Franklin Pierce' (1888); Stoddard, 'Franklin Pierce' (in his 'Lives of the Presidents,' 1888).

**Pierce, George Foster**, American Methodist bishop, son of Lovick Pierce (q.v.): b. Greene County, Ga., 3 Feb. 1811; d. near Sparta, Ga., 3 Sept. 1884. He was graduated from Franklin College, Athens, Ga., in 1829, and entered the ministry in 1831. He attained great





FRANKLIN PIERCE,  
FOURTEENTH PRESIDENT OF THE UNITED STATES.







## PIERCE — PIERREPONT

popularity as a preacher, was president of the Georgia Female Seminary, Macon, Ga., in 1839-42, of Emory College, Oxford, Ga., in 1849-54, and was elected bishop in the latter year. He was a member of the convention which met at Louisville, Ky., in 1846, and organized the Methodist Episcopal Church, South, and was prominently connected with it until his death. Consult 'Life' by George G. Smith (1888).

**Pierce, Lovick**, American Methodist clergyman: b. Halifax County, N. C., 17 March 1785; d. Sparta, Ga., 9 Nov. 1879. He entered the Georgia Conference in 1805, was chaplain in the army in the War of 1812, and afterward studied medicine, which he practised until 1821, when he re-entered the ministry. He was prominently connected with the organization of the Methodist Episcopal Church, South, in 1846, and was famous for pulpit eloquence.

**Pierians**, pī-ē'rī-anz, or **Pierides**, pī-ēr'ī-dēz, a name given the Muses from their birth-place, Pieria in Thessaly.

**Pier'idæ**, a large family of butterflies, of medium or large size, and chiefly white and yellow in their coloration, and represented in all parts of the world. They are distinguished from their nearest relatives, the *Papilionidæ* (q.v.), by the fact that all six legs are fully developed in both sexes; and from the *Hesperidæ* and *Lycaenidæ*, by the greater specialization of the neuuration of the wings. The widespread "cabbage-white" is a typical representative. A well-known American genus is that of the orange-tips (q.v.).

**Pierné**, pē-ār-nā, **Gabriel**, French organist and composer: b. Metz, Germany, 1863. He was graduated from the conservatory at Paris and in 1882 won the Prix de Rome; in 1890 he was appointed organist at Saint Clothilde and has since devoted much time to composition. His operas have been very successful, particularly 'Izéil' (1894).

**Piero di Casimo**, pē-ā-rō dē kā-sē-mō, Italian painter: b. Florence about 1462; d. there 1521. He was a pupil of Casimo Roselli and at times was influenced by Signorelli, Filippino and Leonardo da Vinci. He devoted himself to landscape backgrounds, which were always ably executed, if somewhat fantastic in character. This feature is especially notable in his 'Death of Procris' (National Gallery, London). His pictures are somewhat rare, though the galleries of Florence, Rome, Paris and London possess several specimens.

**Piero Della Francesca**. See FRANCESCA, PIERO DELLA.

**Pierola**, pē-ā-rō'lā, **Nicholas de**, Peruvian politician: b. Camana, Peru, 5 Jan. 1839. He was educated in the college of Santo Toribio in Lima, admitted to the bar in 1860 and was connected with various journalistic enterprises. In 1869-72 he was minister of finance under President Balta. Impeached under the administration of Pardo, he came to the United States, though acquitted, and interested himself in revolutionary schemes. At the outbreak of the war between Chile and Peru his services were accepted by President Pardo and he returned to Peru in 1879. Upon the flight of Pardo he headed a revolt against the government, but was defeated. In 1885 he was banished for attempting to seize

the presidency, but in 1894 headed a revolt which succeeded in overthrowing President Cáceres. Pierola was thereupon elected president and served until the end of his term in 1899.

**Pierpont**, pēr'pönt, **Francis Harrison**, American politician: b. Monongalia County, Va. (now West Virginia), 1815; d. Pittsburg, Pa., 24 March 1899. He was graduated from Allegheny College, Meadville, Pa., in 1839, was admitted to the bar and established a law practice in Fairmount, Va., where he soon became widely known. He was a staunch Whig and Abolitionist and at the outbreak of the Civil War remained loyal to the Union, organized the convention which decided that the western part of Virginia should remain in the Union and was elected governor of the "Restored Government of Virginia." He was recognized by President Lincoln, authorized to raise troops for home protection and after serving two years of the unexpired term was re-elected for a term of four years. After the organization of West Virginia as a State and her admission into the Union Governor Pierpont removed his capital to Alexandria and after the evacuation of Richmond transferred the government to that city, where he continued as governor of the loyal section of the State until 1868. In 1868-70 he served in the legislature and afterward lived in retirement until appointed internal revenue collector by President Garfield.

**Pierpont, John**, American Unitarian clergyman and poet: b. Litchfield, Conn., 6 April 1785; d. Medford, Mass., 27 Aug. 1866. He was graduated from Yale in 1804, studied law at Litchfield and after admission to the bar of Essex County, Mass., practised for a short time at Newburyport. Later he studied theology and in 1819 was ordained pastor of the Hollis Street Church in Boston. His outspoken views on temperance, anti-slavery, and other reforms occasioned his dismissal from the parish in 1845, and he was subsequently pastor of Unitarian churches at Troy, N. Y., and Medford, Mass. His 'Airs of Palestine,' first issued in 1816, was republished in a volume entitled 'Airs of Palestine, and Other Poems' (1840). He also published 'Anti-Slavery Poems' (1843). One of his best-known poems is 'Warren's Address at the Battle of Bunker Hill', and the pathetic lines on the death of his son are still remembered.

**Pierpoudre Court**. See PIEPOWDER COURT.

**Pierre**, pē-ār', S. Dak., city, capital of the State, county-seat of Hughes County; on the Missouri River, and on the Chicago & N. W. R.R.; near the central part of the State. It was settled in 1880 and incorporated in 1883. It is in an extensive farming and stock-raising region, and in a natural gas belt. Its industries are chiefly connected with farm products, natural gas, and the shipment of cattle. About 1,000 car loads of live-stock are exported each year from this city. It is the seat of a Government Indian Industrial School, it has public and parish schools, a public library, and Saint Mary's Hospital. The city owns and operates the gas plant, electric-light plant, and waterworks. Pop. (1890) 3,233; (1900) 2,306.

**Pierrepont**, pēr'pönt, **Edwards**, American jurist and diplomat: b. New Haven, Conn., 4 March 1817; d. New York 6 March 1892. He



## PIERROT — PIETISM

was graduated from Yale in 1837, admitted to the bar in 1840, established a law practice in Cincinnati, Ohio, where he remained until 1845, when he removed to New York. In 1847 he was elected judge of the superior court of New York, resigning in 1860. In 1862 he was appointed by President Lincoln to conduct with John A. Dix the trials of the prisoners of State, and in 1864 actively supported Lincoln in the Presidential campaign. He was prosecutor for the government of John H. Surratt, indicted for complicity in the assassination of Lincoln, and in 1869-70 was United States district-attorney for southern New York. In 1870 he was one of the committee of 70 which fought the Tweed ring, and in 1875 became attorney-general of the United States, which office he resigned in 1876 to accept the appointment of minister to England. He resigned this post in 1878, and resumed his law practice.

**Pierrot**, pē-ā-rō', in France, one of the characters that appear in pantomime. The pierrot is a cunning and shameless poltroon, whose delight is in mischief or roguery. His dress is white, very wide, and loose, with huge buttons.

**Piers Plowman**. See LANGLANDE, WILLIAM.

**Piers Plowman's Crede**, an early English satirical alliterative poem, written about 1394. It follows in general the style of the 'Vision of Piers Plowman,' from which, as from the 'Plowman's Tale' (by the author of the 'Crede'), it should be differentiated.

**Pierson**, pēr'son, **Abraham**, American educator: b. Lynn, Mass., 1641; d. Killingworth, Conn., 7 March 1707. He was graduated from Harvard in 1668, ordained in the following year, served in charge of various pastorates, and in 1700 was one of the founders of Yale College, of which he became the first president in 1701. He remained in that office until his death in 1707.

**Pierson**, Arthur Tappan, American Presbyterian clergyman: b. New York 6 March 1839. He was graduated from Hamilton College, Clinton, N. Y., in 1857, and was a Congregational minister until 1863, when he entered the Presbyterian body. He has held many important pastorates in the United States, was pastor of the Metropolitan Tabernacle in London in 1891-3, and of Christ Church, there, in 1901-3. He has lectured on missions in the United States and in Scotland, and is author of: 'Keys to the World' (1888); 'Heart of the Gospel' (1892); 'New Acts of the Apostles' (1894); 'The Gordian Knot' (1902); 'The Keswick Convention' (1903); etc.

**Pierson**, Israel Coriell, American actuary: b. Westland, N. J., 22 Aug. 1843. He was graduated from the University of the City of New York in 1865. He is actuary of the Washington Life Insurance Company, and first vice-president of the Actuarial Society of America, of which he was secretary 1889-99.

**Pieter de Hooch** (or **Hoogh**), pē tēr dē hōh (hōg), Dutch painter: b. 1630; d. 1681. Very little is known of the life of this painter, of whom no authenticated portrait exists, and a number of contemporary Pieter de Hoochs have added confusion to the various printed accounts. His birthplace is unknown, but from documentary evidence he seems to have been

living at The Hague from 1653 to 1655, where he was employed as servant to a merchant, Justus de la Grange, and painted pictures as he had opportunity. He is recorded 20 Sept. 1655 as a member of the Painters' Guild of St. Luke at Delft. Two years later he is lost sight of, and remains in obscurity until he is found in Amsterdam in 1668. Here he came under the influence of Rembrandt, an influence of highest importance to his art. No picture of de Hooch is dated later than 1677, and it is assumed that he died shortly afterward. He is a painter of genre subjects, choosing for the most part Dutch interiors, though there exist a number of exterior scenes—scenes of cottage life outdoors, where the landscape features are ably handled. Though several of his pictures exhibit animated groups of people, he for the most part relegates the human element to a subordinate position and paints sunlight as his principal object. His reputation has increased in recent years; the English, who possess many of his best works, being earliest in showing their appreciation. His greatest works are: 'The Country House' and 'The Battery' in the Ryks Museum, Amsterdam; the 'Card Party' in the Louvre, and the 'Dutch Interior' in the National Gallery. An 'Interior' is in the Metropolitan Museum, New York, and other examples in the private collections of C. F. Yerkes of Chicago and H. O. Havemeyer, New York.

**Pietermaritzburg**, pē-tēr-mār'its-boorg, or simply **Maritzburg**, South Africa, the capital of Natal, situated on an elevated plain, 2,200 feet above sea-level, 45 miles by rail west-northwest of Durban, on the river Umsindusi, a tributary of the Umgeni. It is a thriving and pleasant town, well laid out, with broad streets, many planted with trees, and lighted by gas and electricity. It contains several handsome public buildings, including the Legislative Council building, in front of which is a white marble statue of Queen Victoria. Pietermaritzburg is the seat of an Anglican bishopric, and among its churches are two cathedrals. Its educational institutions include a library, a small museum, Maritzburg College, and several public schools, an Anglican college for girls, and a Roman Catholic convent. The town has several reserves for recreation purposes, the chief being Alexandra Park. The Botanic Gardens are situated a short distance from the town. The extensive waterworks cost about \$300,000. Fort Napier contains the barracks. The chief industries are the building of carts and wagons, tanning, and brewing, and there is some trade in hides, etc. Pietermaritzburg was founded by Boers in 1839, and derives its name from two Boer leaders, Pieter Retief and Gert Maritz. Pop. in 1900 (excluding military, etc.) 28,500.

**Pi'etism**, a religious movement in the Lutheran churches of Germany, which had its rise toward the end of the 17th century. Like Methodism and Methodist, Pietism and Pietist were originally terms of contempt bestowed on religious innovators by their conservative opponents. The author of the Pietist movement was Philip James Spener, a Lutheran pastor at Frankfort on the Main who in 1670 began to hold private conferences in his own house with devoutly inclined people, in which the Scriptures were explained with a view solely to the



## PIETISTS — PIGEON

promotion of inward piety instead of the inculcation of dogmatic beliefs. In a book entitled 'Pia Desideria' (1675) he sought to bring the Lutheran Church back to its original principles. That church, the foundation principle of which was, for Luther, Christian faith in the heart and acceptance of the Scriptures as the supreme rule of life and belief, had become a creed-bound institution with an inflexible system. In the pulpits the dogmas of the creeds were continually expounded and defended, while the Bible was made of no account by preachers and pastors, in the theological schools or in the family. The true pastoral work of the Christian ministry, that of forwarding the moral and spiritual welfare of the people was in desuetude. To remedy these evils Spener proposed in his work: 1, Cultivation of devout study of the Scriptures in private meetings; 2, Recognition of the Christian priesthood of all the faithful by giving to the laity a share in the government of the Church; 3, Insistence, in pulpit discourse, upon the necessity of vital personal piety; 4, Kindly persuasion instead of polemic bitterness in dealing with heretics and unbelievers; 5, Making theological seminaries schools of personal piety no less than of doctrine; 6, Banishing from the pulpit the tricks of rhetoric and substituting heart-to-heart hortation to Christian faith and love. The book made a deep impression throughout Germany among the devout laity and the more earnest clergy. Spener was the same year appointed court chaplain at Dresden, and in that station was the means of bringing about a reformation of the system of catechetical instruction throughout Saxony. In the Leipsic University some of the students and docents of the theological school formed themselves into a society for study of the Scriptures both intellectual and devotional, and those among them who were the more advanced conducted courses of practical exposition and application of the sacred text, to which students and townspeople resorted eagerly, so that the Church authorities were alarmed and the lectures were suppressed by the government. The young theologians thereupon left the university and the city and entered the new university just founded at Halle by friends of the new movement; thereafter Halle was the chief centre of Pietism. Like most other reformatory movements whether in church or state, its aims were from first to last condemned as impious or as seditious, but one by one they were adopted by their antagonists; Pietism as an organized movement subsisted till the middle of the 18th century; its monument was a state church reformed in nearly every particular in accordance with Spener's programme.

**Pi'etists.** See RELIGIOUS SECTS.

**Pietra Dura**, pē-ā'trā doo'rā, a kind of mosaic executed in Italy, and especially at Florence, in hard stones, such as topazes, garnets, carnelians, rubies, etc. Inferior kinds, in which imitation stones are used, are largely made in England.

**Piezom'eter**, an instrument for measuring the compression of water and other liquids under pressure. The pressure is gauged by the manometer, and the amount of compression indicated by mercury in a glass tube.

**Pig.** See SWINE.

**Pig-iron.** See IRON AND STEEL INDUSTRY IN AMERICA.

**Pigafetta**, pē-gä-fēt'tä, (**Francesco**) **Antonio**, Italian explorer and historian: b. Vicenza, Italy, 1491; d. there about 1535. He accompanied Magellan on his voyage round the world in 1519-23, and wrote the journal which constitutes the only history of the voyage which remains, as that written by D'Anghiera was destroyed during the storming of Rome in 1527. The first complete edition of this valuable work was published under the title 'Primo Viaggio intorno al Globo Terracqueo' (1800).

**Pigeon**, a general name applied to any species of bird of the family *Columbidæ*, or collectively to the entire group, or in an even wider sense to the whole order *Columbæ*. No sharp distinction can be drawn between the usage of the words dove and pigeon for birds of this group; though in a general way the former is applied to the smaller and more delicate, the latter to larger and more robust forms. In the articles COLUMBÆ and COLUMBIDÆ will be found some account of the characteristics, distribution, and chief groups of the pigeons, and under DOVE descriptions of a few representatives of the smaller wild species. This article will be confined to a discussion of the origin, varieties, and care of the domestic pigeons, and a brief account of a few of the native wild species to which the name "pigeon" most properly applies. Accepting the conclusions of Darwin, who investigated the subject extensively, ornithologists and fanciers trace the origin of all the numerous varieties of domestic pigeons to the common rock-pigeon (*Columba livia*) of Europe and North Africa. The ease with which many wild species of pigeons hybridize and produce fertile offspring is, however, well known; and there is much reason to believe that the strain of the domestic pigeons is not entirely pure, but has been mixed from time to time with certain Asiatic species, and especially with such true rock-pigeons as *C. leuconota* and *C. intermedia*. However, all of these forms are very closely related, differing in little besides color; and there is no reason to doubt that *C. livia* is the predominant ancestral species.

Many individuals of the common dovescot pigeon—those of a grayish-blue color with white lower backs and two black wing-bars—very closely resemble the wild rock-pigeon. In the wild state the rock-pigeon inhabits the rocky sea coasts and neighboring islands of Europe and North Africa, but is rare inland; though in many places flocks of domestic pigeons have reverted to the feral state and have re-acquired most of the characteristics of their wild ancestors. Indeed, several of the so-called species found in various parts of Europe, Asia, and Egypt, are considered by Darwin to have thus originated. Like their domesticated descendants, wild rock-pigeons are gregarious and live in communities among the caves and fissures of inaccessible cliffs, where they associate with cormorants and other sea-birds. In the early morning they fly in flocks to the cultivated districts for the purpose of feeding upon grains and seeds. They also relish snails, insects, and fruits. Except when with young, whose needs force them to return to the nesting site more frequently, they remain in the fields throughout



## PIGEON

the day. These pigeons are little, if at all, migratory, and during the winter congregate in larger flocks which search the farming districts for food. About April a simple nest of grass and twigs is constructed on a rock-ledge, and two eggs are laid. After the young are able to leave the nest a second, and perhaps a third, pair is raised. They are strictly monogamous, and are said to mate for life. In movements, voice, and other ordinary habits they resemble the common domestic pigeon.

Rock-pigeons take very kindly to domestication, and they, and perhaps closely related species, have been confined and bred for an memorable period, not alone because of the very excellent quality of their flesh as food, but also as carriers of messages, and because of the interest attached to the remarkable and numerous varieties to which they give origin. It is, however, probable that pigeons were first domesticated solely for the purpose of supplying the table; at least the earliest known record, more than 3000 B.C., signifies their use for this purpose by the Egyptians. Several hundred distinct varieties, of which about 150 are named and recognized by fanciers, have been produced under domestication, some of them differing but little, others to a marvelous degree, from the wild stock; many, indeed, are almost monstrous. Concerning the origin of many of the principal types of domestic pigeons, very little is known historically. Some of them, as the carriers or homing-pigeons, are certainly very ancient, and the Romans, who valued pigeons highly, had many races, the pedigrees of which were carefully recorded. Darwin based his conclusion that all this multitude of divergent forms could be traced back to a common ancestry in the rock-pigeon not only on the well-known facts of the ease with which the rock-pigeon can be domesticated, the resemblance in appearance, habits, and voice between the common domestic pigeon and the wild rock-dove, and the geographical distribution of the latter, but also upon a most painstaking anatomical study of many varieties and of the facts of breeding and reversion. He noticed that triple crosses between distinct varieties of no matter what color, were very likely to produce in the third generation a color pattern precisely like that of the wild race. The remarkable persistence of the white wings, which breeders find to be one of the most difficult features to breed out of fancy-colored strains, points to *C. livia*, of which this feature is a characteristic. Darwin's views have been generally accepted, as has his classification of the numerous varieties. Four principal groups are recognized: (1) The pouters, forming a very distinct race especially characterized by the enormously enlarged inflatable œsophagus and crop; (2) a group in which the beak is generally long (short in the barbs), the skin about the eyes and the base of the beak is rough, swollen, and wattled, and the feet are large; in this group are included the various kinds of carriers, dragons, runts, and barbs; (3) a group in which the beak is short and the naked skin about the eyes but little developed; Darwin considers this an artificial group, and includes in it the fantails, owls, and turbits, tumblers, frill-backs, and jacobins, each representing a well-marked sub-group; (4) this group includes a great number of races more or

less closely resembling the rock-pigeon, from which they have departed much less widely, and are consequently less highly valued by fanciers, than the more strikingly modified races of the preceding groups. Among those which Darwin considers as belonging here are the trumpeters, laughers, nuns, spots, swallows, and common dovecot pigeons, of which the latter stands nearest to the ancestral type. Next to the pouter the fantail is the most extreme modification, for its tail contains up to 36 or even 42 quill feathers, in place of the 12 originally present.

Concerning the care of pigeons a few general principles may be stated and the novice will avoid many difficulties by recalling the habits of the wild birds and not running counter to nature. In domestication a dovecot or loft is substituted for the rocky caverns of their native isles, but pigeons should have as much freedom as possible, with plenty of fresh air, light, clean food, and water, and a clean and roomy shelter from the extremes of weather. Dirty, crowded quarters engender parasites; sour food and lack of air and light cause various diseases; lack of suitable shelter from the weather proves especially fatal to the young birds and nestlings. If possible, pigeons should be given the utmost freedom to fly and return at will; but, if for any reason this is inexpedient, a large flying-cage in the open air should be provided. The gregarious instinct is so strong in pigeons that birds continually desert a small flock in order to join a large one in the same neighborhood. For housing pigeons the loft is preferable to the cot or small house, for very many reasons. It should be a large, airy, well-lighted room, with suitable means for the ingress and egress of the pigeons, and capable of being divided in order to permit of the separation of the different races and sexes when desired. Easily cleaned nesting and roosting boxes may be arranged in shelves on the walls, and during the breeding period should be provided with nesting saucers or pans, some clean, soft hay, and kept scrupulously clean. Pigeons do not dust; but are very fond of bathing, for which ample facilities should always be provided. The food best adapted to the hardier is not always suitable to the more delicate varieties, which require a more dainty diet; but in general crushed Indian corn, wheat, peas, and beans are the staples, the legumes especially for breeding birds. If they have no opportunity to fly in search of insects and snails a few of these or of earthworms should be occasionally added. A little salt, an abundance of ground oyster-shells or other calcareous material, gravel, and drinking water are required. For the special requirements of the fancy varieties reference must be made to some of the special works on pigeon breeding.

Besides the fancy varieties raised in the United States, great numbers of the common sorts are bred for use at shooting-matches and for table consumption in the form of squabs. Most of the supply comes from the small lofts owned by numerous farmers and stablemen; but in a few places the business has been entered upon on a more extensive scale. Perhaps the largest establishment for the exclusive purpose of raising squabs for the market is located near Los Angeles, Cal. This ranch occupies



# DOMESTIC PIGEONS



1. Blue-rock. 2. Drummer-pigeon of Bachara. 3. German Drummer-pigeon. 4. Curly-pigeon. 5. Ruff or Capuchin. 6. German Tumbler. 7. Nun. 8. Almond. 9. Bearded-tumbler. 10. Jacobin. 11. Egyptian Turbit. 12. Chinese Turbit. 13. German Turbit. 14, 15. Fantails. 16. English Pouter. 17. French Pouter. 18. Brown Pouter. 19. Carrier or Homing-pigeon. 20. German Carrier. 21. Cyprian Pigeon. 22. Italian Pigeon. 23, 24. Belgian Carriers.







## PIGEON-BERRY — PIGLHEIN

about eight acres of sandy, well-watered land, and, besides other buildings, has a nesting-house containing between 5,000 and 6,000 nests so arranged that they can be easily cleaned and fumigated, the last operation being performed weekly. About 15,000 breeding-birds are on hand, producing annually about 40,000 squabs, which sell for about \$10,000, or on an average \$3.00 per dozen. The annual cost of food is about \$5,500.

Besides many species known as doves, four species popularly designated as pigeons occur in the United States. Three of these belong to the typical genus *Columba*, to which the rock-pigeon belongs. These are the band-tailed pigeon (*C. fasciata*) of the Rocky Mountain and Pacific region, with a distinct sub-species in Lower California; the red-billed pigeon (*C. flavirostris*) from Arizona southward, and the white-crowned pigeon (*C. leucocephala*) of Florida and the West Indies. They all differ greatly from the rock-pigeon in habits, being wood-pigeons, which build their nests in trees and bushes, among whose branches they largely live, though they feed upon the ground on acorns, nuts, seeds, etc. They lay two eggs, like most pigeons, and are gregarious, the first especially often collecting in great flocks. From all of these the famous passenger pigeon (*Ectopistes migratorius*) is distinguishable at a glance by its long tail composed of 12 slender, tapering feathers. It is a large bird, having a total length of 16 to 18 inches and, with its graceful form and beautiful metallic tints, is a bird of impressive appearance. This bird has no fixed abode, but wanders widely in great flocks in search of food. Formerly it ranged throughout North America east of the Rocky Mountains and occasionally pushed even to the shores of the Pacific. It was most abundant, however, east of the Great Plains and in temperate regions. At the present time it has practically disappeared from most of this region and is now found in any numbers only in the upper Mississippi Valley and the borderland between the United States and Canada. See PASSENGER PIGEON.

Consult: Darwin, 'Animals and Plants Under Domestication' (New York, 1868); Tegetmeier, 'Pigeons' (London 1868); Salvadori, 'Pigeons of the British Museum' (London, 1893); Evans, 'Birds' (New York, 1900). See HOMING PIGEONS, and the names of various groups and species.

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**Pigeon-berry, or Ink-berry.** See POKE-WEED.

**Pigeon English.** See PIDGIN.

**Pigeon Hawk,** a small falcon (*Falco columbarius*), distributed throughout the northern hemisphere. There are more than a dozen species scattered over the world, the two most common being the European representatives Hobby and Merlin; they prefer wooded cultivated districts, and usually follow in the train of the small migratory birds on which they prey; the flight is rapid and long sustained; the nest is made on trees or among rocks, and the eggs are from 3 to 5. The American pigeon hawk is 12 to 14 inches long and about 25 in alar extent; the male smaller.

The general color is bluish slate, every feather with a longitudinal black line; forehead and throat white; below pale yellowish or reddish white, each feather with a longitudinal line of brownish black; the tibiae are light ferruginous, with black lines; quills black, with ashy white tips; tail light bluish ash, tipped with white, with a wide subterminal black band and several narrower bands of the same; cere and legs yellow, and bill bluish; the variations in plumage, according to age and locality, are considerable. It is found over all temperate North America, Central, and the northern part of South America, and breeds in the north. It is the boldest of any hawk of its size, pouncing on thrushes, wild pigeons, woodpeckers, snipe, and even teals, but preying chiefly on birds of the size of the red-winged blackbird and sora rail. It rarely attacks poultry, yet has been known to seize cage-birds hung in the porches of houses even in crowded cities. The nest, placed in some thickly foliated tree, is coarsely constructed of sticks and mosses, resembling that of a crow; the eggs measure about  $1\frac{3}{4}$  by  $1\frac{1}{2}$  inches, and are nearly spherical; the color is not a very clear white, and there are a few bold irregular dashes of light yellowish brown, chiefly about the smaller end.

The pigeon hawk, says Stejneger, is very closely allied to, if not identical with, the European merlin (*F. lithofalco*); these two forms, with the East Indian turumti (*F. chiquera*), and its South African race (*F. ruficollis*), are frequently regarded as a separate genus *Æsalon*. See Newton, 'Dictionary of Birds' (1896); Fisher, 'Hawks and Owls of North America' (1893).

**Pigeon-pea,** the fruit of the leguminous shrub *Cajanus indicus*, a native of India, but now cultivated in tropical Africa and the West Indies. There are two varieties, distinguished as *bicolor* and *flavus*. The former reaches a height of from three to six feet, and has yellow flowers with crimson markings; the latter is larger, sometimes attaining a height of 10 feet, and its flowers are of a uniform yellow color. In India the pigeon-pea forms a pulse of general use. The former variety is called also Angola pea and Kongo pea.

**Pigeon Shooting.** See TRAP SHOOTING.

**Pigeon Woodpecker,** the flicker. See WOODPECKER.

**Piglhein,** pēg'l-hīn, **Bruno,** German painter: b. Hamburg 19 Feb. 1848; d. Munich 15 July 1894. He began his study of painting in the studio of Lippelt in Hamburg. Going to Dresden in 1864 he attached himself to Schilling, with the idea of becoming a sculptor, but in 1870 returned to painting, which he studied under Pauwels in Weimar, and in Munich under W. Diez. The series of decorative works and mythological genres which he soon afterward produced show the influence of Böcklin (q.v.) and Makart. He first became widely known by his 'Moritur in Deo' (the dying Christ supported by an angel), now in the Berlin National Gallery. He then executed a series of drawings in pastel,—busts, heads, and half-lengths of ladies of fashion, rakes, dandies, and children,—which appeared at Munich (1884) under the title 'Douze Pastels.' His genre pictures of child life are well known through the reproduc-



## PIGMENTS — PIKE

tions of his illustrations to the idyll 'Kind mit Hund.' In 1885 he undertook a journey to Palestine with the object of collecting materials for a panorama of 'the Crucifixion,' which he completed with the assistance of several other artists and exhibited in 1886. It was afterward reproduced in wood cuts 1887, but the original was destroyed by fire at Vienna (1892).

**Pigments, Animal.** See COLORATION OF ANIMALS.

**Pigmy.** See PYGMIES.

**Pignuts.** See HICKORY.

**Pig'ot, Sir Robert,** British soldier: b. Patshull, Staffordshire, 1720; d. there 2 Aug. 1796. Entering the army as a boy, he served at Fontenoy, was colonel in 1772, accompanied the 38th foot to Massachusetts, fought at Lexington 19 April 1775, and 17 June commanded the British left at Bunker Hill, becoming colonel of the regiment in December of the same year and major-general in 1777. He was stationed in Rhode Island in the next year, and in 1782 became lieutenant-general. In 1778 he succeeded his brother as baronet and became part owner of the Pigot diamond, brought by his brother from India; it was raffled for in 1800, the receipts being nearly £24,000, and in 1802 was sold for £30,000 to Ali Pasha, who had it ground to powder in 1822, when he was mortally wounded by Reshid Pasha.

**Pigris,** a Greek poet, brother of Artemisia, queen of Caria (352-350 B.C.). Modern critics assign to him the authorship of the famous mock epic, *Βατραχομυομαχία*, 'The Battle of the Frogs and Mice,' a work formerly accredited to Homer.

**Pigweed.** See GOOSEFOOT.

**Pi'ka,** a small animal of the higher mountains of the northern hemisphere, representing the family *Lagomyidæ*, and closely allied to the hares, of which it seems a degenerate branch. The pikas differ from the hares in their much smaller size, in the nearly equal length of the fore and hind legs, in the short, rounded ears, the very small size or absence of the tail, and in the possession of nearly complete clavicles or collar-bones. In their most southern distribution they inhabit the mountainous districts and highlands, well-known species being numerous on the mountain tops of the European Alps, in the Himalayas and in the Rocky Mountains. They are never seen below timber-line, but are found far above it, in Ladak to the altitude of 16,000 feet. They dwell in underground burrows, or among the loose fallen rocks of a slide or cliff-talus, where large communities occupy favorable places. To this they owe the name "coney," commonly given to *Lagomus princeps*, the best known American species, which the Indians called "little chief." The European name, "calling" or "piping" hare, refers to the shrill, piping bark. They feed upon herbage during the summer, and in the early autumn cut and dry a great quantity of this, which they take into their deep burrows as provender for the winter. Their fur is exceedingly warm and close, and was utilized by the American Indians as material for underclothing, infants' garments, etc. About 16 species are known. Consult: Blanford, 'Fauna of British India Mammals' (1888); Stone and Cram, 'American Mammals' (1902).

**Pike, Albert,** American author and lawyer: b. Boston, Mass., 29 Dec. 1809; d. Washington, D. C., 2 April 1891. He was educated at Harvard, engaged in teaching, in 1831 accompanied an expedition to Santa Fé, afterward exploring the head-waters of the Red and Brazos rivers, and in December 1832 settled at Fort Smith, Ark. He edited the Arkansas 'Advocate' in 1833-6, was admitted to the bar and engaged in law practice. In the Mexican War he commanded a squadron, fought at Buena Vista, received the surrender of Mapimi in 1847, and during the Civil War was Indian commissioner of the Confederate government, and later brigadier-general. After the war he practised in Memphis and in Washington, edited the Memphis 'Appeal' in 1867-8, and engaged in literary work. His 'Hymns to the Gods,' published in Blackwood's Magazine in 1839, gained for him a reputation as a poet, and besides 30 volumes of Masonic works he published 'Prose Sketches and Poems' (1834).

**Pike, Robert,** English colonist in America: b. England 1616; d. Salisbury, Mass., 1706. He came to America in 1625, from 1629 resided on a farm at Salisbury, Mass., and from 1644 until his death held public office in the colony. He is distinguished for his liberal attitude on various questions of colonial interest. Thus, though a believer in witchcraft, he opposed the admission in court of "spectre" testimony; and though a strictly orthodox Puritan, defended the Quakers, and censured the general court for its position in the matter. In these questions he appears as one of the earliest exponents in America of the sentiment toward free speech, criticism, and petition of legislative assemblies, and acquittal in courts of law in default of sufficiently conclusive evidence.

**Pike, Zebulon Montgomery,** American soldier and explorer: b. Lambertton, N. J., 5 Feb. 1779; d. York (Toronto), Canada, 27 April 1813. He was the son of an army officer, into whose company he volunteered, serving as a cadet when only 15, and becoming a first lieutenant six years later. In 1805 after the Louisiana Purchase he was ordered to trace the upper course of the Missouri, and with 20 men spent nearly nine months on the dangerous voyage to Red Cedar Lake. Immediately upon his return he was commissioned by Gen. Wilkinson to lead a party through the centre of the Purchase. This expedition was overtaken by winter and the party, while on the banks of what they thought the Red River, was arrested by the Spanish authorities, who later released all members of the expedition. Before his arrest Pike had discovered "Pikes Peak" and had explored the country around Leadville. He arrived at Natchitoches 1 July 1807, was warmly thanked by his superiors, and was rapidly promoted. In 1812 he was stationed on the frontier, and in the next year, having become a brigadier, led the attack on York, Canada. The magazine of the fort exploded during the assault and Pike was killed by a flying stone. The fort surrendered just before he died.

**Pike,** a weapon much used in the Middle Ages as an arm for infantry, and still sometimes used by irregular and hastily armed troops. It was from 16 to 18 feet long, and consisted of a pole with an iron point. (See LANCE.) Men



## PIKE — PIKES PEAK

armed with it were called pike-men. After the invention of guns pikes gradually fell into disuse. The Prussian Landsturm was armed with pikes in 1813, to be used in case no better arms were to be had. The Swiss first substituted the halbert for the pike toward the 15th century. For some time every company in the armies of Europe consisted of at least two thirds pike-men. In the United States during the John Brown (q.v.) insurrection at Harper's Ferry, Va., Brown's followers were armed with pikes as well as muskets.

**Pike, Pickerel**, fresh-water, ravenous fishes of the family *Luciidae* or *Esocidae*. They are teleostomous fishes, forming, with the mud-minnows, cyprinodonts and blind fishes, the order *Haplomi*. In the pikes the body is lengthened, flattened on the back, and tapers abruptly toward the tail. One dorsal fin exists, placed far back on the body, and opposite the anal fin. The mouth is very large and lower jaw projects, the biting edge of the upper jaw being formed by the maxillary and premaxillary bones. Teeth are present in plentiful array, and are borne by almost every bone entering into the composition of the mouth as well as small ones upon the tongue. They are very sharp and of various sizes, the larger ones having a hinge-like attachment, by means of a ligament, to the bones. The body is clothed with small cycloid scales, or those of a simple rounded variety. There is a single genus (*Lucius*) with five species, four of which are confined to North America, the fifth being found in Europe and Asia also. The common pike (*Lucius lucius*) occurs in the rivers of Europe, northern Asia, and North America. Pikes are the tyrants of their sphere, being the most voracious of fresh-water fishes. They feed upon smaller fishes, upon frogs, muskrats, and other animals; and young ducks and other aquatic birds have been known to be dragged below the water and devoured by these fishes. Perches and sunfish are said to escape the pike's attack owing to the presence of their spiny dorsal fins. When fully grown the pike may ordinarily attain a length of four feet, and there are instances on record in which these fishes have greatly exceeded that length. For example, the monster pike caught at Kaiserslautern, near Mannheim, in Swabia, in 1497, which is said to have measured 19 feet, and weighed 350 pounds. This same pike had attached to it a copper ring, on which an inscription stated that the fish had been placed in the water by the Emperor Frederick II. on 5 Oct. 1230. This date made the fish at the date of its capture at least 267 years old. This story was told by Gesner and has never been verified.

In America no such colossal pike has been recorded. With us this species ranges from the Ohio River and southern New York to Alaska and Greenland, and is especially abundant in the lakes and rivers of British America. It prefers quiet waters; and remains for long periods suspended perfectly stationary in the water, but, when its prey approaches, darts upon it with the utmost suddenness and the speed of an arrow. Throughout the year, except in the spring when they consort in pairs, the pike leads a solitary life; 100,000 to 500,000 eggs are deposited from April to May, according to the latitude. No nest is made, and the non-adhesive eggs sink to the bottom. The muskellonge or

muscalonge is a still larger species, often attaining a length of five to eight feet and a weight of 100 pounds or more. It may be quickly distinguished from the pike, with which it is often confused, by the absence of scales from the lower part of the cheeks and the greater number of rays in the fins. It is found in the Great Lakes and other large bodies of water in that general region and northward. Being a pike on a large scale, its habits closely resemble those just described for that species. It prefers the deeper waters, resting among plants near the bottom and is a most formidable enemy of all living creatures inhabiting the same waters.

The name "pickerel" is the diminutive of pike and is employed to designate all of the small species as well as the young of the larger. The species to which this name is especially applied are the banded pickerel (*L. americanus*), which seldom exceeds twelve inches, and is found in lowland streams of the Atlantic watershed from New England to Florida; the western pickerel (*L. vermiculatus*), a similar species of the Mississippi Valley; and the common pickerel, pike, or jack (*L. reticulatus*) of the entire eastern United States. The last named attains a length of two feet and is common everywhere, being especially abundant in clear lakes, where it reaches the largest size.

All of these are most excellent table fishes. The dash with which they take the hook, and the vigor and determination with which they fight for liberty makes them great favorites with sportsmen, though their destructiveness to other game fishes has gained them many enemies. The larger species, and especially the muskellonge, are usually taken by trolling, a copper wire line being used when they seek the depths of the lakes. The smaller ones may be taken with a light tackle, the chief precaution being to provide against the severance of the line by their sharp teeth. Live minnows or small frogs are tempting baits.

The name pike is also used for several other quite unrelated fishes which present some resemblance to the pikes in their elongated forms. Among these may be mentioned the gar pikes (*Lepidosteus*) and the sea pike or silver gar (*Tylosurus*). Consult: Henshall, 'Bass, Pike, Perch and Others' (New York 1903); and Cholmondeley-Pennell, 'Book of the Pike' (1890).

**Pike-perch**, a fish closely allied to the perch, but showing a resemblance to the pike in the elongated body and head. The American pike-perches belong to the genus *Stizostedion*, which differs from the European *Lucioperca* in the weaker development of the fin spines. From the true perches the pike-perches are easily distinguished by the elongated head and the presence of canine teeth on the jaws. The most important species is *G. vitreum*, which bears a large number of local names, but is best known as the wall-eyed pike (q.v.). The chief European species is *L. sandra*, which attains a length of three or four feet, and weighs 25 or 30 pounds.

**Pikes Peak**, in Colorado, a peak of the Rocky Mountains, lat. 39° N., lon. 105° W.; height is over 14,000 feet above sea-level. Gen. Z. M. Pike, of the United States army, discovered this mountain in 1806. In ascending the mountain the transition is abrupt from pine



## PILASTER — PILCOMAYO

forests, which cover the sides up to nearly 12,000 feet in height, to bare granite rocks with here and there tufts of sage grass in the crevices and at the summit, fringing the snow fields, plants with pale yellow and delicate purple blossoms. Two gorges extend from the top almost to the base. The summit is nearly level, with an area of about 60 acres. From the top may be seen a view of unsurpassed magnificence and grandeur; for fully 100 miles in all directions is a vast expanse of mountains and valleys, dotted with sparkling lakes and rivers. From 1873 to 1888 the United States Signal Service had here a meteorological station. The Weather Bureau established a station here in 1892. In 1891 a rack and pinion road was opened to the summit. The name Pikes Peak is often applied to the gold region in the vicinity of the mountain.

**Pilas'ter**, in architecture, a square column, generally attached to a wall, as an ornamental support to an arch, etc., and seldom projecting more than one fourth or one third of its breadth from the wall.

**Pilate**, pī'lat, **Pontius** (PONTIUS PILATUS), the Roman governor (procurator) of Judæa, Samaria and Idumea at the time of Christ's crucifixion: he held that station from the year 26 till he was deprived of office in 36: the capital of the district ruled by him was Cæsarea, in earlier times known as Turris Stratonis. Little or nothing 'is known regarding his history previous to his appointment as procurator. He was a man specially unfitted by temperament for the station to which he was assigned, in view of the keen animosities existing for ages between the Jews, the Samaritans and the ancient inhabitants of Philistia, and the abhorrence of the Jews for their Gentile rulers. Pilate flaunted in the face of the people of the Holy City the standards of the Roman armies with the image of Tiberius and the eagles of the legions, both of which were always saluted with religious veneration as gods; he rifled the sacred treasury (*corban*) of the temple to pay the cost of an aqueduct; he slaughtered a company of Galileans while they were engaged in an act of sacrifice; he set his troops upon a peaceable assemblage of Samaritans on Mount Gerizim, the holy place of that nation: it was this act, and not his surrendering Jesus into the hands of his enemies in violation of Roman justice and simple humanity, that led to his being deprived of office. Eusebius adds that he was banished to Vienna (Vienne) in Gaul and that he died by suicide. But legend does not treat his story so prosaically: one legend makes him die at Rome where his body, having been thrown into the Tiber, caused violent tempests and inundations: but the patrons of the Vienne tradition make Vienne and the river Rhone the theatre of these prodigies. Strangely, Tertullian holds Pilate to have been at heart a Christian (*pro sua conscientia christianus*); the Copts reckon him among the martyrs, and he has a place in the Abyssinian Church calendar. Pilate's wife, traditionally named Procla, or Claudia Procula, is venerated in the Greek Church as a saint; her day in the Greek Church calendar is 27 October.

**Pilatus**, pē-lā'toos, **Mount**, in Switzerland, a peak of the Bernese Alps, near Lake Lucern. The highest crest, Tomlishorn, is 6,998 feet

above sea-level. A rack and pinion railroad extends to the summit. The name seems to have come from the word *pila*, a pillar, hence, "pillar mountain." Some authorities claim the name comes from *mons pileatus*, "hatted mountain," from its appearance when the mists or clouds are rising. One of the numerous legends connected with the place is that it is named after Pontius Pilate, who from the top of this mountain, threw himself into a lake and was drowned. Allusion is made to this legend in Scott's work, 'Anne of Geierstein.'

**Pilau**, pī-lâ', or **Pillaf**, a food preparation common in Turkey, Egypt, Syria, and India, consisting generally of rice, thoroughly boiled, drained, and gently stirred with butter, pepper, and finely-chopped onions. For the tables of the wealthy, fowls, lamb, mutton, shreds of ham or bacon, variously cooked, but always well boiled or roasted, are placed on the top of the rice, and served with it.

**Pil'chard**, a European herring (*Clupea pilchardus*), the full-grown form of the sardine (q.v.), which closely resembles the ordinary herring but is of smaller size and straighter outlines. This species is found in greatest plenty on the southern coasts of England, the Cornwall pilchard fisheries being those best known and most celebrated. The fishery is more or less continuously carried on, but proceeds with the greatest vigor in July. Shoals of pilchards then appear, which are taken in seines in vast amounts. More than 10,000 hogsheads, each holding 3,000 fish, have been filled in a single day's fishing at one port. These fishes are salted and cured, and are then piled into great stacks, from which a valued oil exudes. They remain four weeks in these stacks, and are then washed to free them from the oil, packed in barrels, and afterward exported. The pilchards are chiefly consumed in Spain, Italy, and France during Lent and other fasting seasons.

**Pilcomayo**, pēl-kō-mī'ō, a South American river, one of the affluents of the Paraguay, rising in the Bolivian plateau east of the Andes from several small streams in the provinces of Lipez, Chichas, and Poopo. Its general course is south. It receives the Potosi and the Cachimayo; crosses the department of Potosi, Sucre and Tarija; joins the Pilaya, which drains southern Bolivia, above San Francisco Solano; and, near that mission is joined by the Chaco. Its course so far is narrow, winding, and full of rapids and cascades, and its drop has been from a height above the sea of 6,500 feet to only 1,300 feet. But on coming into the flat country it does not become a navigable river, but like many of the western rivers of the United States almost disappears in the sands and then spreads out in shallow lagoons, so that the embouchure of its main branch into the Paraguay is a forest swimming in a lake delta. Other branches join the Paraguay farther south than Asuncion, where the main branch empties. Which the main branch was, was a subject of dispute between Argentina and Paraguay, as the boundary was defined simply as being the main branch of this river. The Spanish explorers had considered it to be the Araguaí Guazu (or Río del Instituto Argentino); but a board of arbitration decided against this claim in 1878. Fishing in the river is excellent. Exploration





PIKE'S PEAK.







## PILE — PILGRIM'S PROGRESS

was begun by Father Patino in 1721. In 1882 Crevaux, a French explorer, was killed with five of his comrades by the Toba Indians.

**Pile**, (1) in engineering and building, a beam or timber driven into treacherous ground to form a foundation for a structure, or to form part of a wall. (See FOUNDATION.) Piles are named according to their structure. (2) In heraldry, one of the lesser ordinaries, triangular in form and issuing from the chief with the point downward. When borne plain it should contain one third of the chief in breadth, and if charged two thirds. (3) In electricity, a series of elements thus constituted: First, a disk of copper resting below on a wooden framework, and above in contact with a disk of cloth moistened by acidulated water or brine; above this again a disk of zinc. As frequent a repetition of this series as is desired (the disk of zinc, however, being always the highest) will constitute a more or less tall column like a pile, whence the name. The first having been planned and made by Volta, the appellation generally given is voltaic pile. Also, any instrument or mechanism for producing voltaic electricity, even though it do not take the form of a pile.

**Pile-driving.** See FOUNDATION.

**Pile-dwellings.** See LAKE-DWELLINGS.

**Piles.** See HÆMORRHOIDS.

**Pilewort**, a plant regarded as curative of piles. In Great Britain these virtues and the name belong to the celandines (q.v.), especially *C. majus*. In the United States several herbs of medicinal repute are called pileworts, such as the Maryland figwort (*Scrophularia marylandica*); the fire-weed (*Erechtites hieracifolia*), a thistle; and a crowfoot, the so-called lesser celandine (*Ficaria verna*).

**Pilgrim Compact, The.** See MAYFLOWER, THE.

**Pilgrim Fathers.** See MAYFLOWER, THE.

**Pil'grimage of Grace**, in English history, an insurrectionary movement in 1536-7, consequent upon the proceedings of Henry VIII. in regard to the church, and led in the first instance by Robert Aske, a Lincolnshire gentleman. The insurgents demanded the fall of Cromwell, redress to the church, and reunion with Rome. Mustering to the number of 30,000, they marched upon York, and within a few days were masters of England north of the Humber. Henry temporized, promising a free parliament at York; but when the insurgents returned home all concessions were revoked, and a renewal of the revolt was suppressed with great rigor. Many perished by the block, the gibbet, and the stake. See ENGLAND.

**Pilgrimages**, journeys to distant places for devotional purposes. The custom of pilgrimage is ancient and, till modern times, was universal. In ancient Egypt and Syria were privileged temples to which devotees resorted from distant parts. Pilgrimage is an important element in the religions of India. In the period of highest Grecian culture, whether in Greece itself or in Asia Minor or in Magna Græcia, the chief temples of the Hellenic gods were the resort of pilgrims in thousands; the temple of Athenē at her own city, that of Zeus at Olympus, that of Æsculapius at Epidaurus, of Hera at Samos, of Artemis at Ephesus, were

for the Greeks what the temple at Jerusalem was for the people of Israel, or what Mohammed's tomb at Mecca is for the Moslems. "We are inly stirred," says Cicero, "by the very places that bear the footprints of those we love or admire." The pilgrimages of the Jews to their holy city at the high festivals were matter of precept; in Christianity, though pilgrimages have never been commanded by the Church, the custom of pilgrimage has had a vast development, beginning probably in the first Christian age, and certainly attaining considerable proportions in the century which saw the triumph of the new religion over Roman paganism. Among the works of Saint Jerome (340-420) occur letters of his correspondents in Syria, the ladies Paula and Eustochium, in one of which the resort of numerous pilgrims to the holy places in Palestine is recorded in terms which give proof that in that day pilgrimage was a highly esteemed form of devotion, though the historical accuracy of the statement that pilgrims had flocked to the scenes of Christ's life "ever since the ascension" is open to question. "It were irksome," the lady Paula writes, "to count the bishops, the martyrs, the masters of ecclesiastical learning, who from the Lord's ascension till this day have come to Jerusalem, thinking that they would have less devotion, less knowledge; that their virtues would lack their last perfection, unless they should have worshipped Christ at the very spot where first the gospel light beamed forth from the gibbet." We learn from Saint Augustine and some of his contemporaries that the tomb of the protomartyr, Saint Stephen, attracted in his time great throngs of pilgrims. But it was in the Middle Ages that pilgrimage had greatest vogue. For some time after the Saracens had become masters of Palestine the pilgrims from the West had unhindered access to the holy places; but when Jerusalem came under the control of the fanatical sect of the Fatimites, Christian devotees were made the victims of all forms of outrage. After enduring this for about two centuries the Western world poured out its hosts of armed pilgrims, the Crusaders. But Palestine did not comprise all the places of pilgrim resort: near the city of Rome is Loreto, believed to contain the very house in which Jesus and his mother lived; Spain had the shrine of Saint James (Santiago) de Compostella; France that of Saint Martin of Tours. In the year 1428 there sailed from nine different ports of England for Spain on the way to Compostella 866 pilgrims; at the same time there were several famous shrines in England itself, chief among them the shrine of Saint Thomas Becket, archbishop of Canterbury, one of the most celebrated resorts of pilgrims. In the latter half of the 19th century there was a revival of the custom of pilgrimages, especially in France.

**Pilgrim's Progress, The**, an allegorical prose tale by John Bunyan (q.v.), by whom it was written during imprisonment in Bedford jail. The first part appeared in 1678, the second in 1684. It is presented under the guise of a dream, and represents the life of a Christian from conversion until death. The doubts of the hero figure as giants, his ill-deeds as a pack; while his clergyman is Evangelist, his conversion a flight from the City of Destruction, his Bible a chart, and so forth. The narrative is



an interesting example of vigorous Anglo-Saxon writing, and has long held place among English classics.

**Pilid'ium.** See LARVA.

**Pill,** a form of prepared medicine consisting of a globule convenient in size for swallowing. The ordinary weight of a pill is five grains. Some vegetable substances used as medicines may be made into pills without the addition of any other material, but usually the substances having medicinal properties are not of the proper consistence to be made into pills by themselves, and require the addition of some other material, which is called an excipient. The usual excipients are bread-crumbs, hard soap, extract of licorice, syrup, molasses, mucilage, castor-oil, honey, and conserve of roses. The last-named of these is especially valuable, as it preserves for a long time the proper consistency of the pills. The materials of which pills are made are mixed together until they are perfectly homogeneous, and are afterward separated into pills with instruments or machinery devised for the purpose. To prevent them from adhering to one another, as well as to some extent to conceal the taste, they are covered with some fine powder, such as licorice-powder, wheat-flour, fine sugar, and lycopodium. Immense numbers of pills are made by machinery, and it is very common to coat them with sugar, gelatin, and other substances, which are flavored and colored in various ways. Pills also sometimes receive a thin coating of gold or silver. The pill is a highly suitable form for administering medicines which operate in small doses, or which are intended to act slowly, or not to act at all until they reach the lower intestines, and especially convenient in the case of substances which are strongly offensive to taste or smell.

**Pil'laf.** See PILAU.

**Pillar,** an upright, free, supporting member used in building, of any shape in section and thus to be distinguished from the column which follows the classical rule demanding a circular section. Within this definition may be included the clustered column or the pier, though the pier, at least when it is without capstone or base, can hardly be called more than the section of a wall whose length and thickness are equal. The term is applied to the supports left for the roof in mining excavations, and their rude form perhaps typifies the first step in this architectural usage. But its usual significance is taken as representing in its transverse section a modification of a circle.

Among the earliest peoples of which we have record the Egyptians used the pillar as an architectural member. Their temples, if any there were, have disappeared, but in the remains of tombs at Beni-Hasan and elsewhere are found two types of pillars. One called the Proto-Doric is found in front of a tomb having a portico-in-antis of two columns. The resemblance of this pillar to that afterward developed by the Greeks has given it its name. The other type has received the name of lotiform from the fact that it seems to resemble a bundle of four lotus stalks bound together near the top. Above the ligature is carved the conventionalized lotus bud to form a capital. This pillar, no doubt originally constructed of wood, was adopted as the favorite order of later Egyptian builders.

The pillars used in classical and neo-classical architecture were single shafts of circular transverse section, and are described under their proper term, column. In a derivative style like the Romanesque great liberties were taken in the ornamentation of these classical pillars, in rare cases going to the extent of carving the semblance of a knot in the centre of the shaft. But no decided variation from the single shaft norm was introduced until the time of the Middle Ages when the rise of the Gothic style introduced a problem in the additional weight laid upon the pillars. A similar problem was met by the Romans in building the Colosseum by placing pillars in front of heavy piers, which latter virtually carried the principal weight. The Gothic builders added a pillar or half-pillar to support the pier arches and carried up the central pier to support the springing of the vault or roof. The Gothic builders of the south used the Roman piers with two, four or eight encircling pillars or half-pillars. The northern builders generally adopted the circular pillar with surrounding smaller ones which in time came to merge in clustered pillars of 8, 12, 16 or 24 engaged pillars encircling the central pillar-shaft. The effect of this was beautiful, but was finally felt to lack the strong accent that was lent to the work of southern builders from the contrast of square and round forms. The remedy was sought in the introduction of ogee forms, and sharp edges, giving to the pillars the forms used for rib-moldings of the vaults or window-tracery. The experiment succeeded until it degenerated into a riot of fantastic contours of no particular meaning. See ARCHITECTURE.

**Pillar Saints** (Greek, *stylitai*), the name of a class of hermits in Syria and Palestine who from the 5th to the 12th century lived on the summit of pillars in the open air. The earliest was Simon Stylites, who in 420 invented this new kind of asceticism, professing a desire to do public penance and make vicarious atonement for others sins. Accordingly he built a pillar 18 feet high and 3 wide at the summit. This he eventually raised to 60 feet high and 6 feet broad. There he lived for 37 years. His example was widely followed by a succession of hermits who, however, died out before the beginning of the 13th century.

**Pillars of Hercules.** See PILLARS OF MELKART.

**Pillars of Melkart,** the name given by the Phœnicians to the peaks on either side of Gibraltar (q.v.), near which they planted the colony of Gades, now Cadiz. The Greeks, identifying the god Melkart with Heracles or Hercules, their own guardian of travelers, called the place the Pillars of Hercules. See CALPE.

**Pillnitz,** pīl'nīts, a palace of the king of Saxony, on the right bank of the Elbe, seven miles from Dresden. The court remains here for some time each year. Pillnitz is famous for a meeting of the Emperor Leopold II., Frederick William II. of Prussia, the Count of Artois, the ex-minister Calonne, and several other personages, from 25 to 27 Aug. 1791. A treaty of offensive alliance was not concluded, but preliminaries were agreed on for a defensive alliance between Austria and Prussia, which was settled at Berlin, 7 Feb. 1792. The



## PILLORY — PILOS

French were greatly irritated by this convention, which they considered as the basis of the coalition of Europe against France.

**Pil'lory**, an old-time punishment consisting of a frame of wood erected on posts, with movable boards, and holes through which were put the head and hands of the criminal. In this situation criminals in Great Britain were formerly often exposed to the outrages of the mob in a way inconsistent with any rational notions of punishment. Those who were offensive to the crowd were in no small danger from the missiles by which they were assailed. The culprit was allowed to make speeches, defending himself and attacking his enemies. In 1816 this punishment was abolished in all cases except that of perjury, and it has since been abolished altogether.

**Pillow, Gideon Johnson**, American soldier: b. Williamson County, Tenn., 8 June 1806; d. Lee County, Ark., 6 Oct. 1878. He was graduated at the University of Nashville, studied law, became prominent in the Democratic party of the State, and in 1844 as delegate to the National Convention did much to secure the nomination of Polk, his intimate friend, for the presidency. In 1846 he was commissioned brigadier-general, immediately went to the front with his Tennessee volunteers, fought bravely at Vera Cruz, was severely wounded at Cerro Gordo, became second in command to General Scott, was again wounded at Churubusco, and after the war was accused by Scott of insubordination, but acquitted. His difference with Scott as to the Convention of Tacubaya seems to have been the origin of these charges. He opposed secession at first, acquiesced later, was made major-general of Tennessee troops, raised 35,000 men, and advanced to the Confederate government much money, which was never returned. Jefferson Davis disliked him and reduced his rank to brigadier. He fought under Leonidas Polk at Belmont 7 Nov. 1861, opposed the surrender of Fort Donelson February 1862, and thereafter did not figure in any battle save Murfreesboro, in which he had a courtesy command. He was ruined by the war, and tried heroically but vainly to recover his former financial position.

**Pillow, Fort.** See FORT PILLOW.

**Pillow-lace.** See LACE.

**Pillsbury, pīlz'bēr-ī, Henry N.**, American chess-player: b. Boston, Mass., 5 Dec. 1872; d. Philadelphia, Pa., 17 June 1906. He won the world's championship at the Hastings International Chess Congress in England, in 1895, the first American to attain that honor since 1858. He tied with Tarrasch in 1898 in the international cable match at Vienna, divided second honors with Janowsky and Maroczy in 1899 and won first prize at the American tournament in Buffalo in 1901, and was an honored competitor in the leading international games.

**Pillsbury, John Sargent**, American legislator: b. Sutton, N. H., 29 July 1828; d. Minneapolis, Minn., 18 Oct. 1901. He was engaged in various business ventures until 1872 when he became a member of the noted flour milling firm of Charles A. Pillsbury and Company. At the outbreak of the Civil War he organized three regiments for the Union army and later he assisted in the organization and equipment of other regiments for the suppression of an In-

dian uprising in Minnesota. In 1863 he was sent to the State senate and served almost continuously until elected governor in 1875 to which office he was twice re-elected. During his administration he prevented the repudiation of the Minnesota State Railway bonds and favored measures to benefit the agricultural portions of the State. He was a generous benefactor of educational institutions, hospitals, libraries, etc.

**Pillsbury, Parker**, American reformer: b. Hamilton, Mass., 22 Sept. 1809; d. Concord, N. H., 7 July 1898. He was graduated in 1838 from Gilmanton Theological Seminary, studied also at Andover, and became pastor of the Congregational Church at New London, N. H. Under the influence of William Lloyd Garrison's pleas, he joined the anti-slavery forces, withdrew from ministerial duties, and became an anti-slavery lecturer in New England and the West. In 1854 he went to England and there lectured in the principal cities. He was one of the more violent of the abolition orators, but in his way effective. At different times he was editor of the 'Herald of Freedom' at Concord, N. H., and of the 'Anti-Slavery Standard' in New York. In his later years he was a preacher for various Western religious societies. He published his recollections of the anti-slavery struggle and its leaders as 'Acts of the Anti-slavery Apostles' (1883).

**Pil'moor, Joseph**, American Episcopal clergyman: b. Tadmouth, Yorkshire, England, 31 Oct. 1739; d. Philadelphia, Pa., 24 July 1825. He was educated in John Wesley's school at Kingswood, entered the Methodist ministry in 1765 and in 1769 came to America where he assisted in establishing the Methodist faith. He founded the first Methodist church built in Philadelphia and preached in the interests of the Wesleyans until 1774, when he returned to England, angered at what he considered Wesley's injustice in having omitted him from the "legal hundred." In 1785 he again took up his residence in America, was ordained in the Episcopal Church in that year and held charges in Philadelphia and New York. In 1804 he became rector of Saint Paul's, Philadelphia, which post he retained for 20 years.

**Pilocar'pin.** See JABORANDI.

**Pilon, Germain**, zhār-măñ pē-lōñ, French sculptor: b. Paris 1535; d. there 1590. He was a favorite court sculptor of Catherine de' Medici. Many of the works were destroyed in the Revolution. The earliest extant is a canopy for the tomb of Francis I. at Saint Denis. In the Chapel of Saint Eustache at Saint Denis is also the famous tomb of Henry II. on which Pilon was occupied from 1564 to 1583. His 'Three Graces,' 'Saint Catherine du Val des Ecoliers,' erected by Cardinal Birogue in honor of his wife, the tomb of the cardinal himself, 'The Four Cardinal Virtues,' and others are now in the Louvre. A statue ordered by Catherine, 'Vièrge de Pitié,' is now in the Church Saint Paul and Saint Louis, Paris. Pilon, in the voluminous folds and tortuous lines in the draperies of his figures, marks the beginning of the decadence from the classic simplicity and strength of his immediate predecessor, Jean Goujon.

**Pilos.** See HATS AND HAT-MAKING.



## PILOT—PILOTY

**Pilot, The**, a sea story by James Fenimore Cooper, published in 1823. Walter Scott's 'Pirate' had just been published, and was discussed at a New York dinner where Cooper was present. The guests generally expressed the opinion that it could not have been written by Scott, who was suspected to be the author of 'Waverley,' because Scott never had been at sea. Cooper said that for that very reason he thought Scott wrote it, and added that he would undertake to write a real sea story. 'The Pilot' was the result. Paul Jones' adventures suggested the plot; which is, in brief, an attempt during the Revolutionary War to abduct some prominent Englishmen for exchange against American prisoners.

**Pilot and Pilotage.** A pilot is a seafaring man familiar with a particular coast, who is licensed by the government or State to navigate a vessel within a particular district. In Great Britain and the United States every qualified pilot on his appointment receives a license for a particular district from the pilotage authority of that district. Masters or mates of any ship may, upon giving due notice, be examined and passed by the proper authorities, and receive pilotage certificates. In this case they must be renewed every year. Further, any master or mate of a ship may obtain, after examination, a certificate to the effect that he is authorized to pilot any ship or ships belonging to the same owner of and under a certain draft of water. Any qualified pilot who commits any fraud against the customs or excise, or is guilty of corrupt practices as to ships, cargoes, crews, or passengers; who lends his license, acts as pilot while suspended or when drunk, causes unnecessary expense to enhance his own or someone else's gain; declines, without reasonable cause, to go off when signaled for or required; unnecessarily cuts or slips a cable; refuses to conduct a ship into port, except on reasonable ground of danger to the ship; or leaves the ship of which he is in charge, without the master's consent, before the service for which he was hired has been performed—renders himself liable to suspension or dismissal, as well as to a fine in addition to damages to the persons aggrieved. Pilotage fees depend on the draft of water of the ship piloted, and for vessels with a large draft of water are very much higher than for those with a small one. In Great Britain no owner or master of any ship is answerable to any person for any loss or damage occasioned by the fault or incapacity of any qualified pilot acting in charge of such ship within any district where the employment of such pilot is compulsory; but the pilot must not be interfered with in the discharge of his duties. Other maritime countries have also passed laws to regulate the pilotage of vessels. In the United States each individual State makes its own regulations as authorized by acts of Congress. The most important body of pilots in the United States are those under the pilot commissioners of New York. The master of a vessel with a pilot on board has still the management of the vessel, and sees that she is kept in the course the pilot directs. A master refusing to take a pilot vitiates the insurance on the vessel.

**Pilot Chart.** See CHART.

**Pilot-fish**, any of several fishes reputed to act as guides and sentinels to sharks, or re-

sembling species so acting. The fish traditionally so called (*Naucrates auctor*) is a small mackerel-like member of the family *Carangidae* (q.v.), which abounds in all warm seas, and was well known in the Mediterranean where the ancient fishermen observed its constant association with sharks, and its habit of following ships for many days together. They said it acted as a guide and protector of the sharks, leading them to prey and warning them of danger; and that when a mariner lost his way on the high seas it appeared and piloted him to port. The association with sharks and other large fishes and the following of ships are still observable, but the modern explanation is that the little fish gain food and some protection from the big ones, and these seek to swim near them. They are excellent eating. Another nearly related fish (*Seriola zonata*), one of the amberfishes, is called "shark's pilot" along the South Atlantic coast of the United States; in the West Indies several chichlids are called black, or cow, or cockeye pilots; and in Lake Champlain this name is given to a whitefish (*Coregonus quadrilateralis*) called Menominee or round whitefish in the Northwestern lakes. Consult Goode, 'Fishery Industries, Sec. I.' (1884); Day, 'Fauna of British India: Fishes' (1889).

**Pilot Knob**, a low mountain or hill in Missouri, in Iron County, about 80 miles southwest of Saint Louis. It is an elevation on the Ozark Plateau, about 500 feet above the surrounding plain, and one mile in diameter at its base. It is composed of iron ore of a peculiar steel-gray color, and of porphyry. The ore is magnetic. Iron Mountain (q.v.) is northwest of Pilot Knob.

**Pilot Mountain**, in North Carolina, on the border of Stokes and Surrey counties near Ararat River. See ARARAT.

**Pilot-plant**, the compass-plant (q.v.).

**Pilot Snake**, a rustic name in the United States for several different snakes, as the mountain blacksnake (*Zamenis obsoletus*), and the copperhead (q.v.).

**Pilot Whale**, a caaing whale (q.v.).

**Piloty**, pē-lō'tē, **Ferdinand**, German painter: b. Munich 8 Oct. 1828; d. there 21 Dec. 1895. After studying in the academy of his native city, he directed his artistic activity altogether under the influence of his brother Karl von Piloty, especially imitating him in technique and color. A number of his historical frescoes are to be seen in the National Museum at Munich and in the town hall of Landsberg-on-Lech. He also painted in oils for the Maximilaneum at Munich the picture 'Elizabeth of England reviewing her Troops in Sight of the Armada.' Of his other works, among the most notable are 'Sir Thomas More in Prison'; 'Raffael on a Sick Bed'; 'Count Eberhardt of Würtemberg by the Dead Body of his Son'; 'The Judgment of Solomon.' He designed many illustrations for Schiller's 'Glocke' and for the Shakespeare Gallery.

**Piloty, Karl von**, German painter: b. Munich 10 Oct. 1826; d. there 21 July 1886. After attending for a short time the Munich Academy, where he especially attached himself to the guidance of Schnorr, he joined the lithographic business of his father. He later fell under the influence of his brother-in-law,



Schorn, whose realistic teaching he enthusiastically accepted and later was molded by the colorists of Belgium and France. Beginning as a genre painter in his remarkable canvas 'The Nurse' (1853) he revealed for the first time a most brilliant technique which inaugurated a new style at Munich, and indeed throughout Germany. Two years later he was appointed professor in the Munich Art Academy. In 1854 he produced his first historical picture 'The Institution of the Catholic League,' which, despite its fine color scheme, was marred by a too emphatic and theatrical action, and a lack of depth and spirituality of expression. A long series of paintings of the same class followed this, and among them, 'Seni by the Corpse of Wallenstein' (1855), an important work, now in the New Pinakothek at Munich; 'Nero amid the Ruins of Rome' (1861); 'Godfrey de Bouillon with the Pilgrims at the Holy Sepulchre'; 'Assassination of Julius Cæsar' (1865); 'Columbus' (1866); 'Thusnelda in the Triumphal Procession of Germanicus' (1873), a replica of which is in the Metropolitan Museum of New York; 'The Death of Alexander' (1877), unfinished. He painted many portraits and designed illustrations for Shakespeare, and the German classic writers. In 1874 he was director of the Munich Academy. In his style he turned from classicism to realism; and was inclined to choose subjects of a melancholy or tragic caste, and sometimes was given to the melodramatic treatment of a theme, but his drawing, coloring and handling were masterly. As the representative of a distinct school in German art he counts among his pupils and followers Makart, Max, Defregger, Lenbach, J. Brandt, etc. Consult Rosenberg, 'Die Münchener Malerschule' (1887).

**Pilpay**, pīl'pī, or **Pilpai**. See BIDPAI.

**Pils**, pēlz, **Isidore Alexandre Auguste**, French painter: b. Paris 1815; d. Douarnenez, Brittany, 3 Sept. 1875. The son of an artist and soldier, he studied with Lethière and Picot and in 1838 gained the Grand Prix de Rome. His first success, after trying religious subjects, was in 1848 with 'Rouget de l'Isle chantant pour la première fois la Marseillaise' (Louvre). His greatest successes were with military scenes such as 'Débarquement en Crimée' and 'Bataille de l'Alma,' and water-color studies of soldiers during the siege of Paris. He was professor at the Ecole des Beaux Arts and Membre de l'Institut.

**Pilsen**, pīl'sēn, Austria, a city of the Austrian crownland of Bohemia, at the confluence of the Radbusa with the Mies (Beraun), 53 miles southwest of Prague. It consists of the town proper and extensive suburbs; is a well-built, handsome place; has a splendid Gothic church of the 13th century; a town-house, Franciscan monastery, a German and a Czech theatre, German and Czech gymnasia, barracks; and important and varied industries, embracing machinery and metal wares, porcelain, glass, liqueurs, refined spirits, etc., and large breweries which produce a famous variety of beer. Coal, iron, and alum mines are in the vicinity, and there is a considerable trade. Pilsen possessed a printing-press as early as 1475. It was once a fortified town, and was several times besieged during the Hussite wars. In 1618 it was

stormed by Mansfield, and in the Thirty Years' war was for a time the headquarters of Wallenstein. Pop. (1880) 38,883; (1890) 50,221; (1900) 68,292.

**Pilum**. See JAVELIN.

**Pilz, Vincenz**, Austrian sculptor: b. Warnsdorf, Bohemia, 1816; d. 1896. He studied both painting and sculpture at the Vienna Academy, but eventually came under the influence of Führich and Rahl and gave all his attention to sculpture, producing many groups and reliefs under the approval of these masters. Among his works are the two 'Winged Horses' in front of Memorial Hall, Philadelphia; the 'Neptune' of the Vienna Exchange and 'Science and Commerce' at Windsor Castle, England. He also decorated public buildings at Vienna with statues of Austrian generals, celebrities of antiquity and modern composers.

**Pim, Bedford Clapperton Trevelyan**, English naval officer: b. Biddeford, England, 12 June 1826; d. London, England, 1 Oct. 1886. He was educated at the Royal Naval School and entered the English navy in 1842; took part in the Franklin search expedition in 1852; commanded a gunboat on the Baltic during the Crimean war; served in China in 1857, and was promoted commander in 1858. In 1859 he served in Central America and surveyed the Nicaragua Canal route. He was retired from active service in 1861, but received rank as rear-admiral in 1885. He was admitted to the bar in 1873 and was a member of Parliament 1874-80. He wrote: 'The Gate of the Pacific' (1863); 'Jottings on the Roadside in Panama, Nicaragua, and Mosquito' (1869); 'The War Chronicle' (1873); etc.

**Piman** (pē'man) **Indians**, an American family or group residing in Mexico and Arizona. The stock includes among other tribes the Papagos, Pimos, Gatschets, Tarumaris, Yaquis and Huichols. The Piman family is a southern extension of the Shoshone (q.v.) family. They number about 90,000.

**Pimen'to**. See ALLSPICE.

**Pim'lico**. See FRIAR-BIRD.

**Pimo Indians**, an American tribe of the Piman family, living in New Mexico, in the valley of the Gila. They are neighbors of the Maricopas, whom they resemble so much in person and manners that they are not easily distinguished from them. Their number may be estimated at 3,200. The men have slender forms, but the women, who do most of the hard labor, are well made. Agriculture is their principal occupation. They are the most civilized of any of the North American Indians; they manufacture cotton fabrics, pottery, and other useful articles with considerable skill, and enjoy a reputation for simplicity of character, peacefulness, and honesty. The only weapon used by the tribe is the bow and arrow. They possess horses and cattle, but very few mules. About two thirds of the Pimos live on government reservations.

**Pim'pernel**, a flowering plant of the primrose family and genus *Anagallis*, with a wheel-shaped corolla. The scarlet or field pimpernel (*A. arvensis*) is wild in Europe, and both cultivated and run-wild all over the world. The small flowers are usually scarlet with a purple



## PIMPLES — PIN

spot in the centre, but in one variety blue. This species is commonly known in England as the "poor man's weather-glass," from the fact that its flowers do not open in rainy weather. The bog pimpernel (*A. tenella*) is an extremely delicate and beautiful plant, which naturally grows in the drier parts of marshes; its flowers are red, and it is distinguished from the field pimpernel by the fact that its corolla considerably exceeds the calyx. The blue and lilac varieties of the *A. collina*, originally a native of South Africa, have been introduced into gardens generally, where they have a fine effect. A closely allied plant (*Centunculus minimus*) is called false pimpernel or chaff-weed.

Another group of pimpernels is the genus *Pimpinella* of the *Umbelliferae*, relatives of the snake-root. A widespread and representative species is *P. saxifraga*, sometimes called burnet saxifrage.

**Pimples**, eruptions of the skin, of which several varieties are distinguished by special names, but various causes may transform one of these into another. The papule is a solid elevation, apparently containing no fluid, and either of the natural skin-color, or bluish, blackish, etc. The vesicle is an elevation of about the same size, containing a clear or milky fluid; by alteration of its contents to yellow pus it becomes a pustule. A bleb or bulla is a larger vesicle or pustule, and may be as large as a hen's egg. A large papule is called a tubercle, and wheal is the term applied when the raised skin is of greater extent than elevation.

**Pin**, a small piece of brass or steel wire, sharp at one end and furnished with a head at the other, used chiefly for the toilet for temporarily securing portions of the dress, and generally by seamstresses and tailors for fastening their work together. The need of little utensils of this sort has been met from ancient times by various devices. In the Egyptian tombs they are found much more elaborate and costly than the pins of the present time. They vary in length up to 7 or 8 inches, and are furnished sometimes with large gold heads, and sometimes with a band of gold around the upper end, those of the latter kind having probably been used for securing the hair. The ancient Mexicans found in the thorns of the agave convenient substitutes for metallic pins; and even the English, up to the middle of the 16th century, made use of rude skewers of wood, though they also made others of gold, silver, and brass to serve as pins. To that time they had depended upon the manufacturers on the Continent for their supplies of the better sorts of pins, and this importation appears to have been established previous to 1483, when it was interrupted by a prohibitory statute. In 1543 an act of parliament provided "that no person shall put to sale any pins but only such as be double-headed and have the head soldered fast to the shank of the pin, well smoothed, the shank well shaven, the point well and roundly filed, canted, and sharpened." Within three years from this time the manufacture was so much improved that the statute was of no importance. In Gloucester the business of pin making was introduced in 1626, and soon proved so prosperous that it gave employment to 1,500 persons. It was established in London in 1636, and afterward in Birmingham, which became the chief seat in England of this and

other manufacturing operations of similar character.

In the United States pins were first made in Rhode Island during the Revolution by Jeremiah Wilkinson, the heads being made by twisting fine wires firmly at one end. Samuel Slocum at about the same time commenced in Providence in the same line. In 1824 a machine for making solid-headed pins was invented by Lemuel W. Wright, of New Hampshire, which was soon after introduced into England, patents also being granted there. It was, however, crude compared with those of later construction, and did not complete all the operations of pin making. In 1831 the first machine for making perfect solid-headed pins like those now in use was invented by John Ireland Howe, a physician of Bellevue Hospital, New York city, and in the next year a company was started in that city. Six years later the business was removed to Derby, Conn., where it is still carried on. In 1835 another company was formed by Dr. Howe, which continued its operations under his charge till 1865, many improvements being made. Samuel Slocum, an ingenious Connecticut man, invented a pin-sticking machine, which was used in Howe's factory in 1841, and was improved in 1843, he and Slocum becoming joint owners of the two patents.

The manufacture of pins has become such an industry in the United States that the mills of this country practically supply the world with this article. In 1900 the 75,000,000 people in the United States used 66,000,000 gross of common pins, which is equal to 9,500,000,000 pins, or an average of about 126 pins for every man, woman and child in the country. This is the highest average reached anywhere in the use of pins. Ten years ago we used only about 72 pins each. The total number of pins manufactured in the United States during 1900 was 68,889,260 gross. There are 43 factories with 2,353 employees. There has been a considerable increase in the number of women and children employed in pin factories of late years, which is an indication that the machinery is being improved and simplified and that its operation does not require so high an order of mechanical skill. Hooks and eyes are a by-product of pin-making, and are produced at most of the factories from material that will not do for pins. The output of hooks and eyes in 1900 was 1,131,824 gross. Pins and hooks and eyes are turned out by automatic machines in such quantities to-day that the cost of manufacture is practically limited to the value of the brass wire from which they are made. A single machine does the whole business. Coils of wire, hung upon reels, are passed into machines which cut them into proper lengths, and they drop off into a receptacle and arrange themselves in the line of a slot formed by two bars. When they reach the lower end of the bars they are seized and pressed between two dies, which form the heads, and pass along into the grip of another steel instrument, which points them by pressure. They are then dropped into a solution of sour beer, whirling as they go, to be cleaned, and then into a hot solution of tin, which is also kept revolving. They here receive their bright coat of metal, and are pushed along, killing time, until they have had an opportunity to harden, when they are dropped into a revolving barrel



of bran and sawdust, which cools and polishes them at the same time. Because of the oscillation of the bran they work gradually down to the bottom of the barrel, which is a metallic plate cut into slits just big enough for the body of the pins, but not big enough for the head to pass through. Thus they are straightened out into rows again, and, like well drilled soldiers, pass along toward the edge of the bottom, and slide down an inclined plane, still hanging by their heads, until they reach strips of paper, to which they are introduced by a curious jerk of the machine. The first they know they are all placed in rows, wrapped up and on their way to the big department stores, where they are sold at from five cents to ten cents a gross. A machine is expected to throw out several thousand gross an hour. Needles are made by a similar machine. In 1900 there were made 1,397,533 gross of machine needles, 212,689 gross for shoemaking, 324,476 gross for ordinary household sewing machines, 307,426 gross for knitting machines and the rest for other kinds of sewing and knitting machinery, generally for factory use. We imported \$418,004 worth of ordinary needles, most of them from England. Hairpins and safety pins and other kinds of pins are manufactured in a similar manner. We made 1,189,104 gross of hairpins in 1890. Both needles and hairpins are manufactured to a greater extent in Europe than plain pins. Safety pins, however, are decidedly American, and of these we make on an average 1,000,000 gross a year.

**Pin-money**, an annual sum of money, sometimes provided for in a marriage settlement, to be paid by the husband to the wife for her separate use, and to be applied in the purchase of apparel, ornaments for her person, or for private expenditure. See LAW OF HUSBAND AND WIFE.

**Pina** (pē'nyä) **Cloth**, an extremely soft and delicate fabric, the manufacture of which is peculiar to the Philippines. It is made from the unspun fibres of the leaves of the cultivated pineapple plant, and the finer qualities are always made in small pieces, since only single fibres are used for them. For the coarser qualities several fibres are often joined together, so as to make warp threads of considerable length. Its color is almost white, but has a slight tinge of yellow in it. Its chief use is for making ladies' pocket handkerchiefs, and is frequently adorned with exquisite embroidery.

**Pin'afore**, H. M. S., a noted comic opera composed by Sir Arthur Sullivan and first played in London in May 1878. The libretto, furnished by W. S. Gilbert, is a humorous satire upon matters of the day and its suggestion may be found in Gilbert's 'Bab Ballads.'

**Pinakothek**, pīn'a-kō-thēk (Ger. pē-nä-kō-tāk') (Greek, "collection of pictures"), anciently, a chamber in which votive pictures of the gods were hung in Greece. Such a chamber was situated in the left wing of the propylæum or gate of the acropolis at Athens. In other states (Samos, Ephesus, etc.) special buildings were raised for the storing of votive tablets. Among the Romans the entrance to the atrium of their houses was adorned with statues, pictures and other objects of art. In Munich at the present day the term is applied to a public art gallery, and there is in that city an old and a new pinakothek.

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**Pinalobo**, pē-nä-lō'bō, a mountain of the Cordillera de Cabusilan, Philippines, in the northwestern part of the province of Pampanga, near the intersection of the boundary of Tárlac and Pampanga with Zambales. It is 6,040 feet in height, and the highest of a series of peaks which ends in the south with the Mariveles summits and forms a landmark for Súbic Bay and for vessels approaching Manila Bay from Hongkong and northern China.

**Pinar del Rio**, pē-när' dēl rē'ō, Cuba, the most western province of the island, bounded on the east by Habana Province, area 5,764 square miles. The Cordillera de los Organos traverses the centre of the province from east to west, and from this range the land slopes gradually to the coast. The coasts are generally low and marshy. The southern slope is the most fertile, and forms the famous Vuelta Abajo, where the finest quality of tobacco in the world is grown. This tobacco is the staple crop of the province; but coffee, sugar, and fruits are also raised. The mountains are heavily wooded, mainly with pine, and lumbering is an important industry; some cattle are also raised; and charcoal is manufactured. The mineral resources are comparatively unimportant and have not been developed; asphalt and copper are found. Pop. (1899) 173,064.

**Pinar del Rio**, Cuba, city, capital of the province of Pinar del Rio; 95 miles southwest of Havana. It was founded in 1776. It is connected with Havana by rail and with La Coloma by highway, and being situated on the southern slope of the mountains is the commercial centre of the tobacco-growing district, Vuelta Abajo. Pop. (1899) 8,880.

**Pinas'ter**. See PINE.

**Pinch'back**, **Pinckney Benton Stewart**, American lawyer and politician: b. Macon, Ga., 10 May 1837. He was of negro stock, studied in the public schools of Cincinnati, became a river boatman, and in 1862 enlisted in the Union army. In 1867 he was made inspector of customs at New Orleans. He took a prominent part in politics as a Republican leader; was a delegate to the Reconstruction Convention of the State in 1867; was State senator 1868-71, lieutenant-governor 1871-2, and acting governor during Warmoth's impeachment Dec.-Jan. 1872-3. He was elected to the U. S. Senate in 1873, but was never seated though he received regular pay and mileage; in 1882 was named surveyor of customs of New Orleans; and in 1886 was admitted to the bar, but has now retired from practice.

**Pinch'beck**, an alloy, four parts copper and one part zinc, with occasional traces of tin, used in the manufacture of cheap jewelry. It has something the appearance of gold, but is cheaper than bronze. The alloy is seldom used now. It was named from its discoverer, Christopher Pinchbeck, a London jeweler, b. about 1670; d. 18 Nov. 1732. He made clocks, watches, astronomical instruments and various automata, especially musical, which he exhibited at fairs.

**Pinche**, a sort of marmoset (q.v.).

**Pinckney**, pīnk'nī, **Charles**, American statesman: b. Charleston, S. C., 1758; d. there 29 Oct. 1824. He was educated for the bar, was elected to the provincial legislature, was held prisoner from the capture of Charleston until



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the end of the Revolution, then resumed practice, and in 1785 was chosen to the provincial congress. In 1787 he was a delegate to the United States constitutional convention, in 1789 was elected governor of South Carolina, and in 1791 and 1796 was re-elected. He was elected to the United States Senate as a Republican in 1798, in 1802-3 was minister to Spain, and in 1806 was made for the fourth time governor of South Carolina. In 1819-21 he was in Congress, where he opposed the Missouri Compromise. He wrote well on political topics and his addresses to the people under the pseudonym "Republican" (1800) were of assistance in Jefferson's election to the presidency.

**Pinckney, Charles Cotesworth**, American soldier and statesman: b. Charleston, S. C., 25 Feb. 1746; d. there 16 Aug. 1825. He was educated at Oxford; read law in the Middle Temple, London; studied military affairs in the Royal academy at Caen, France, and in 1769 began the practice of law in Charleston. He was a member of the first provincial congress of South Carolina (1775), and during the Revolution served with distinction in the Continental army. During the second attack on Charleston he at first commanded Fort Moultrie, but after the entrance of the enemy's fleet into the harbor, withdrew to the city, and was taken prisoner at the capitulation in May 1780. He was held in severe confinement for two years, exchanged in 1782, and made a brigadier in 1783. In 1787 he was a member of the United States constitutional convention, and took an active part in the busy debates connected with the framing of the instrument. He favored the slave trade, urged a landed-property qualification for the executive, judiciary, and the legislative department; and demanded that blacks be counted equally with whites in the estimate for representation in the national legislature. It was he who secured the insertion in the Constitution of the clause that "no religious test shall ever be required as a qualification to any office or public trust under the authority of the United States." Under the Constitution he was a zealous Federalist. He was a member of the State constitutional convention of South Carolina in 1790, and in 1796 became United States minister plenipotentiary to France. Ordered by the Directory to quit France within 30 days, he retired to Amsterdam, and on his arrival in America was made (1797) major-general of United States troops by President Washington. It is during the French mission that Pinckney, in response to Talleyrand's insinuation that recognition might be obtained by money, for lack of which war might follow, is said to have replied: "Millions for defense, but not a cent for tribute!" In 1800 he was Federalist candidate for the vice-presidency, and in 1804 and 1808 for the presidency.

**Pinckney, Thomas**, American diplomat and soldier: b. Charleston, S. C., 23 Oct. 1750; d. there 2 Nov. 1828. He was educated in England with his brother Charles Cotesworth, was called to the English bar in 1770, returned to Charleston in 1772 and in 1775 entered the Constitutional Congress as a zealous Federalist. He acted as aide to Lincoln, D'Estaing, and Gates, distinguished himself in the engagements at Stone Ferry and Savannah in 1779, and at Camden in 1780 was wounded and taken prisoner, not

regaining his liberty until the end of the war. In 1787-9 he was governor of South Carolina, minister to England in 1792-4, and in 1794-6 was engaged in a special mission to Spain, with whom he secured in 1795 a treaty which granted to the United States free navigation of the Mississippi for three years. He was a member of Congress in 1799-1801 and in the War of 1812 was major-general in command of the 6th Military District where he utterly routed the Creek Indians at Horse Shoe Bend. He spent the remaining years of his life in retirement.

**Pin'dar** (Gr. Πίνδαρος), Greek lyric poet; b. Cynoscephalæ, near Thebes, 522 B.C.; d. Argos, probably 448 B.C. For the development of his poetical talent he was sent to Athens, where he became the pupil of Lasus of Hermione, the Athenian school of dithyrambic poetry. On his return to Thebes he was especially indebted for the further cultivation of his poetic gifts to Corinna, a distinguished poet. He was held in great honor by many princes of Greek states, for whom he composed choral songs. Alexander, king of Macedonia, was one of his most ardent patrons. He regularly attended the contests at Olympia, Delphi, and elsewhere, and frequently attended the victors home to direct the triumphal ceremonies. In 472 he visited Sicily and the courts of King Thero of Agrigentum and King Hiero I. of Syracuse. Æschylus made a journey to the island at about the same time; and rival descriptions of the eruption of Ætna appear in the 'Odes' and in Æschylus' 'Prometheus.' Pindar practised all kinds of lyric poetry, and excelled equally in all. His works embraced hymns to the gods, pæans, dithyrambs, dancing and drinking songs, dirges, panegyrics on princes, and hymns in honor of the victors of the games, but the only poems of his, with one exception, which have come down to us entire belong to the last class, the 'Epinicia.' The one exception referred to is the ode which appears in editions of Pindar as the 11th Nemean, and was intended to celebrate the installation of Aristagoras as prytanis at Tenedos. Forty-five of the epinician odes of Pindar are still extant (including the one just mentioned). Of all, undoubtedly the fourth Pythian, in honor of the victory in the chariot race of Arcesilas, king of Cyrene, is the finest. His poems celebrated not alone the conquerors and their fellow-citizens, but all assembled Greece, and thus were soon spread wherever the Greek language was spoken. To understand Pindar it is necessary to be intimately acquainted with Greek antiquities. In the judgment of the best critics his poems belong to the most beautiful remains of ancient literature. They are marked by profundity of thought, elevation of diction, and majesty of rhythm. Fragments of his other works have also been preserved. Of the editions of Pindar the following deserve to be recommended: those of Böckh (1811-22); Dissen (2d edition, by Schneidewin 1843-67); Bergk, in 'Poetæ Lyrici Græci' (1878); Tycho Mommsen (1864); Fennell (1879-83); and Christ (1896). His odes have been translated into English by H. F. Carey (1833), F. A. Paley (1869); and, most worthily, Myers (1875). Consult: Jebb, 'Lectures on Greek Poetry' (1893); Fraccaroli, 'Le Odi di Pindaro' (1894).

**Pindemonte**, pēn-dā-mōn'tā, CAVALIERE **Ip-polito**, Italian poet: b. Verona 13 Nov. 1753;



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d. there 18 Nov. 1828. He was of a rich and cultured family, and early showed signs of poetical taste and ability. He traveled in England, Germany, and France, and, like the great English poets of the epoch, greeted with joy the French Revolution, publishing 'La Francia' in 1789, but was soon disillusioned by its excesses and especially by the sufferings of Italy, which followed it. His principal poems were: 'Poesie campestre' (1788), filled with charming descriptions of British scenery; 'Dodici sermoni poetici' (1819) in a Horatian manner; and 'Arminio' (1804), a tragedy. These are classic in manner, graceful, and tinged with melancholy.

**Pindemonte**, MARCHESE **Giovanni**, Italian dramatist, brother of Ippolito Pindemonte (q.v.): b. Verona 4 Dec. 1751; d. there 12 Jan. 1812. His early years were full of political ups-and-downs, now in Italy in high office and again living in exile in France. In 1802 he became a member of the Italian parliament. He was a brilliant improvisateur, a translator of note, like his brother, and the author of 10 tragedies, of which the best are 'I Bacchanali' and 'Ginevra di Scozia.'

**Pindharees**, pîn-dâr'êz, **Pindarees**, or **Pin-daris**, the name given to the hordes of mounted robbers in Central India who for several years (after 1812) infested the possessions of the East India Company. These freebooters had existed since 1761, but made themselves particularly formidable in the beginning of the following century. They were descended mostly from the caste of Mohammedan warriors, which formerly received high pay from the Indian princes. But the British East India Company disarmed many of the tributary native princes, and maintained under the command of the British residents at the Indian courts large bodies of mercenary troops, which the mediatized nabobs were obliged to pay. The number of the Pindarees was thus increased, and they were secretly excited by the Indian tributaries to attack the company. In 1817 the British governor-general, the Marquis of Hastings, determined on the destruction of these robbers, whose force was estimated at 40,000 horse. Attacked on all sides, they were conquered and dispersed.

**Pin'dus**, in ancient geography, the main range of northern Greece between Thessaly and Epirus, running from the northwest to the southeast, and the source in its northern part of the principal rivers of Greece, the Achelous, Haliacmon, and Peneius. Geologically it is calcareous in formation. The range is well watered and profusely wooded. In classic times its inhabitants were the half barbarian Athamanes and Dolopes, and the range, like Parnassus and Helicon, was sacred to the Muses and to Apollo. The inmost recesses of the mountains were the fortress and hiding place of determined brigands in the days of Ali Pasha. Its present inhabitants are peaceable shepherds and farmers, both Greek and Albanians, for the range now lies partly in Turkish and partly in Greek territory.

**Pine**, a genus (*Pinus*) of trees and a few shrubs of the order *Coniferae*. The species, of which about 70 well-marked ones have been described, are natives of the Northern Hemisphere, and more than half are indigenous to North America. Their distribution is from the Arctic Zone to near the Equator, where, however, they

are found only near the snow-line on the mountains. They are characterized by resiniferous wood, foliage, etc.; usually tall trunks; spreading branches which form a pyramidal or round top; needle-like leaves arranged in clusters of two, three, or five, sometimes solitary; yellow or purple staminate flowers, greenish or purplish pistillate ones, the latter developing into usually cylindrical brown cones, which vary in size from less than an inch to 18 inches long and reach maturity generally when two years old; some not until three or more years of age.

Economically the pines are more important than any other timber trees used by man; the nearest rival being the oaks. The main reasons for this eminence are the wide extent of their distribution, the enormous area occupied, their adaptability to human needs, and their occurrence largely upon poor land unfit for agricultural purposes. Not only for fuel and for timber are they noted; certain species yield pitch, tar, and turpentine, used extensively for naval supplies; the leaves of several are made into "pine wool" and also furnish essential oils; the seeds of other species are used as food and for flavoring; and many are serviceable as wind-breaks and shelter-belts or for ornamental planting. They thrive on a wide variety of soils, from beach-sand to alluvial river bottoms or rocky mountain-sides; and usually are found in large numbers together, often to the exclusion of other trees.

Pines are readily propagated by seeds, which in some species may require more than one year to germinate, unless planted as soon as gathered. They do best in a moderately moist soil enriched only to a slight depth so as to encourage the formation to surface roots rather than tap roots. While little they generally need partial shade and care in watering, both extremes of wetness and of dryness being avoided. When two years old or younger they are transplanted to increase the stockiness of the roots and render the trees better able to stand transplanting to final quarters. In general, the species do best in dry, upland soils, sandy rather than clayey, poor rather than rich, though soils of moderate texture and richness suit them well. When removed from the nursery rows the roots should be puddled in loamy mud to prevent the drying of the rootlets. Generally, best results are obtained in transplanting in the spring before growth starts and selecting youngest specimens or such as have been transplanted in the nursery several times.

A very large number of insects feed upon the pine, nearly 300 being recorded in Europe and 200 in America, although the actual number in this country is probably twice as many. Of these probably the most troublesome are the borers, of which a very large number are known, among which the following may be mentioned: Wood-engraver bark-beetle (*Xyleborus cæ-latus*), which attacks the Georgia and the white pine; coarse-writing bark-beetle (*Tomicus calligraphus*) also attacks the white pine, but seems to be more partial to the pitch pine; the white pine-weevil (*Pissodes strobi*) works, as a larva, in the leading shoot, which dies and thus forces the tree to develop a second leader, forming a crook in the trunk or branch attacked; the sawyer (*Monohammus confusor*) is a scourge of Southern pine forests; the pine-destroying



## PINE

beetle (*Dendroctonus ponderosa*) has greatly injured the timber of the Black Hills region by boring in the trunks; and there are many other boring beetles. The Nantucket pine-moth (*Retinia frustrana*) burrows, as a larva, in the wood of the twigs, and when in sufficient numbers kills the trees. Of other insects than borers perhaps the caterpillars are most frequently troublesome. Among the best known are the larvæ of two hawk-moths (*Lipara combycoides* and *L. pinetum*); of the imperial moth (*Eacles imperialis*); and of two butterflies (*Thecla niphon* and *Pieris menapia*). These all feed upon the foliage. A leaf miner (*Gelechia pini-foliella*) burrows in the leaves. A gall midge (*Diplosis pini-rigidæ*) forms galls at the bases of the leaf-clusters, and its relative (*D. resinicola*) lives in the pitch of the pitch pine. There are also many saw-flies, plant-lice, and scale-insects which destroy the foliage. The best known species are the following:

*White Pine* (*Pinus strobus*).—In every way this is the most useful species of the genus, combining utility in many directions with ornamental qualities superior to other species, adaptability to many soils and climates, and rapidity of growth with productivity. It is an American species, ranging from Newfoundland to Manitoba and southward to Illinois, and, in the mountains, to Georgia. It attains heights often exceeding 100 feet, sometimes 150 feet, and diameters of four feet or more. The white or cream-colored wood is soft, straight-grained, somewhat resinous, and easily worked. It is very popular for house-building especially for making door and window-frames, shingles, blinds, and interior finish. But since the forests of the northern United States and adjacent Canada have been considerably depleted other woods are replacing it for certain purposes.

*Georgia, Southern, Yellow, or Long-leaf Pine* (*P. palustris*).—As a timber tree this species ranks next to the white pine, and is the most important and most widely distributed timber tree of the Southern States. It is found upon the coastal plain from Virginia to Mississippi in a belt about 125 miles wide. It often exceeds 100 feet in height, but rarely more than 120 feet, gradually tapering from a base of about 30 inches. Its orange-brown branches form an open head; its leaves are often more than a foot long, and its cones larger than those of species in the same range. The yellow, very resinous wood is the heaviest and strongest of the pines. It is extensively used for ship and bridge building, flooring, and for interior finish of houses, especially when such is to be left unpainted to show the grain. The tree is the most important source of turpentine, resin, etc., the obtaining of which ranks second only to its timber industry. Its leaves are one of the most important sources of a turpentine-like oil and of pine wool, to obtain which they are boiled in alkalies.

*Red or Norway Pine* (*P. resinosa*).—Third in importance among American pines, this species is second in the north to the white pine as a lumber tree. It ranges from Labrador to Manitoba and south to Pennsylvania. Though usually about 75 feet tall and two feet in diameter, it sometimes doubles this height. It occurs most frequently upon dry, sandy soils, where it often forms dense forests. Its light, elastic,

resinous, hard wood is durable only when in dry places, and is used like that of the short-leaf pine of the South.

*Spruce or Yellow Pine* (*P. echinata* or *P. mitis*).—This species ranks second in the South to the Georgia pine, and comes fourth in the American list as a lumber tree. Its range is from New York to Illinois and southward to the Gulf States, sometimes excluding other species in large tracts. It attains from 75 to 120 feet in height and a diameter of two feet. The heavy, hard, coarse-grained timber is valued for its strength and durability. It is largely used for framework, railway ties, outside finish of buildings, railway cars, etc. It also furnishes resin. As an ornamental specimen it has been found hardy as far north as Rhode Island.

*Loblolly, Frankincense or Old Field Pine* (*P. taeda*).—This species yields very variable timber, the quality depending upon the conditions under which it is grown. When in forests it is considered valuable; when in fields usually not. It is a rapidly growing tree which often exceeds 150 feet in height and has about the same range as the Georgia pine. Its chief use is probably for fuel, though it is also cut for timber when grown under favorable conditions.

*The Slash, Swamp, or Cuban Pine* (*P. cubensis*).—This species is associated with the preceding, and though used similarly is considered inferior to the Georgia pine.

*Sugar Pine* (*P. lambertiana*).—One of the most important timber trees of the Pacific coast. It is indigenous from Oregon to Mexico, attains heights of 200 to 220 feet, diameters exceeding 10 feet, and a large portion of its trunk is branchless. It is one of the tallest trees of the region and of its genus. Its timber is heavy, straight-grained, easily worked, and is largely used for furniture and interior finish of houses. It bears edible nuts. Its name is derived from the sugar-like odor of its burning resin.

*Bull, or Yellow Pine* (*P. ponderosa*).—Perhaps second in importance to the preceding species in the West, its range being from British Columbia to Nebraska and southward to Texas and Mexico. It has several sub-species or varieties, which are of varied usefulness and application; those growing remote from the coast having coarser grained, harder and more fragile wood than those on the coast. Like the preceding it is one of the largest species of its genus and region, sometimes attaining a height of 230 and even 250 feet, and a diameter of 10 feet, but usually ranging from 100 to 150 feet with a diameter of about six feet.

*Mountain White, or Silver Pine* (*P. monticola*).—Another large species of the West, extending from British Columbia and Idaho to California, and attaining heights of 100 to 150 feet. It resembles the eastern white pine somewhat in appearance.

*Species of Inferior Importance*.—The pinon, or nut pines (*P. monophylla*, *P. edulis*, and *P. parryana*) are small trees in comparison with the foregoing, seldom attaining 50 feet. They are natives of the southwestern United States, where their wood is used as fuel and their large edible seeds as food. The Scotch pine (*P. sylvestris*) is the leading species of Europe, where it often forms extensive forests, frequently mixed with spruce fir, extending well into northern and western Asia. Though usually



## PINE BLUFF—PINE GROSBEAK

less than 100 feet tall and about 30 inches in diameter, it sometimes attains 120 feet and a diameter of four feet. In its economic uses it resembles the Georgia pine, being good for ship-, bridge-, and house-building, though there is considerable variation in the quality of the timber produced upon various soils and by various varieties. It also furnishes much turpentine, resin, etc., and its leaves are used for making pine wool and oil. The timber of the best grades is known as red pine or red deal. Corsican or black pine, or black fir (*P. laricio*) is a large native of southern Europe and western Asia, which is exceedingly rich in turpentine, etc., and supplies also some Burgundy pitch. Its wood is of little value except for fuel. The Aleppo pine (*P. halepensis*) is a native of the Mediterranean region and western Asia, and rarely exceeds 60 feet in height. It is useful for shore-planting, yields Venice turpentine, a liquid resin, and a timber used in its eastern range for ship-building and similar purposes. The cluster pine or pinaster (*P. pinaster*) grows on the south European seaboard, and like the Corsican pine is used for shore-planting extensively in southern England along the coast. The Japanese red pine (*P. densiflora*) and Japanese black pine (*P. thunbergi*) are the two principal Japanese and North Chinese species. They are used for many timber purposes and also for ornamental planting, having developed several horticultural varieties. The Cheer pine (*P. longifolia*) is a Himalayan species which often exceeds 100 feet in height and is valued for its timber, which is often substituted for European deal. Its resin is also obtained in commercial quantities. It has been introduced into California, where it is prized as one of the most decorative of pines, on account of its light, green, drooping leaves. Another Himalayan species, the Bhutan pine (*P. excelsa*) furnishes a close-grained durable wood which on account of its abundant resin is often used for torches. It is about the same size as the preceding species, and somewhat resembles the white pine of America.

Numerous other pines are more or less locally important, as the Philippine Island pine (*P. insularis*), which is one of the leading timber trees of the Philippine Islands, upon the high lands of which it forms large forests; the stone pine (*P. pinca*), one of the most picturesque trees of southern Europe, and valued for its almond-flavored nuts and beautifully grained wood; Mexican pines (*P. montezumæ*, *P. ayacahuite* and *P. arizonica*), the first a white pine, the other two yellow; and the Cembra or Swiss pine (*P. cembra*), a species ranging from the Swiss Alps to northern Russia and Siberia, throughout which country it is valued for its nuts and its "Carpathian balsam."

Consult: Sargent, 'Sylva of North America,' Vol. II.; Lambert, 'Description of the Genus Pinus'; Antoine, 'Die Coniferen'; Veitch, 'Manual of the Coniferæ'; Carrière, 'Traité Général des Conifères'; Forbes, 'Pinetum Woburnense'; Lawson, 'Pinetum Britannicum'; Mayr, 'Die Waldungen von Nordamerika' (1890); Hopkins, 'Insect Enemies of the Pine in the Black Hills Forest Reserve' (Washington, 1902); Packard, 'Report on Insects Injurious to Forests' (ib. 1890).

Pine Bluff, Ark., city, county-seat of Jefferson County; on the Arkansas River, and on the St. Louis, I. M. & S. and the St. Louis S. R.R.'s.; about 40 miles in direct line south by east of Little Rock. It is in an agricultural region in which cotton is one of the chief products. Its chief manufacturing establishments are cotton gins, cotton compresses, cottonseed-oil mills, foundry, furniture factory, feed mills, printing establishments, and boiler-sheet iron works. The railroad shops of the Saint Louis Southwestern are located there. The annual fair under the auspices of the State Fair Association is held here. It is the seat of the State Colored Normal College, the Merrill Institute, and a girls' industrial school, and it has public and parish schools, and a public library. There is a free library connected with the Merrill Institute. Pop. (1890) 9,952; (1900) 11,496.

**Pine Bluff (Ark.), Engagement at.** Pine Bluff was held 25 Oct. 1863 by Col. Powell Clayton with a Union brigade consisting of the 5th Kansas and 1st Indiana cavalry regiments, a company of State militia, and seven field guns, in all about 575 men. Early in the morning of the 25th Gen. Marmaduke with a division of about 2,500 Confederate cavalry and 12 guns approached the place and demanded its surrender. The outpost commander refused to permit the demand to be sent into headquarters, and skirmishing began; the Union pickets being slowly driven in. Meanwhile Clayton, whose troops were quartered in the town, had set 300 negroes at work rolling cotton-bales out of the warehouses and barricading the streets leading into the public square. Artillery was put in position to sweep every avenue of approach; sharpshooters were posted in the buildings; and barrels were filled with water from the river to withstand a siege. The skirmishers were driven in about 8 o'clock and Marmaduke made an attack with his 12 guns and sharpshooters, but making no headway, set fire to several buildings near the square to burn Clayton out. Failing in this, Marmaduke at 2 P.M. fell back, leaving some of his dead and wounded, and followed a mile by Clayton. He reported a loss of 40 killed and wounded. Clayton's loss was 11 killed and 27 wounded, and in addition several negroes were killed and wounded. The court-house and several other buildings were burned and the town wrecked by the Confederate artillery fire. Consult 'Official Records,' Vol. XXII.

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**Pine Finch, Linnet, or Siskin,** a small greenish finch (*Spinus pinus*), related to the goldfinch, whose home is in northern Canada, and which visits the northern United States in cold winters. These birds frequent coniferous trees and depend upon their seeds, buds, etc., for most of their food.

**Pine Grosbeak,** a large northern finch (*Pinicola enucleator*), whose summer home is in northern Europe, Canada, and the Rocky Mountains. It measures 9 to 10 inches in length. The head, fore-parts, neck and rump are bright red; back blackish brown, the feathers of this region having red edges; lower portion of the body light gray; wings and tail dusky. Like most winter visitors, it is very tame during the time when it is seen within the United States, which is irregularly in midwinter. Its



## PINE, GROUND — PINEAPPLE

food seems to consist principally of pine seeds, but it is also fond of those of the birch and alder, and occasionally descends to the ground, where it picks up the seeds of various plants, and probably a few insects. During late summer and winter it has a very pleasing song—clear, sweet, and flowing, like that of the purple finch. Four or five eggs of a pale green color spotted with brown are produced; the nest, roughly built of sticks and lined with feathers, being placed on a branch of a tree near the ground. Consult: Coues, 'Birds of the Northwest' (1874).

**Pine, Ground.** See *Lycopodiales*, under FERNs AND FERN ALLIES.

**Pine Marten**, the American sable. See MARTEN; SABLE.

**Pine Mountain, Engagement of.** Gen. J. E. Johnston, commanding the Confederate army opposing Gen. Sherman in the Atlanta campaign, abandoned his lines in front of New Hope Church 4 June 1864 and withdrew to a new position prepared by his engineer, running west from Brush Mountain to Pine Mountain and thence southwest to Lost Mountain. Pine Mountain, an isolated hill rising 300 feet above the surrounding country, formed a salient near the centre of this line. Upon Johnston's withdrawal Sherman occupied the railroad at and near Acworth, brought up supplies, was joined by Gen. Blair, with two divisions of the Seventeenth corps, and on the 10th moved his whole line forward and closed up on the Confederate position. By the 14th Gen. Thomas, with a part of his line, had worked his way close to Pine Mountain, and during the day Gen. Johnston, with Gens. Hardee and Polk, two of his corps commanders, were on the mountain observing the movement, when some of Thomas' batteries opened upon the group, killing Gen. Polk. During the night Johnston abandoned Pine Mountain, placing Bates' division, which had occupied it, in reserve, and on the morning of the 15th it was occupied by Howard's Fourth corps. Johnston still held the intrenchments connecting his principal line with Pine Mountain and other detached works, and at noon both Howard's and Hooker's corps advanced against these, Howard on the left of the mountain and Hooker on its right, driving the Confederates to their main works after a sharp engagement. Hooker then pushed against the principal line, Geary's division, supported by Williams', on the left, and Butterfield's division on the right. The Confederate resistance was very strong, and Hooker was repulsed with a loss of 639 killed and wounded. The Confederates, well covered by log breastworks, suffered but slightly. There was brisk and incessant skirmishing until the 18th, Sherman pressing closely and persistently at all points, and on the 19th Johnston was back on a new line, Hood's corps with its right on the Marietta and Canton road; Loring's (formerly Polk's) on the Kenesaw Mountain, and Hardee's on the left, extending across the Lost Mountain and Marietta road. (See KENESAW MOUNTAIN; KOLB'S FARM.) Consult: 'Official Records,' Vol. XXXVIII.; Cox. 'Atlanta'; Sherman, 'Memoirs,' Vol. II.; The Century Company's 'Battles and Leaders of the Civil War,' Vol. IV.

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**Pine Mouse.** See FIELD MICE.

**Pine, Running.** See *Lycopodiales*, under FERNs AND FERN ALLIES.

**Pine Sis'kin.** See PINE FINCH.

**Pine Snake, or Bull Snake**, a large colubrine serpent (*Pityophis melanoleucus*), prevalent in the pine-covered coast region from New Jersey southward, and locally called thunder-and lightning snake and bull-snake, the latter in reference to the loud hissing and bellowing noise it is able to make by reason of its peculiarly constructed glottis. It is pugnacious and malodorous, but harmless, and feeds on insects, mice, ground squirrels, eggs, and young birds, etc., and lays its eggs in a shallow burrow in the sand. This serpent reaches a length of six feet, and is cream white, variously blotched with chocolate brown. Consult the writings of Holbrook, Cope, Abbott, and Lockwood, the last named furnishing an extended account of this serpent's habits in 'The American Naturalist,' Vol. IX., January 1874.

**Pine-tree Flag**, an American colonial flag used in New England as early as 1700. It was at first red or blue with a pine-tree on a white field. Later it was all white with a pine-tree in the centre, and also the motto "An Appeal to Heaven." This flag was carried by the first war vessels used in the Revolution.

**Pine-tree Shilling.** See NUMISMATICS.

**Pine-tree State**, a popular name applied to Maine, from the extensive pine forests covering a large part of the State.

**Pin'cal Body**, a small reddish body (frequently but incorrectly called pineal gland), ovoid and conical, an organ attached to the posterior cerebral commissure. It projects downward and backward between the anterior pair of the corpora quadrigemina. Its function is not known, and it is now supposed to be a vestigial sense-organ, probably an eye. A hollow found in the parietal bone in many fossil mammals and reptiles is believed to have been the site of such an organ.

**Pineapple**, a perennial herb (*Ananas sativus*) of the order *Bromeliaceæ*. It is a native of the American tropics, but has been introduced into warm climates throughout the world. It grows about three feet high, bears long, stiff, sword-shaped, brittle leaves in an elongated rosette, from the centre of which arises the fruit, surmounted by a crown of stiff leaves. After fruiting another stem may arise and bear a fruit, the process being repeated sometimes for ten years or even more. The fruits vary from four to ten inches or even more, and from four to twenty pounds, but the average weight is probably about eight pounds. Until the introduction of recent methods of rapid transit the pineapple was confined to warm countries, or to hothouses, in which large quantities were formerly grown. Very few are now cultivated under glass, but immense and annually increasing numbers are shipped from tropical and subtropical fields to the markets of cooler countries, and also are used for canning. The principal fields are the West Indies, Florida, Northern Africa, Queensland, Hawaii, and Azores Islands. In 1894, 4,000,000 pineapples, valued at \$750,000, were marketed from Florida alone.



## PINEAPPLE FIBRE — PINERO

The freezes in 1894, 1895, and 1899 reduced the output, but forced growers to take better care of their plantations, to select frostless or protected places, and to cultivate the plants under sheds, the last method resulting in the production of the finest specimens.

The pineapple thrives best in an equable climate where the temperature averages between 70° and 80°, and where dry and rainy seasons alternate. Whatever the soil it must be thoroughly drained, even dry. Depth is inconsequential; the plants produce well in the Florida Keys, where the soil is often only one or two inches deep above the coralline rock. They will withstand months of dry weather but quickly succumb to an excess of moisture, either in the air or the soil. Florida pineapple land frequently contains only a trace of the fertilizing elements considered essential; hence applications of plant-food must be liberal, care being taken to avoid an acid phosphate. Dried blood, nitrate of soda, ground bone, carbonate and sulphate of potash and cotton-seed meal are favorite fertilizers. The plants are never raised from seed except for the production of new varieties, since ten years is often required to bring such plants into bearing. Rattoons, crowns, slips and suckers are used instead. Crowns, or the rosettes of leaves upon the fruits, are little used except when varieties are rare. Suckers develop from axillary buds near the ground and produce thrifty plants which usually bear before 18 months old; slips, taken from the base of the fruit, require fully a year longer to reach bearing age. Rattoons, which develop from buds beneath the ground and form a root-system of their own, are relied upon to a large extent to replace the plants that have borne. The land having been prepared, the plants are set in checks 18 to 36 inches apart, with alleys left at intervals of 6 or 8 feet. Cultivation consists in keeping the surface loose with a scuffle hoe. With reasonable care a plantation should bear for ten years without resetting. The fruits are gathered about a week before full maturity, wrapped individually in brown paper, packed firmly in half-barrel or barrel crates and shipped.

Pineapple sheds are built of slats upon a framework of posts and beams high enough to permit a man to stand upright under them. The slats are about three inches apart, to permit the ingress of light. The sheds protect the plants from excessive heat and from frost, and they improve the quality of the fruit. Only choice varieties are so grown, the cost of erection, about \$500 an acre, being prohibitive of inferior sorts.

The principal enemies of the pineapple are red spider (*Stigmæus floridanus*); scale insects (*Diaspis bromeliæ*); and mealy bugs (*Dactylopius citri*, etc.). The first appears upon the tender leaf bases and causes rot. A handful of tobacco-dust placed in the crown of the plant is effective, rains dissolve and carry the solution to the infected parts. Resin wash, whale-oil soap, and kerosene emulsion are used for the scale; these and the tobacco are used for the mealy bugs. The scale usually appears on the under surfaces of the leaves, but produces a yellow spot on the upper; the mealy bugs attack the bases of the leaves below ground, the buds and the fruit.

*Blight* or *wilt* is said to be due to a soil

fungus at the roots. Removal and resetting are practised, though plants of valuable varieties are sometimes trimmed and replanted. *Sanding*, which follows the filling of crowns of young plants with sand, may be prevented by filling the crown after planting with cottonseed meal, or other loose material which will not prevent growth but will keep out the sand. *Spike*, non-expansion of the leaves, is due to unfavorable conditions of the soil. Change of fertilizer is recommended. *Heart rot* or *bitter heart*, which often accompanies wet seasons, is of unknown origin. The affected part, the heart, looks watery, and the whole fruit becomes bitter. If not serious in nearly mature fruits the pineapples may be marketed; otherwise destroyed. Consult: Bailey, 'Cyclopedia of American Horticulture' (New York 1900-2); Rolfs, 'Pineapple Growing,' United States Department of Agriculture (Washington 1901); Rolfs, 'Pineapple Fertilizers,' Florida Experiment Station, Bulletin 50.

**Pineapple Fibre.** See FIBRE.

**Pineapple-melon.** See MELON.

**Pineda**, pē-nā'dā, Philippines, pueblo of Rizal, Luzón. See PASAY.

**Pinehurst**, pīn'hērst, N. C., village in Moore County; 70 miles southwest of Raleigh and 125 miles from the seacoast. It is 650 feet above sea-level. The Pinehurst electric railroad connects with the Seaboard Air Line at Southern Pines. Railroad connection is made from Pinehurst over the Aberdeen & Asheboro Railroad with the Seaboard Air Line at Aberdeen and the Southern Railroad at High Point. Pinehurst is 18 hours' ride from New York city. It is a summer resort, founded in 1895 by James W. Tufts of Boston. It embraces a large tract of country, 150 acres of which has been beautifully laid out with croquet grounds, tennis courts, parks, etc. It owns a shooting preserve of 50,000 acres, a dairy and poultry farm, and a large market garden. The location was selected for its scenery and healthfulness. Part of the year there is a population of about 3,000, at other times only 200 or 300.

**Pinel**, pē-nēl, Philippe, French alienist: b. St. André d'Alayrac 20 April 1745; d. Paris 26 Oct. 1826. He studied medicine in Toulouse, in Montpellier and in Paris, where he had to teach philosophy and mathematics to keep himself alive; in 1791 became directing physician in the Insane Asylum at Bicêtre and in 1794 at the Salpêtrière; and in both these institutions introduced gentle, kind treatment in place of the barbarities he found. In his book, 'Sur l'Aliénation Mentale' (1791) he first suggested moral remedies for the insane, so that this work is the foundation of modern psychiatry. His 'Nosographie philosophique' (1798) created an epoch in French medicine. He became a member of the Institute in 1803 on Cuvier's death. Suspected of liberal political views he was removed from his post in the medical school in 1823.

**Pinero**, pī-nēr'ō, Arthur Wing, English dramatist: b. London 24 May 1855. His ancestors the Pinheiros, Portuguese Jews, settled in England in the 18th century. He was a solicitor's clerk for several years; went on the stage in 1874, appearing first in Edinburgh; became a member of Henry Irving's company soon afterward, playing Claudius in 'Hamlet';



## PING PONG—PINKERTON

and had written a farce, 'Two Can Play at that Game'; a successful comedietta, '£200 a Year'; the one act plays, 'Daisy's Escape' and 'By-gones,' which were curtain-raisers for the Irving company at the Lyceum; and in 1881 'The Squire' and 'Imprudence,' before turning himself in 1882 entirely to dramatic authorship. His earliest plays after that date show a striving after real characters—none too successful, for example, in 'The Magistrate' (1885). The beginning of his naturalistic power was to be seen not only in the well known farces of the next two years, 'The Schoolmistress,' 'The Hobbyhorse' (1886), and 'Dandy Dick' (1887), but in the tragedy called 'The Weaker Sex,' first played in 1888. 'Sweet Lavender,' a pretty, rather unpleasant, very unreal and quite uncharacteristic play, was written in 1888. 'The Profligate,' with its Puritan theme of the impossibility of burying a wicked past, was dramatically powerful but poorly written. It was followed by the weak farces, 'The Cabinet Minister' and 'The Times,' in 1891 by 'Lady Bountiful,' and in 1893 by 'The Second Mrs. Tanqueray,' which showed great gain in literary ability and in dramatic machinery. Between them and 'The Notorious Mrs. Ebb-smith' (1895), no doubt his best play, came again a farce 'The Amazons'; indeed it seems that after every serious effort he returned to the farce. Pinero's later works are: 'The Benefit of the Doubt' (1895), a triumph of theatrical construction; 'The Princess and the Butterfly' (1897), a charming combination of satire and romance; the graceful 'Trelawney of the Wells' (1898); a study in moral evolution, 'The Gay Lord Quex' (1899); the unpleasant but strong 'Iris' (1901); and 'Letty' (1903). All in all, Pinero ranks as a master of the problem play.

**Ping Pong, or Table Lawn-tennis,** a game that was introduced from England and became very popular in the United States in 1902. The game is played very much as is the regular game of lawn-tennis. Following are the rules of the game, which should be learned thoroughly before attempting to play:

First.—The game is for two people, one standing at one end of the table, the other opposite. The player who first delivers the ball is called the server, the other the striker out.

Second.—At the end of the first game the striker out becomes the server and the server becomes the striker out, and so on, alternately.

Third.—The service is strictly underhand and delivered from beyond the end of the table.

Fourth.—The ball served must drop on the table top beyond the net, and is then in play. If it drops into the net or off the table it counts to the striker out.

Fifth.—In serving it is permissible for the ball to touch the net in passing over.

Sixth.—If the ball in play strikes any object above or around the table before it bounces on the table itself (net or post excepted) it counts against the player.

Seventh.—The server wins a stroke if the striker out fails to return the service or ball in play off the table.

Eighth.—The striker out wins a stroke if the server makes a foul or fails to return the ball in play so that it falls off the table.

Ninth.—No volleying is allowed, but so long as the ball touches the table it is in play and can be taken at half volley.

Tenth.—On either player winning his first stroke the score is called 15 for that player; on either player winning his second stroke the score is called 30; on either player winning his third stroke the score is called 40, and the fourth stroke won by either player is scored a game for that player, except as below.

Eleventh.—If both players have won three strokes (40) the score is called deuce, and the next stroke won is scored to the player. If the same player win the

next stroke he wins the game; if he lose the next stroke the score is again called deuce, and so on until either player wins the two strokes immediately following the score of deuce, when the game is scored for that player.

Twelfth.—The player who first wins six games wins a set.

Thirteenth.—The game may also be scored by points, 20 up. In this case the players change the service every five points, as in cricket.

The game may be played on an ordinary dining table, about nine feet by five feet being the most convenient dimensions, though either a larger or a smaller table may be used. The net is between six and seven inches high, and the remaining accessories are posts to hold the net when stretched across the table; vellum, string or wood racquets and celluloid balls.

**Ping-Yang,** pīng-yāng', Korea. See PIENG-AN.

**Pingree,** pīn'grē, **Hazen Senter,** American politician: b. Denmark, Maine, 3 Aug. 1842; d. London, England, 18 June 1901. He enlisted in the Union army and served through the war, afterward settling in Detroit, Mich., where he became one of the largest shoe manufacturers in the West. In 1889 he was elected mayor of Detroit and in 1896 gained control of the Republican political organization and notwithstanding the opposition to his radical ideas was elected governor. He continued to hold his office as mayor until 1897; he was elected governor of the State, and re-elected in 1898, retiring in 1900.

**Pin'guin,** the West Indian wild pineapple largely grown in the Antilles as a hedge-plant. See BROMELIA.

**Pink-eye,** a disease of horses, frequently suffered in the Southern States, but rare in the North. It is allied to influenza and scarlet fever in man. It usually breaks out in wet, cold weather, and its chief symptoms are, besides the redness of the eye to which it owes its name, loss of appetite, feverishness, quickened pulse, and perhaps stiffness of the limbs and constipation. It is likely to be epidemic in limited districts, because spread by the aid of the midges of the genus *Hippelates*, which hover about the eyes of diseased horses and carry pathogenic germs to the next animal they visit. It usually runs its course in ten days or less, and is generally not fatal. In treating this disease an antiseptic wash for the eyes should be used; cardiac stimulants may be required, and strict attention must be given to all sanitary care.

**Pinkerton,** pīng'kēr-tōn, **Allan,** American detective: b. Glasgow, Scotland, 25 Aug. 1819; d. Chicago, Ill., 1 July 1884. In 1842 he came to Chicago, Ill., and was appointed its first detective in 1850. In the same year he established a detective bureau, now well known. He organized the secret service division of the United States army in 1861, was made its first chief, and later formed and directed the secret service department of the Gulf until the end of the war. While employed by the Wilmington & Baltimore Railway he discovered a plot to assassinate Lincoln on the way to Washington (1861). He was very successful in his detective work, being particularly skilful in the detection of bank and express thieves and the recovery of the money taken. He also broke up the "Molly Maguire" band of Pennsylvania. Among his writings were: 'The Spy of the Rebellion' (1883); and 'Thirty Years a Detective' (1884).



**Pinkerton, John**, Scottish antiquary: b. Edinburgh 17 Feb. 1758; d. Paris, France, 10 March 1826. In 1781 he settled in London, where in 1783 he published 'Select Scottish Ballads,' a part of the supposedly ancient contents of which was from his own pen. He was for a time editor of the 'Critical Review'; and he turned out a large number of volumes, original and compiled, the former showing more of skill in research than literary merit. Among works editorially prepared by him were: 'Ancient Scottish Poems' (1786), sometimes declared to have been a forgery, though the manuscripts are in the Pepysian library at Cambridge; and a 'Collection of Voyages and Travels' (1807-14), a voluminous (17 vols.) and, in its day, valuable publication.

**Pinkerton, William Allen**, American detective: b. Dundee, Ill., 7 April 1846. He is a son of Allan Pinkerton (q.v.). During the Civil War period he was employed in the United States Secret Service, and afterward entered his father's office. On the death of his father, in 1884, he became head of the agency and extended its operations throughout the world.

**Pinkney, pink'nī, Edward Coate**, American poet, son of William Pinkney (q.v.): b. London 1 Oct. 1802; d. Baltimore, Md., 11 April 1828. After serving in the navy 1816-24 he was admitted to the Baltimore bar in 1824 and soon after became professor of rhetoric in the University of Maryland. He published 'Rodolph and Other Poems' (1825). His verse was lyrical in character and not without grace and melody.

**Pinkney, William**, American diplomat: b. Annapolis, Md., 17 March 1764; d. Washington, D. C., 25 Dec. 1822. He was educated at King William's Seminary, studied law under Samuel Chase, and was admitted to the bar in 1786. While a member of the Maryland legislature he assisted in the ratification of the Federal Constitution in 1788 and in the same year was elected to the house of delegates. As United States commissioner to England under the Jay Treaty he secured in 1796 a claim of \$800,000 for the State of Maryland against the Bank of England for losses and damages to American merchants caused by the English government. Afterward he engaged in law practice in Baltimore and in 1804 became attorney-general of Maryland. In 1806 he was sent as minister extraordinary to England, where in conjunction with James Monroe he treated with England in regard to the latter's violation of the rights of neutrals. He was resident minister to England in 1807-11 and in the latter year was appointed attorney-general of the United States. He fought in the War of 1812, served in Congress in 1815-16 and in 1816 was appointed minister to Russia and special envoy to Naples. In 1818 he resigned and resumed his law practice in Baltimore and in 1820 was elected to the United States Senate. Consult Wheaton, 'Life, Writings, and Speeches of William Pinkney' (1826).

**Pinkroot**, the rhizome of a loganaceous medicinal woodland (*Spigelia marilandica*) of the United States, which is bitter, anthelmintic, toxic, dilates the pupil, etc.

**Pinks**, a genus (*Dianthus*) of mostly perennial herbs of the order *Caryophyllaceæ*. The species, of which about 200 have been described, are natives of the Eastern Hemisphere, espe-

cially Europe and Western Asia. Their jointed stems, which grow in tufts, bear grass-like leaves and terminal, often fragrant, flowers either in clusters or solitary. Their popular name is derived from the prevailing color of the flowers, though white and purple are common in garden varieties. For centuries the pinks have been cultivated, their flowers, hardiness, and ease of cultivation rendering them garden favorites. They are easily propagated from seeds or cuttings; thrive in well drained, rather light loam; and the perennial kinds mulched during the winter with loose litter, straw or brush to prevent the formation of ice around the stems and to hold the snow and keep the frost in the ground until late in the spring. The seeds are usually sown under glass in early spring and the plants set in the garden when the weather has become settled. Cuttings are used for double and other choice varieties. Seeds sown in late summer will produce plants for early spring blossoming if mulched during the winter.

Among the best known species are the following: Common grass, or garden, Scotch or pheasant's eye pink (*D. plumarius*), a general favorite in old fashioned gardens; sweet-william (*D. barbatus*) one of the oldest and most popular of garden flowers; clove pink, picotee, grenadine or carnation (*D. caryophyllus*) popular in various forms either as a garden or a greenhouse plant (see CARNATION); maiden pink (*D. deltoides*), popular as an edging plant; *D. prolifer* and the Deptford pink (*D. armeria*) well known weeds naturalized in the Eastern States; Chinese or Indian pink (*D. chinensis*) and *D. superbus*, also popular garden species. In rock gardens *D. alpinus*, *D. neglectus* and *D. glacialis* are favorites. They are too easily covered by earth washed upon them by rains to be of value in level gardens.

**Pin'na**, or **Wing-shell**, a genus of bivalve mollusks of the family *Aviculidæ* with wedge-shaped shells of a horny, delicate structure, the hingeless beaks forming a pointed extremity. The foot is long and grooved, and secretes a large byssus of strong, silky texture. The genus is represented by the *Pinna nobilis* of the Mediterranean Sea, from whose byssus in past days the Neapolitans, Sicilians and Maltese used to weave quantities of durable silk. Frequent mention is made of the fabric by Latin authors. Pope Benedict XV. in 1754 had a pair of stockings made from this "silk." Many other species are known in various parts of the world, including the shores of the Gulf of Mexico.

**Pin'nace**, a vessel with a square stern, having sails and oars, usually carrying two masts. One of the boats of a man-of-war was formerly used to carry the officers to and from the shore, was also called the pinnacle. It was smaller than the launch, but larger than the cutter, and was rowed by from 10 to 16 oars.

**Pin'nacle**, in architecture, a small square or polygonal shaft, terminating upward in the form of a pyramid, embellished with foliage at the angles of the pyramidal part. It is much employed in Gothic architecture as a termination to buttresses, the tops of gables, etc., in which cases it is in the form of a spire with crockets and a finial.

**Pin'nated Grouse**. See GROUSE.

**Pinnipe'dia**, a suborder of *Carnivora*, the seals, especially adapted in the structure of their



limbs to an aquatic existence, as the name indicates. Both pairs of limbs, and especially their proximal segments, are very short, and the distal part flattened, webbed and paddle-like. The hind limbs are placed very far back and are very peculiar in that the first and fifth toes are stout and as long or longer, instead of shorter, than the others. The head is usually short and rounded, the neck short, the trunk thick and fusiform and the tail rudimentary. The teeth are simpler in structure than in most carnivora, the molars and premolars being either nearly simple cones or crowned with numerous small pointed tubercles; the incisors are reduced in size and often in number, but the canines of the males are usually enlarged, and in the walruses become enormous tusks. The brain is large and much convoluted, and the eyes large and possessed of a very human expression. All of the pinnipeds spend the great part of their lives in the water, swimming with great speed and dexterity; but the peculiar structure of their limbs ill adapts them for terrestrial progression, which is accomplished in an awkward shuffling manner with severe contortions of the back. They are chiefly marine, frequenting the coasts of colder climates, though some species are tropical, and others enter fresh water. Some of the species spend much time far out at sea, but land on islands for the purpose of mating and bearing young. Most of them are carnivorous, feeding upon fishes, mollusks and crustaceans, but a few subsist in part upon marine algæ. The Pinnipedia have been derived from land animals, probably from the bears, and their adaptation to an aquatic habitat is not nearly so extreme as in the whales. Three families are usually recognized: the *Otariidæ*, or eared seals, which have a small, valvular, external ear and include the sea-lions and sea-bears. The *Phocidæ* have no external ear, and are the most completely aquatic members of the suborder. Here belong the common harbor-seal of the North Atlantic coast, the hooded seal, the sea-elephant and numerous other species. In the *Trichechidæ* is included only the walrus, in many respects the most remarkable of the entire group. See SEALS; SEA-LION; ELEPHANT-SEAL; WALRUS.

**Pinochle**, pē'nō-kl. See PENUCHLE.

**Pinos**, pē'nōs, Mexico, town in the state of Zacatecas, 75 miles east of the city of Zacatecas, and capital of the administrative district of Pinos. It is about 7,700 feet above the sea-level, lying on the eastern slope of the Cerro de Candelaria; is centre of a rich silver and gold mining district; and produces an excellent grade of mescal. Pop. (1895) 8,183; the district (1880) 40,975.

**Pinsuti**, pēn-soo'tē, **Ciro**, Italian composer: b. near Siena 9 May 1829; d. Florence 10 March 1888. He was trained as a musician by his father and by Rossini; became a singing teacher in London and Newcastle in 1848 and professor of singing in the English Royal Academy of Music in 1856. He wrote the successful Italian operas 'Il mercante di Venezia' (1873); 'Mattia Corvino' (1877); and 'Margherita' (1882); as well as a 'Te Deum' (1859) on the annexation of Tuscany to Italy, and several fine songs.

**Pint**, a measure of capacity, the eighth part of a gallon. See WEIGHTS AND MEASURES.

**Pin'tail**, or **Sprigtail Duck**. See DUCK.

**Pinto**, pēi'tō, **Alexandre Alberto da Rocha Serpa**, Portuguese explorer in Africa: b. Castle Polchras 10 April 1846; d. Lisbon 28 Dec. 1900. He was educated in America, where he lived with his father 1848-58, and then in the Lisbon Military College, whence he entered the Portuguese army in 1864. He served in Mozambique and in 1877-9 explored the country between Mozambique and Pretoria, in 1885 the region west of Lake Nyanza, and in 1889, having been named governor of Mozambique, the region around the Shire River. His bold attitude toward English expansion in Africa and his efforts to spread Portuguese influence made his recall necessary in 1890 because of a protest from England. His trip across Africa in 1877-9, the fourth crossing from west to east, was his greatest feat and is described in his book 'How I Crossed Africa' (1881).

**Pinto, Fernao Mendez**. See MENDEZ PINTO, FERNAO, or FERNAM.

**Pintsch System**, a system of compressed gas chiefly used for lighting railroad cars. Nearly every large railroad system in the United States has adopted this system. The gas is compressed from oil, 125 pounds of pressure to the square inch giving one foot of oil gas, equal to the illuminating power of five feet of coal gas. The lamps used are of special design, each having from four to six burners.

**Pinturicchio**, pēn-too-rēk'kē-ō ("the good little painter"), easel name of Bernardino de Betto Bagio, Italian painter: b. Perugia 1454; d. Siena 11 Dec. 1513. It is thought that he was a fellow student of Pietro Perugino under Niccolo da Foligno, and he was assisting Perugino (his senior by only eight years), at Rome (1484) in executing the frescoes of the Sistine Chapel for Innocent VIII. Among his other Roman patrons were Sciarra Colonna and Alexander VI.; for the latter he painted a series of scenes from the life of Saint Bernard in the Church of Ara Cœli, and five frescoes in the Vatican. He returned to Umbria in 1498 and works of his are extant in Perugia, Orvieto and Spoleto. Cardinal Francesco Piccolomini, afterward Pius III., on completing his cathedral at Siena, invited him to decorate the library of that building (1502). The walls he frescoed with scenes from the life of Pius II., the cardinal's uncle, and the roof with arabesques and mythological compositions. Raphael, then 19, accompanied him to Siena, but whether he took part in the execution of the frescoes is uncertain. These works are brilliant in conception and execution and are considered the finest of his frescoes. Fresco-painting was indeed his strongest point, he understood well the decorative resources of his art, and was master of ornament. He left few easel pictures and these are scattered through the chief public and private galleries of Europe. His 'Return of Ulysses' was sold in 1874 for \$10,761.50, and his three scenes from the life of Griselda for \$3,620. The last of his known works, painted in 1513, is the 'Procession to Calvary,' now in the Casa Borromeo, at Milan. Sigismodo Tizio, parish priest at Siena, has left a true but tragic account of his death. When confined by sickness to his bedroom his wife locked him in, went off with her lover, and left her husband to perish by hunger. In the history of painting he is to be looked upon as the link between Perugino and



Raphael and some pictures of his have been attributed to each of these masters. He bore a high character among his fellow citizens and was elected Decemvir of Perugia in 1501.

**Pin'worm**, a small parasitic nematode worm (*Oxyurus vermicularis*), usually less than half an inch in length, which infects the human rectum and large intestine, especially in children. Pinworms travel down the bowel and cause irritation about the anus, which provokes the victim to scratching. The eating of fruit, etc., handled by one suffering from pinworms, is a probable means of infecting another.

**Piny Resin, Tallow, or Varnish.** See DAMMAR.

**Pinzon, pēn-thōn', Martin Alonso**, Spanish ship-builder and navigator. He was a native of Palos, and at the summons of prior Juan Perez of La Rábida, held a conference with Columbus (q.v.) and decided to aid the latter in his first voyage. In this expedition he sailed in command of the Pinta, the second caravel, but deserted Columbus off the coast of Cuba 20 Nov. 1492. The Pinta was the fleetest of the three vessels, and the purpose of Pinzon's treachery was evidently that he might first reach Spain and there make exaggerated claims for himself. He was the first to reach Haiti (Hispaniola), where he traded and found gold, and where when he fell in with Columbus 6 Jan. 1493, he explained that stress of weather had separated him from the other ships. In a fierce storm during the return (12-18 Feb. 1493), the Niña and Pinta were parted, and the Pinta reached Bayonne, a Galician port. Thence Pinzon despatched to the sovereigns an account of the discovery, claiming much. But this was quite disregarded, and when he reached Palos it was only to find the admiral already there. A letter from the monarchs forbade him to appear at court, and it was said that chagrin hastened his death.

**Pinzon, Vincente Yañez**, Spanish ship-builder and navigator, brother of Martin Alonso Pinzon (q.v.). He was a native of Palos, and set sail from there on Columbus' first voyage as commander of the third caravel, the Niña. But he is better known for a voyage he undertook in 1500, during the course of which he discovered the Brazilian coast and the mouth of the Amazon. He made with Juan Diaz de Solis two voyages, one probably in 1497 to the bay of Honduras, the other in 1508-9 along the eastern coast of South America as far as the Colorado River, lat. 40° S.

**Piombino, pē-ōm-bē'nō**, Italy, a former principality of Tuscany, lying between Siena and the Mediterranean, opposite the island of Elba, from which it is separated by the channel of Piombino. Its extent was about 216 square miles, with a population of 25,000 at the time of its incorporation with the kingdom of Italy (1860). It was originally a fief in the possession of the Appiani family, which, after a rule extending over 300 years, sold it to the Buoncampagni family in 1634. In 1804 Napoleon granted it to his sister Eliza, Princess Baciocchi; but she was rejected by the Congress of Vienna, and the old family restored. Piombino now forms part of the province of Pisa.

**Piombo, pē-ōm'bō, Sebastiano del**, Italian painter: b. Venice 1485; d. Rome 21 June 1547.

His family name was Luciani. Having renounced music, to which he had early devoted himself, for painting, he studied under Giovanni Bellini, and Giorgione, the latter of whom he especially imitated. Something of the fine coloring of Giorgione appears in the figure of Saint Chrysostom writing, in the altar-piece of the church of that name at Venice, which is Piombo's earliest fresco. In 1510 he went to Rome, and became acquainted with Michelangelo, whose mastery of form he tried to make his own and to combine with his own Venetian skill in coloring. He also vied with Raphael, and the so-called 'Fornarina' in the Uffizi, and the 'Saint Dorothea' at Berlin were both for a long time attributed to Raphael. When Raphael had painted his 'Ascension,' Sebastiano was induced by Michelangelo to attempt to surpass it by the 'Raising of Lazarus,' considered his greatest work. His 'Martyrdom of Saint Agatha' also ranks among the masterpieces of the Italian school. His chief merit, however, lay in single figures and portraits. His 'Pietro Aretino' and his 'Clement VII.' are admirable likenesses and perfect in coloring. He was high in favor with Clement: who created him one of the keepers of the Papal seals, *Frate del Piombo*; hence his surname, the seals attached to the papal bulls being at that time of lead (*piombo*). This post made it necessary for him to assume the clerical habit, and from that time he painted but little. He wrote verses, entertained learned men at his table, and only occasionally painted a portrait, and made experiments in vehicle; inventing a peculiar method of painting in oil on walls, in which manner there is a 'Scourging of Christ' to be seen in S. Pietro in Montorio.

**Pioneers'**, a detachment of soldiers equipped with pickax, spade, etc., in the proportion of 10 to every battalion of infantry, whose duty it is to clear and repair roads, bridges, etc., as far as possible, for troops on the march. They are placed at the head of the battalion of which they form a part, and are commanded by a pioneer sergeant. In former times civilians were employed to perform the labor of pioneers. Also one who goes before to prepare or clear the way, or remove obstructions for another, especially in the settlement of a new region.

**Piotrkow, pēy-ōtr'kōv**, Russian Poland, (1) the capital of a government of the same name, 90 miles by rail southwest of Warsaw. Cotton and wool spinning, with the manufacture of agricultural implements, are the chief industries. The town dates from before the 12th century and is one of the oldest in Poland. In its ancient castle still standing, diets were held in the 15th and 16th centuries, and the kings elected. Pop. (1897) 30,372. (2) The government in the west of Russian Poland, south of the government of Warsaw, has an area of 4,735 square miles. The surface is undulating and diversified by hills from 1,000 to 1,600 feet high, extending southwest to northeast. It is rich in coal deposits, and iron, zinc, and lignite are also mined. Agriculture and stock-raising are important industries, and there are manufactures of textiles and ironware. Pop. (1897) 1,406,951.

**Piozzi, pī-ōz'ī** (Ital. pē-ōt'sē), **Hester Lynch Salisbury**, English author: b. Bodvel, Carnarvonshire, Wales, 16 Jan. 1741; d. Clifton,



## PIP — PIPE

Gloucestershire, 2 May 1821. In 1763 she was married to Henry Thrale, a wealthy brewer of Southwark, which borough he afterward represented in Parliament. In 1764 the Thrales made the acquaintance of Dr. Johnson, who lived much with them for more than 16 years, and of whom she published 'Anecdotes' in 1786. Thrale dying in 1781, his widow married in 1784 Gabriel Piozzi, a Florentine music master, then resident in Bath. This alliance annoyed her friends, and Johnson gave up her society. She accompanied her husband to Florence, and while there contributed several poems to the 'Florence Miscellany,' founded by the leaders of the Della Cruscan school, much ridiculed by Gifford. Among her writings are: 'British Synonym, or an Attempt at regulating the Choice of Words in Familiar Conversation' (1794); 'Retrospection, or a Review of the most Striking Events and Characters of the last 1,800 Years' (1801). Consult: 'Autobiography, Letters, and Literary Remains' (1861); Seeley, 'Mrs. Thrale' (1891); Countess Cæsaresco, 'Glimpses of Italian Society in the 18th Century' (1892); Boswell, 'Life of Samuel Johnson' (1791).

**Pip.** See POULTRY.

**Pi'pa.** See SURINAM TOAD.

**Pipe**, a wine measure, usually containing very nearly 105 imperial or 126 wine gallons. Two pipes or 210 imperial gallons make a tun. In practice, however, the size of the pipe varies according to the kind of wine it contains. Thus, a pipe of port contains 138 wine gallons; of sherry, 130; of Madeira, 100, etc. The pipe of port is seldom accurately 138 gallons, and it is customary to charge what the vessel actually contains.

**Pipe, Manufacture of.** Pipes are hollow cylinders made of various materials, and used as conduits for liquids, air, or gas. The material of construction varies according to the character of the substance to be conveyed, its availability in any particular locality, and its relative cheapness. They may be divided into five general classes characterized by the materials of which they are made—metal, wood, earthenware, cement, and rubber. Metal pipes are made of lead, block-tin, zinc, brass, copper, cast-iron, wrought-iron, and steel. Lead pipes have been used from the earliest times. Up to the close of the 15th century, they were made of sheet lead bent around a metal core, and welded or soldered along the horizontal joint. About the beginning of the 16th century, a casting method was invented by Robert Brooke, which was extensively employed in England up to the close of the 18th century, when it was superseded by the pressing and drawing methods in use at the present time. They are made in continuous length, by squeezing the molten metal through a die (a steel plate perforated with a hole containing a central core) by hydraulic pressure. Different sizes of pipes are produced by changing the dies, the cores of the dies determining the diameter of the bores. Sizes of pipes are designated according to the measurement of their internal diameters. Lead water-pipes range from  $\frac{3}{8}$  to 5 inches, while the waste pipes range from  $1\frac{1}{2}$  to 5 inches. Lead pipes as small as 1-16 of an inch, and as large as 8 inches, are made for various purposes, but the 2-inch is the size most generally used.

The high cost of lead and the great thickness of metal required to withstand high pressures, practically prohibit the production of the larger sizes. Pipes of ductile metal such as block-tin, brass, and copper, are made by drawing methods. An ingot of metal is cast in cylindrical shape with a conical end, and with a hole through its axis corresponding in size to the bore of the desired pipe. A mandrel (long iron rod) is thrust into the hole so that it projects slightly beyond the conical end. This end is then placed in a funnel-shaped hole drilled through a steel post fixed to the drawing table, and gripped at the outer end by a pair of pincers at the end of a chain attached to the power machinery. The ingot together with the mandrel is then drawn through the hole, the former being thus extended uniformly over the latter in the form of a complete pipe. Unlike the pressure method, the metal is drawn cold, and often requires annealing, as it hardens under the repeated drawings. Block-tin pipes are used in soda fountains, and as conveyors of beer and chemicals. Copper pipes are used in distilleries, and when employed in chemical works are tin-plated within to protect them from corrosion. Brass is generally used for pipes exposed to great heat, such as the tubes of steam boilers, etc. Block-tin pipes range from  $\frac{3}{8}$  to  $2\frac{1}{2}$  inches in diameter.

**Cast-iron Pipe.**—In making cast-iron pipes, the mold used consists of two parts—the core which shapes the interior, and the flask which holds the pattern for the exterior form. The core is made by winding a hay-rope around a spindle and coating it with several layers of clay. It is then shaped in a lathe to the desired size, and dried in an oven. Tempered clay and sand are rammed around the pattern in the flask, and then dried in an oven to form a mold. The pattern is then removed, the flask is placed in a vertical position and the core exactly centred within it. The molten metal is run into the space between the mold and the core and, when partly cooled, the core is drawn out and the interior of the pipe is coated with asphaltum to prevent corrosion. In size they range from 2 to 60 inches, and are made in standard lengths of 12 feet. The larger pipes are generally cast in shorter lengths in order to keep down the weight of the individual pipes so as to permit convenient handling. They are used for water mains, pneumatic tubes, exterior casings for other tubes and pipes, etc.

**Wrought-iron Pipe.**—Wrought-iron pipes appear to have been first employed to convey illuminating gas. At the present time they are used for a great variety of purposes, but principally as street water main and service pipes, the house pipes being made, usually, of lead, or block-tin. At first they were made by hand, the plates being bent and the seams welded, a few inches at a time. The development of steam engineering, however, created a demand for larger and stronger pipes, in the production of which new processes of manufacture employing special machinery have been introduced and developed to a high state of perfection. The wrought-iron pipe and tube industry was one of the last to discard puddled iron in favor of Bessemer steel. The advantages of increased strength and lower cost, to be obtained by the use of steel, had been fully realized for some



## PIPE

time, but the difficulty of making lap-welded and butt-welded steel pipes, having the same strength in the weld as in the body of the pipe, prevented its adoption.

*Methods of Manufacture.*—These difficulties, however, have been overcome by improved methods of production in materials, and machinery in pipe making. The general process of manufacture is as follows: A carefully selected grade of cast iron, together with the proper quantities of coke and limestone, are melted down in the cupolas of a blast furnace, drawn off, and placed in the Bessemer converters, where it is heated until practically all of the carbon in the cast iron has been burned out. The metal is then poured into casting ladles, into which an amount of ferromanganese is also added, sufficient to give the proper proportions of manganese and carbon. The resulting metal is a mild steel of a very reliable welding quality. The cast ingots are then placed in the soaking pit and raised to a white heat. From the soaking pit they are picked out by overhead cranes, and rolled down into the blooms of the blooming mill. This mill is of massive construction, and is driven by a pair of horizontal reversing engines of 3,000 H.P. It consists of a set of reversible mill rolls, with a long table of rollers on each side. The action of the rollers draws the ingot quickly into the rolls, and as soon as it has passed through, the engines are reversed, the rolls are brought a little closer together by a pair of screws set in the standards, and the ingot is again reduced in thickness. This operation is repeated until it has been brought down to the desired section, when it is sheared into short lengths, called slabs and billets. These are reheated and passed through a continuous mill, consisting of a large number of rolls in pairs, placed one beyond the other at increasing intervals. As the billets or slabs are carried through each successive pair of rolls, they are reduced in thickness and increased in length, until they issue from the last pair of rolls in the form of long narrow plates, known as skelp. They vary in width from a few inches up to eight feet. In the narrower strips, used for smaller pipes, the width is sufficiently uniform to dispense with the necessity of trimming up with shears, but the skelp for large pipes has to be carefully trimmed to the right dimensions. In general, all wrought-iron or steel pipes may be divided into two classes—lap-welded, ranging from  $1\frac{1}{2}$  to 30 inches, and butt-welded, from  $\frac{1}{3}$  to  $1\frac{1}{4}$  inches in diameter. In lap-welding, the plate is first laid upon a traveling table and has its edges scarfed or beveled. It is then heated in a bending furnace and rolled up into the form of a pipe, with the beveled edges overlapping. This partially made pipe (known also as skelp) is brought up to a welding heat in a gas fired furnace, and then passed through the concave welding rolls between which a ball-shaped mandrel, the diameter of which is equal to that of the pipe, is held in position by a long bar. As the skelp passes through the rolls, the overlapping edges are squeezed together between the rolls and the mandrel into a perfect weld. The rough pipe is then passed through the sizing rolls and brought to the exact diameter required; then through the cross-straightening rolls and made perfectly straight; then rolled on a cooling table while cooling, to prevent warping, and

finally forced through the dies of the straightening machine by hydraulic pressure. The ends are then trimmed and threaded, and after being screwed into the couplings, it is tested in a hydraulic testing machine. The smaller sizes under pressures ranging from 600 to 1,500 pounds, and the larger sizes from 500 to 750 pounds to the square inch. Oil well piping is tested under pressures as high as 2,500 pounds to the square inch. In butt-welding, the edges of the plate are left square. The skelp is heated in a furnace and raised to a welding heat. It is then drawn through a bell-shaped die, the diameter of which is a little less than that of the skelp. The pressure thus induced squeezes the edges together and makes a perfect weld. The smaller pipes are usually fitted with screwed flanges and couplings. In the larger pipes the flange is formed out of a bar of steel, bored out and faced on the inner face, a half inch fillet being left on the inner edge. The end of the pipe is swaged down slightly, the flange pushed over it and the edge of the pipe beaded over to hold the flange in place while it is in the furnace. When it has reached a welding heat, it is placed on a concave anvil, stepped to receive both pipe and flange, and revolved axially under the blows of the hammer which quickly effect a weld. Flanges have been welded on pipes over 30 inches in diameter, with satisfactory results.

*Coupling.*—Pipe couplings are made from bars of iron corresponding to the width and thickness of the desired coupling. The smaller sizes are made by a machine which cuts up the bar into the proper lengths and forms up the pieces on a mandrel with great rapidity. These pieces are then heated in a welding furnace, and welded under the blows of a quick-acting steam hammer. The larger sizes are made from bar iron of the proper length, which is formed up by a machine consisting of a vertical cylindrical mandrel of a diameter equal to that of the desired coupling. A vertical roller attached to the end of a horizontal arm travels around the mandrel. One end of the heated bar is placed between the mandrel and the roller; the roller is then revolved around the mandrel and bends the bar into the required circular form. The piece is then reheated, slipped over a cylindrical mandrel, and the joint welded under the blows of a quick-acting steam hammer.

*Varieties.*—Spiral-riveted and spiral-welded pipes are made by winding thin iron plates spirally around a mandrel into tubular forms, and the overlapping edges riveted or welded together. They are made in standard lengths of 20 feet, and range from 3 to 24 inches in diameter. The metal plates used range from .035 to .109 inches in thickness. They are capable of withstanding bursting pressures up to 1,330 pounds to the square inch.

The locking-bar pipes are made of two semi-circular plates of metal joined together longitudinally by a channel bar of soft steel, the flanges of which are pressed into the edges of the plates until a tight joint is effected. They are used extensively in Australia, the largest manufactory being situated at Falkirk, on the outskirts of Perth, in Western Australia. Their most important employment is in connection with the Coolgardie water supply system, which includes a pipe line 30 inches in diameter and over 300 miles long, through which water is



## PIPE

pumped to the gold fields in the interior. The earliest forms of wood pipes were simply bored logs. Their first use as a continuous tube was the 6-foot pen-stock built at Manchester, N. H., in 1874, by J. T. Fanning. It is still doing service.

The use of metal bands around wood-stave pipes was first suggested in 1880, and were first extensively used in Denver, Colo., in 1883. This particular kind of pipe is built in a trench. The staves are of different lengths (break joints when laid, and allows continuous construction), have radial edges and concentric faces. They are bound together by metal rods of circular section, provided with screw ends and nuts for tightening. These rods or bands are spaced on the pipe according to the amount of internal pressure they are expected to withstand. The staves used are thin enough to secure complete saturation, and to deflect readily to the curvature employed; yet, thick enough to prevent an undesirable amount of percolation through them. The proportion between the thickness of the staves and the strength of the bands is such that the swelling of the wood does not produce injurious strains upon the bands. They range from 10 to 72 inches in diameter; are capable of withstanding pressures as high as 1,100 pounds to the square inch; and have done service, in the United States, for periods ranging from 20 to 50 years, without any material deterioration.

*Fibre Pipe.*—Fibre pipes are made by winding sheets of wood pulp around a core. The desired thickness being obtained, the tubes are saturated with a wood preserving solution, and dried. The joints at the ends are turned in a lathe, and they are provided with screw couplings. They may be made in any size or thickness, but usually range from 1 to 8 inches in diameter, with a uniform length of 5 feet. Being made of a non-corrosive material, they are especially useful for conveying chemicals.

*Clay Pipe.*—Earthenware or terra-cotta pipes are represented by the various forms of drain tiles, designedly made porous or vitrified, and with or without joint sockets, according to the purposes for which they are used. They were first made in England about the close of the 18th century, and were mere cylinders of porous baked clay. In recent years their manufacture has attained the proportions of a great industry. They are produced by forcing prepared plastic clay through a die into the form of a continuous tube, which is subsequently cut up into shorter lengths, and the joint sockets molded by a special machine. They are then baked in kilns by a very high temperature. The vitrified variety are glazed by the introduction of salt into the fire holes of the kilns while the pipes are being baked, so that the salt is volatilized and combines with the silica in the clay. They range from 1½ to 36 inches in diameter, and from 1 to 3 feet in length. (See SEWER PIPE.) Pipes are also made of cement and concrete. They are usually molded in place by the use of a movable mold and core, which is shifted along the work, or by stationary built-up molds, which are torn out after the cement has set. Wire nettings and iron rods are often inserted in the cement to give additional strength.

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**Pipe, Tobacco,** a bowl and connecting tube, made of baked clay, wood, stone, or other material, and used in smoking tobacco. The cheap pipes in common use are made of a fine-grained white plastic clay. Much finer and more expensive pipes are made of meerschaum, a somewhat plastic magnesian stone of a soft greasy feel. (See MEERSCHAUM.) This material is found in several parts of Europe (in Moravia, Piedmont, and the Crimea), but more abundantly and of finer quality in Asia Minor. Meerschaum pipe making is carried on to the greatest extent by the Germans, and Vienna may be said to be the centre of the manufacture. Sometimes the bowl alone (which is frequently artistically carved) is of meerschaum, the stem being of wood, the best sorts of which are got from the young stems of the Mahaleb cherry, grown near Vienna, the mock orange of Hungary, and the jessamine sticks of Turkey. The stem, whether of the same material as the bowl or of wood, is usually provided with a mouth-piece of ivory, silver, or amber, the last being preferred. Briar-root pipes, with the bowl and stem of one piece of wood, and provided with amber, ivory, or bone mouth-pieces, are now very common; they have little or no advantage over the clay pipe except in being less liable to break. Many Germans prefer pipes with porcelain bowls, which are sometimes beautifully painted in the style of fine chinaware painting. The Eastern hookah is a pipe of great size, the bowl of which is set upon an air-tight vessel partially filled with water, and has a small tube which passes down into the water; the long flexible smoking-tube is inserted in the side of the vessel. By exhausting the air in the smoking-tube, the smoke is forced down through the water, and entering into the space above it passes into the stem, cooled and freed from some of the most acrid properties of the tobacco.

In the United States, Indian pipes have been in use from very remote periods. They are found in the ancient mounds of the West, together with other relics of an unknown race, elaborately carved in stone into fanciful shapes, often resembling various animals of the country. In northern New York they are frequently discovered in plowing the land. Some are of soapstone and others of baked clay. In the account of the discovery of the Hudson River by Robert Juet, mention is made of "red copper tobacco pipes and other things of copper, which the savages did wear about their necks." In the Northwest Territory, upon the summit of the dividing ridge between the Saint Peter's and the Missouri rivers, and in the latitude of Saint Anthony's Falls, the Indians have long procured a peculiar variety of red steatite or soapstone of which all the red stone pipes of that region are made. The locality is held in great reverence by the Indians, and they have strongly opposed any attempts of the whites to visit it. Catlin, however, succeeded in overcoming their scruples, and was shown the spot at the base



## PIPE-CLAY — PIPE LINES

of a long vertical wall of quartz, which lay in horizontal strata, the pipestone layers spreading under the adjoining prairie land of the ridge, whence it was obtained by digging a few feet in depth. He judged from the great extent of the excavations, and from the graves and ancient fortifications, that the place must have been frequented by different tribes of Indians for many centuries. The pipes made of this stone are heavy, and usually of rather plain form, decorated by bands and ornaments of lead, which appear to have been run into depressions made to receive it and then smoothed down. The stems are long and curiously carved sticks of hardwood, sometimes flat, frequently ornamented with gaily colored feathers of birds and horse hair dyed of scarlet hue.

The manufacture of the more expensive pipes in the United States began about 1860. Previous to that time they were imported; but the ordinary clay pipe has been in use since 1820. The earliest manufacturer whose name is now recorded was Thomas Smith, tobacco-pipe maker, of the city of New York, in 1847. The high tariff during the Civil War stimulated manufacturing. This was commenced on the smallest possible scale by two or three enterprising German workmen, with neither machinery nor experience. The goods could not be compared with the European product, and they were almost as expensive, even with the high tariff paid on the imported articles. Trade itself previous to the Civil War was very small. Edward Hen, who before 1860 was almost the only importer of note, was known as the pipe man of the United States. His pipe business was less than \$50,000 per year. William Demuth, a pupil of the celebrated Edward Hen, began the making of pipes in 1861. The prices of goods before and during the war were twice as high as they are now, and American goods in many instances were not up to the standard of European goods. In 1904 the pipe industry in the United States was not only equal to that at the celebrated factories in Vienna, Ruhla, and Saint Claude, but surpassed the latter in many respects. Many improvements and inventions have been made in America, which were later introduced into Europe. The capital now used in this business is over \$2,000,000, fully 75 per cent of this amount being invested in domestic manufactures and their products. The sales of smokers' articles will not fall short of \$3,000,000 annually. Machinery, study, enterprise, and protection have enabled the manufacturers here from year to year to reduce the cost of production.

**Pipe-clay.** See CLAY.

**Pipe-fishes,** small teleostomous fishes included in the order *Lophobranchii* (and with the sea-horses (q.v.) constituting the family *Syngnathidæ*). The gills are disposed in tufts on the branchial arches, the gill-cover is a simple plate and the gill-aperture of small size. The body is covered by bony plates arranged transversely, and in the pipe-fishes is very long and attenuated. No ventral fins exist, and the jaws are united to form a pipe or tube, bearing the small, toothless mouth at the tip.

A very curious and remarkable circumstance in connection with the pipe-fishes consists in the males of some species possessing a pouch-like fold, situated on the under side of the abdomen or tail, in which the eggs are contained after

being extruded from the body of the females. And after the young fry are hatched they continue to reside within this pouch for a longer or shorter period, when the pouch opens and permits them to escape. No analogous structure is found in the female.

The family *Syngnathidæ* comprises about 15 genera and 150 species, all small fishes of warm seas, and most of them true pipe-fishes, which differ from the sea-horses in the possession of a caudal fin, while in the latter the fin is absent and the tail prehensile. Several genera of pipe-fishes occur in American waters, the principal one being *Siphostoma*, with at least 25 North American and West Indian species. The common pipe-fish (*S. fuscum*) is the only species found on the coast of the New England and Middle States and is very common in shallow bays and estuaries, where it lives among the vegetation. In this and related species the egg-pouch is formed of a pair of longitudinal folds which extend along the greater part of the long tail. All of the pipe-fishes are feeble swimmers, the fins being very small and weak; and their manner of moving through the thick vegetation may be described as crawling rather than swimming. They make very interesting tenants of salt-water aquaria. In *Doryrhamphus* the egg-pouch is beneath the abdomen; while the males of the genus *Syngnathus* carry the eggs uncovered on the skin.

The name pipe-fish is also applied to the members of the genus *Fistularia*, or trumpet-fishes, included in the order *Hemibranchii*. The bones of the face are prolonged to form a tubular structure, at the extremity of which the mouth opens. The *Fistularia tabaccaria* of the Antilles, averaging about three feet in length, represents this genus and occurs not infrequently on our Atlantic coast.

**Pipe Lines.** A form of transportation that may be used for any liquid or gas, but principally employed to transport the petroleum and natural gas products from the wells in the oil fields to the refineries and the markets or points of utilization, with the minimum of expense. Soon after the discovery of petroleum in the United States, the transportation of the product formed an important factor in the problems relating to its profitable marketing. Although petroleum was discovered as early as 1829, up to 1870 the use of wooden and iron tank cars prevailed, entailing a great cost in transportation, and resulting in a comparatively slow disposal of the product. To lessen the cost of transportation, the practicability of employing a conduit of wrought-iron piping was suggested by Gen. S. D. Karns, of Parkersburg, W. Va., as early as 1860, but pipe lines were not successfully operated until ten years later. Karns' idea involved the principle of gravity; he proposed to lay a line of pipe from the wells at Burning Springs to Parkersburg, a distance of about 36 miles, and allow the oil to flow down to the shipping points on the Ohio River. Through a lack of enterprise more than any other reason, the line was never laid. His idea was taken up and developed by J. L. Hutchinson, of New York, who in 1862 laid a pipe line from the Tarr Farm wells to the refinery at Plumer, Pa. As the wells and the refinery were situated on opposite sides of the hill, the pipe line formed a siphon, which, under the effect of the high air



## PIPERINE—PIPING CROW

pressure, leaked freely at the joints, and resulted in its final abandonment. He laid another line in 1863, from the well at Sherman to a refinery three miles distant. In this case, the oil was pumped from the well to the refinery, but as in the former case the leakage at the joints was too great to allow the line to be a practical success. Between 1865 and 1870, a great many attempts were made to employ this method of transportation in the various oil fields throughout the country, with more or less success, in spite of the opposition of those interested in the employment of wagons and tank-cars, but, the unqualified success of the line laid by Samuel Von Sycle, of Titusville, Pa., from Pithole City to Miller's Farm, in 1865, induced the creation of numerous pipe line companies, and the extension of the lines to distant shipping points. In 1875, the Pennsylvania Transportation Company, authorized to lay a pipe line from the oil regions to tide water, laid one from the lower oil regions to Pittsburg, a distance of about 60 miles. Its operation was highly successful. The refineries, heretofore located near the wells, were removed to various ports on the seaboard, and on the shores of the Great Lakes, and the connecting pipe lines were rapidly laid. By 1877, ten or twelve pipe lines were being operated through the oil regions, while the laying of long distance lines was commenced by the United Pipe Lines Company. By 1892, the National Transit Company controlled several great trunk lines, of which, the most important ran from Bear Creek, Ohio, to Pittsburg, Pa., 55 miles; Bear Creek to Cleveland, Ohio, 111 miles; Colegrove to Philadelphia, 237 miles; Olean to Buffalo, 50 miles; Olean to New York, 325 miles; Millway to Baltimore, 60 miles; and a double line from Lima, Ohio, to Chicago, a distance of over 200 miles. By this time, the great competition reduced the profits derived from pipe line transportation, and led to the consolidation of the companies, and by 1902, two companies, of which the National Transit Company was the larger, controlled all of the pipe lines in the United States. It is estimated that the National Transit Company, handling the output of the Standard Oil Company, exclusively, controlled in 1904 about 40,000 miles of pipe line; while, in Pennsylvania alone, it is estimated that over 25,000 miles of line are used in the transportation of crude oil. In foreign countries, Russia appears to be the only one employing the method. The first line was laid in 1879, from the Baku wells to a refinery situated at a distance of about nine miles. By 1895, over 20 pipe lines were in operation, and long distance lines are now being constructed. The line from Mikhoilov to Bohem, laid in 1900-1, is about 145 miles long.

Oil pipe lines connect points by straight lines, as near as possible, and are usually laid below frost line, two or three feet under the surface of the ground, the undulations of which they follow throughout their entire course. They are constructed of wrought-iron pipes 4 to 8 inches in diameter, and are provided with bends at regular intervals to compensate the expansion and contraction due to varying temperatures. Pumping stations and storage tanks are placed at intervals of 30 miles, or they are located at central points in the valleys along the lines, to pump the oil over the intervening hills and mountains. High pressure compound condensing pumps are

used, working under a head depending upon the topography of the country through which the line is laid, and upon the friction due to the diameter of the pipe and the length of the line. The plugging up of the pipes by sedimentary deposits is prevented by running a "go devil" scraper through the pipes, which is forced along from station to station with the oil by the pressure of the pumps, and scrapes off the paraffin incrustations.

Pipe lines for conducting natural gas vary in construction greatly, being made from wrought-iron piping 2 or 3 inches in diameter, large cast-iron pipes, or from riveted steel-plate tubes, ranging from 15 to 25 inches in diameter. In the United States, the use of natural gas followed the general development of the petroleum industry. Numerous gas pipe lines were established in the various gas producing areas, some of which are in operation at the present time, while many have been abandoned upon the exhaustion of the wells. Each of the main lines is about 50 miles in length, and originally conducted gas at pressures ranging from 200 to 1,200 pounds per square inch. In late years, however, these pressures have decreased enormously, being now but a small fraction of what they were, and necessitating the employment of pumps to maintain a delivery pressure ranging from 10 to 50 pounds per square inch.

*Bibliography.*—For detailed information consult: 'Proceedings of the British Association for the Advancement of Science' (1885); and 'The Mineral Industry' (New York 1893).

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**Pip'erine, Piperidine, Piperic Acid and Piperonal Piperine** ( $C_{17}H_{19}NO_2$ ), an alkaloid found in different varieties of pepper and related to both pyridine and pyrocatechnic acid. Obtained from black pepper by extraction with hot alcohol. A colorless crystalline substance, insoluble in water, soluble in alcohol ether and other like solvents. When digested with a hot alcoholic solution of caustic potash it breaks down into piperidine and piperic acid. Piperidine ( $C_5H_{11}N$ ) or hexa-hydropyridine is an oily liquid boiling at  $106^\circ C.$ , soluble in both water and alcohol, having the odor and taste of pepper. Piperic acid ( $C_{12}H_{10}O_4$ ) is a monobasic, pale yellow crystalline acid, slightly soluble in water, somewhat more so in alcohol. Careful oxidation in dilute neutral solution with permanganate of potash gives piperonal (heliotropine) ( $C_8H_5O_2.CHO$ ), a colorless crystalline body, soluble in both water and alcohol and having a very pleasant aromatic odor. Used in perfumery. It is closely related to vanillin, the flavoring principle of vanilla bean. All of the above compounds have been made in the laboratory by various synthetic processes.

**Pipe'wort**, an acaulescent, or very short-stemmed bog or aquatic plant, with tufted grass-like basal leaves and very small flowers in terminal solitary heads on long, slender, hollow, ribbed scapes. Many species exist in the family *Eriocaulonaceæ*.

**Pi'ping Crow**, a bird (*Gymnorhina tibicen*) of New South Wales, remarkable for its musical powers, and for its ability in mimicking the voices of other birds. It is black and white in color, and is allied to the shrikes.



**Pipiri**, pē-pē'rē, a West Indian name for the large tyrant flycatchers known in the United States as kingbirds, especially *Tyrannus dominicensis*.

**Pipistrelle**, one of the smallest and most familiar of European bats (*Vespertilio Pipistrelle*).

**Pip'it**, or **Titlark**, a small European lark-like bird of the genus *Anthus*, of the wagtail family (*Motacillidæ*), to which these birds conform in their habit of running swiftly on the ground. Their food consists chiefly of insects. The meadow-pipit (*Anthus pratensis*) and the tree-pipit (*A. arboreus*) are familiar species. All the pipits build their nests on the ground. The song in all consists of a clear simple note, suggesting the bird's name.

**Pip'pal**, an Indian tree. See PEEPUL.

**Pippi**, pīp pē, **Giulio**. See GIULIO ROMANO.

**Pip'pin**, the name given to a certain class of dessert apples, probably because the trees were raised from the pips or seeds, and bore the apples which gave them celebrity without grafting. They seem to have been introduced into Great Britain from France, and were little known there until about the end of the 16th century. In the time of Shakespeare pippins were delicacies for the dessert: Sir Hugh Evans, in the 'Merry Wives of Windsor,' says: "I will make an end of my dinner — there's pippins and cheese to come." Justice Shallow, in his invitation to Falstaff, says: "You shall see mine orchard, where, in an arbour, we will eat a last year's pippin of my own grafting." The ribston, golden, Newton, and the small Scotch oslin or arbroath pippin are favorite sorts. See APPLE.

**Pipsis'sewa**, a plant, prince's pine (q.v.).

**Piqua**, pīk'wā or -wā, Ohio, city in Miami County; on the Miami River, the Miami & Erie Canal, and on the Pittsburg, C., C. & St. L. and the Cincinnati, H. & D. R.R.'s; about 70 miles northwest of Columbus. The extensive water-power has contributed toward making the city an important industrial centre. The chief manufacturing establishments are large linseed-oil works, strawboard mills, woolen mills, furniture factory, rolling mills, iron-works, stove and ranke works, and sheet steel-mills. Its educational institutions are a high school, public and parish schools, and the Schmidlapp Free Library. The city owns and operates the water-works. Pop. (1890) 9,090; (1900) 12,172.

**Piqué** (pē-kā') **Work**, a fine kind of inlaid work, the inlay being minute pieces of gold, silver, and other costly materials. It is confined to articles of small size, such as card-cases, snuff-boxes, etc.

**Piquet**, pē-kēt, a game of cards played between two persons with 32 cards, all the plain cards below seven being thrown aside. On the cards being shuffled the players cut for deal; the party drawing the lowest card has to deal first. The cards are then dealt two by two until each player has 12 cards, the eight remaining undealt (called the stock) are laid on the table between the players. The first hand (the non-dealer) must then discard five or less of his cards (he must discard at least one), exchanging them for an equal number drawn from the stock; the younger hand (the dealer) may exchange from

the stock three or less, but may refuse to exchange altogether. In playing, the cards rank in order as follows: the ace (which counts 11), the king, queen, and knave (each of which counts 10), and the plain cards, each of which counts according to the number of its pips. The player who first reaches 100 has the game. The score is made up by reckoning in the following manner: Carte blanche, the point, the sequence, the quatorze, the cards, and the capot. Carte blanche is a hand of 12 plain cards, and counts 10 for the player who holds it. The point is the suit of highest value, the value being determined by the number it makes up when the cards held are added together; thus, if a player holds ace, king, ten, nine, and eight, his point would be 48. The first player having called a point, the younger hand must then say whether his point is superior, equal, or inferior in value to his opponent's, by calling in the first place "good," in the second "equal," and in the last "not good." If the elder hand's point is "good" he at once shows it, and counts one for each card in it, except with the points 34, 44, 54, and 64, which count one less than the number of cards. If the points are equal he counts nothing. The sequence is composed of a regular succession of cards in one suit, and the highest sequence. The quatorze is composed of four aces, four kings, four queens, four knaves or four tens, and counts 14. The winner of the greatest number of tricks counts 10 in addition (the "cards"), if he holds all the tricks he counts 40 in addition (the "capot"). For the sake of convenience the scores are generally recorded at the end of the hand; but they are recordable no matter by which hand they are made, according to the following table of precedence: 1, carte blanche; 2, point; 3, sequences; 4 quatorzes and trios; 5, points made in play; and 6, the cards. If one player scores 100 before the other obtains 50 he wins a double.

**Piracicaba**, pē-rä-sē-kä'bä, Brazil, a town of the state of São Paulo, on the Piracicaba headstream of the Tieté affluent of the Parana River, about 100 miles northwest of São Paulo with which and Rio de Janeiro, 270 miles eastward, it is connected by rail. It has an active export trade in the coffee and sugar of the surrounding region. Pop. 5,000.

**Piracy**. See PIRATE.

**Piræus**, pī-rē'ūs, Greece, the port of the city of Athens, lying five miles southeast of the city and now terminus of railroads to Athens and to the Morea. Three excellent harbors indent the shore deeply, Piræus, Zea, and Munychia. Munychia is also the name of the mountainous peninsula separating the harbor from the Saronic Gulf, and on this peninsula is the town, which was built 493 B.C. by Themistocles, whose able policy of Athenian defense soon effected the construction of the famous "long walls." These made Athens independent of the rest of Attica, as was plainly seen in the Peloponnesian War, when, with the additional walls built by Cimon and Pericles, Athens was undisturbed, although all Attica outside of the walls was in the hands of the Peloponnesians. But the destruction of the remains of the Athenian navy at Ægospotami in 404 B.C. left the port defenseless; it was taken and the walls were destroyed to the music of the flute. Canon re-



built them 10 years later and the city regained some of its importance temporarily. But the splendid city, one of the master works of the Periclean age, was finally destroyed by Sulla in 86 B.C., and there was only a wretched village on its site even some years after 1836, when Athens again became the capital of Greece. But in 1835 the old name had been revived, to take the place of Porto Leone, the name given by the Italians. The present city is modern in its construction; has street railways, a gymnasium, exchanges, and theatres; is the second port in Greece, being outranked only by Syra; manufactures macaroni, cognac, liquors, and various textiles; has a large import and a moderate export trade; and is the main station of the Austrian Lloyds Company, and of various steamship lines, so that it is in direct connection with Trieste, Corfu, Constantinople, Smyrna, Alexandria, and Marseilles. There are several consulates. Pop. (1871) 11,000; (1889) 34,327; (1896) 43,001.

**Pirai**, pī-rī', or **Piraya**, pī-rä'yä, (*Serrasalmo piraya*), a voracious fresh-water fish of the caribe family of tropical America. It is three or four feet in length, and its jaws are armed with sharp lancet-shaped teeth, by which cattle when fording rivers sometimes suffer terribly, and which are used by the Indians of Guiana for pointing their blow-pipe arrows, etc. See CARIBE.

**Piranesi, Giovanni Battista**, jō-vän'nē bät-tēs'tä pē-rä-nä'zē, Italian architect and engraver: b. Venice 4 Oct. 1720;; d. Rome 9 Nov. 1778. He passed the greater part of his life at Rome. He published: 'Antichita Romane' (1756); 'Antichita d'Albano e di Castel Gandolfo'; 'Trofei d'Ottaviano Augusto'; 'Della Magnificenza ed Architettura de' Romani'; and over 100 views of modern Rome. His architectural designs display much grandeur and fertility; but his representations of real objects are not always faithful. His son and pupil, Francesco, continued the publication of works on similar lines.

**Pirate**, the name applied a robber or highwayman of the sea; a freebooter, or buccaneer. Piracy is the term applied to the crime of robbery committed upon the high seas. It is an offense against the universal law of society. As the pirate has renounced all the benefits of society and government, and has reduced himself to the savage state of nature, by declaring war against all mankind, all mankind must declare war against him; so that every community has a right, by the rule of self-defense, to inflict that punishment upon him which every individual would, in a state of nature, otherwise have been entitled to do for any invasion of his person or personal property. By various statutes in England and the United States other offenses are made piracy. Thus, if a subject of either of these nations commits any act of hostility against a fellow-subject on the high seas, under color of a commission from any foreign power, this is an act of piracy. So, if any captain of any vessel, or mariner, run away with the vessel, or the goods, or yield them up to a pirate voluntarily, or if any seaman lay violent hands on his commander, to hinder him from fighting in defense of the ship or goods committed to his charge, or make a revolt in the ship, these offenses are acts of piracy by the laws of England.

By statute of George II. the ransoming of any neutral vessel, which has been taken as a prize, by the commander of a private ship of war, is declared to be piracy. By the act of Parliament, passed in 1824, the slave-trade is also declared to be piracy. In the time of Richard I., all infidels were regarded as pirates, and their property was liable to seizure wherever found. By the law of nations the taking of goods by piracy does not divest the actual owner of the property. Piracy, with intent to murder, stab, or wound, is capital, and pirates can gain no rights by conquest. It is of no importance, for the purpose of giving jurisdiction in cases of piracy, on whom or where a piratical offense is committed. A pirate, who is one by the law of nations, may be tried and punished in any country where he may be found; for he is reputed to be out of the protection of all laws. But if the statute of any government declares an offense, committed on board one of its own vessels, to be piracy, such an offense will be punished exclusively by the nation which passes the statute. In England the offense was formerly cognizable only by the admiralty courts, which proceeded without a jury, in a method founded upon the civil law. In the United States piracy is tried in the Federal courts.

Piracy, in the common sense of the word, is distinguished from privateering by the circumstance that the pirate sails without any commission, and under no national flag, and attacks the subjects of all nations alike; the privateer acts under a commission from a belligerent power, which authorizes him to attack, plunder, and destroy the vessels which he may encounter belonging to the hostile state. He is not regarded as a pirate by the laws of nations, but in accordance with these is bound to observe certain rules and restrictions. Thus, he is debarred from attacking the vessels of the enemy while lying in any port or haven under the protection of a friendly or neutral state. See NEUTRALITY.

**Pirate-bug**, a predaceous bug of the family *Reduviidæ*. See CONE-NOSE.

**Pirene**, pī-rē'nē, a spring of crystal water at Corinth, which in Greek tradition was sacred to the Muses.

**Pirithous**, pī-rīth'ō-ūs (Gr. Peirithoos), in Grecian mythology a son of Zeus and Dia, the wife of Iscion: he was king of the Lapithæ. At the marriage of Pirithous with Dejanira, Eurythion, one of the Centaurs, attempted to do violence to the bride, and thence resulted the famous battle of the Centaurs and Lapithæ. After the death of Dejanira (also named Hippodamia) Pirithous with his trusty friend Theseus carried off Helen from Sparta. At Athens it was decided by lot which was to have her, and Theseus won; but under the conditions of the lot the winner must help his comrade to procure a wife, and Pirithous' choice of a wife was Proserpine, wife of Pluto. To the infernal kingdom therefore the two heroes went down, but suddenly were powerless to stir from the seats they had taken. Afterward Hercules delivered Theseus, but Pirithous remained in Hades for evermore, loaded with 300 chains.

**Pirogue**, pī-rōg', or **Periagua**, pēr-ī-ä'gwa, the name given a small canoe used on the Western rivers of the United States and in the West Indies, Central and South America. It is



## PIRON — PISA

commonly cut from a single log and is popularly known as a dug-out.

**Piron**, pē-rôn, **Alexis**, French wit, poet, and dramatist: b. Dijon 9 July 1689; d. Paris 21 Jan. 1773. He studied law at Besançon and later went to Paris, where he produced in 1738 his *chef d'œuvre*, 'Metromanie,' a comedy which Laharpe characterizes as excelling in plot, style, humor, and vivacity almost every other composition of the kind. In the latter part of his life he made repeated attempts to gain admission into the French Academy, but without success. He revenged himself for his disappointment by calling the Academy *Les invalides du bel esprit*, and composing the humorous epitaph,

Ci-gît Piron, qui ne fut rien,  
Pas même académicien.

Here lies Piron, who was nothing —  
Not even an Academician.

There is a collective edition of his works by Juvigny (1776). Troubat published 'Œuvres Choies de Piron' in 1890.

**Pisa**, pē'zä or -sä, Italy, a province of Tuscany and its capital city. (1) The province of Pisa, bounded on the north by Lucca, on the east by Florence and Siena, on the south by Grosseto, and on the west by Livorno and the Ligurian Sea, has hills in the south and east, notably the Monti Pisani and the Monti di Volterra, and at the west a fertile plain, watered by the Arno and Serchio, and rich in vines and olive orchards. Its mineral wealth is marble, alabaster, and mineral waters; and its industries cotton and silk spinning. Its area is about 1,200 square miles and its population (1901) 320,829, of which 243,603 are in the district of Pisa, the others living in the second district of the province, Volterra. (2) The capital of the province, situated on both banks of the Arno, about seven miles from its mouth, is on the railroads between Genoa and Rome and between Florence and Livorno, and is the terminus of a line running from Pistoja through Lucca. The streets are old and crooked, but well paved and broad, and lined with substantial dwellings, many built of marble. The modern city is on the south side of the Arno and contains one old building of importance, the Gothic church of Santa Maria della Spina, on the Lungarno, that is, the street "along the Arno," which is peculiarly picturesque on either side of the river. In the old city to the north are: the cathedral, built of dazzling white marble in 1063 to commemorate a naval victory near Palermo, with a façade formed of four galleries of pillars, bronze doors designed by John of Bologna, and within five naves separated by Greek and Roman columns, the spoil of various Pisan victories, and 12 lateral altars attributed to Michelangelo, but probably the work of Stagi di Pietra Santa; the Baptistery, begun in 1153 and finished in 1278, a great dome-crowned rotunda 190 feet high, in which are a fountain executed by Guido Bigarelli in 1246, and a chair supported by seven columns and decorated in fine bas-relief by Nicolas Pisano (1260); the Campanile or Bell Tower, better known as the leaning tower of Pisa, finished in 1350 by Tommaso Pisano, with its six galleries of pillars, a total height of 179 feet and a deviation from the perpendicular of 14 feet, probably due to an earthquake during

building; and the Campo Santo, originally a cemetery filled in with earth from the Holy Land at the close of the 12th century, and between 1278 and 1283 surrounded by Giovanni Pisano with a rectangular portico more than 400 feet long and 170 feet wide, decorated on the outside with frescoes by Florentine and Siennese artists of the 14th and 15th century, notably the 23 scenes from the Old Testament by Benozzo Gozzoli and the 'Triumph of Death' and 'Last Judgment' by the two Lorenzetti; on the inside are funereal monuments of different periods. There are many other buildings of beauty in the city, mostly churches; mention should be made of the Palazzo Medici on the Lungarno, built in 1027 and enlarged three centuries later, of the University with an early Renaissance court, and of the Palazzo Lanfreducci, built (1590) of Carrara marble.

The industry and commerce of the city are very slight, but it has cotton factories, machine shops, glass and hat factories, and also produces alabaster. The city is a favorite winter resort because of its mild and delightful climate. It has rail connections as noted above and steamboat lines to Marina and Pontedera. It is the seat of an archbishop, of a civil and a military governor, and of a court of the first resort. Its educational equipment includes the University, founded in 1338, closed in 1359, revived in 1364 only to die out again in 1406, and newly established in 1473 by Lorenzo and in 1542 by Cosimo de' Medici, and again in 1838 by Leopold II. of Tuscany, and at present made up of faculties of law, philosophy, medicine and surgery, and mathematics and natural science, with 1,074 students in 1901-2; related to the University are normal, engineering, pharmaceutical, veterinarian and agricultural schools, a museum of natural history, founded in 1596, and particularly rich in Tuscan ornithology and geology, and a botanical garden, as well as a library of 130,000 volumes, excluding pamphlets; and there are also secondary schools, technical and industrial schools, a valuable library in the archiepiscopal seminary, a Museo Civico, and archives with documents dating back to the city's relations with Frederick Barbarossa and Richard I. of England. Pop. (1901) 61,279.

Pisa was one of the 12 cities of the Etruscan confederation, became a Roman colony 180 B.C., and in the 9th and 10th centuries took a prominent place in Italy. In the 11th century its power was extended to Sardinia and Corsica (1050), it defeated the Saracens (1063) off Palermo, and took part in the first crusade. The city sided with the Ghibellines and suffered severely when the Guelfs were victorious. The long feud with Genoa came to an end with the Pisan defeat in 1283 at Leghorn, and in 1300 Sardinia, Corsica, and the Balearic Islands were evacuated. Twenty-five years later Aragon got control of Pisa, which changed owners several times in the next three quarters of a century and in 1406 was sold to Florence. In 1409 the Council of Pisa (q.v.) met (25 March). Pisa rebelled against Florence in 1494, fought bravely for 15 years, and were finally reduced by starvation. As an appanage of Florence it became a part of the grand-duchy of Tuscany, and thus entered the Italian kingdom in 1860. Consult: Rohault de Fleury, 'Les Monuments de Pise au Moyen Age' (1866, with atlas); Schubring,



## PISA — PISCATAQUA

‘Pisa’ (1902); Valtancoli-Montazio, ‘Annali di Pisa’ (1845); Langer, ‘Politische Geschichte Genuas und Pisas im 12. Jahrhundert’ (1882).

**Pisa, Council of**, an assembly of bishops and theologians generally but not universally accounted by Catholic divines to be œcumenical. It was called by leading cardinals belonging to the two “obediences” into which the Church was at the time divided, the “obedience” of Gregory XII., canonically elected in 1406, and that of Benedict XIII. (Peter de Luna), anti-pope since 1395; and its purpose was to end the schism. The two rivals promised to withdraw their claims and to abdicate, so that then a pope might be elected with undisputed title. But the promises were not kept. The council met 25 March 1409, and was dissolved 7 August. The number of bishops who attended in person or by deputy was 200, of cardinals 20, of abbots near 300. When the rival popes refused to submit their claims to the council’s judgment, the cause of each was weighed, and both of them were declared deposed, and the election of a new pope demanded of the college of cardinals. The cardinals elected Cardinal Philargi, who took the name of Alexander V. But as Benedict and Gregory persisted in their claims the situation was only made worse, and the schism, which already had for 30 years divided the Church, continued eight years longer, till it was ended by the action of the Council of Constance.

**Pisacas**, pē-shā’kās, in Hindu mythology, certain base and cruel demons, who devour human flesh; they are practically ghouls, embodying the spirit of lying, adultery, and lunacy. Agni, the pure spirit of fire, is implored to drive them away, and by certain incantations these malignant spirits can be induced to cure diseases and perform other beneficent offices. According to early tradition they were produced by creative power from the drops of water which were scattered, in superfluous profusion at the creation of beneficent beings—gods, men, etc., or as the children of Prajapati, or of one of the Prajapatis.

**Pisagua**, pē-sā’gwā, Chile, a port of the province of Tarapaca; on the Pacific coast, 40 miles by rail north of Iquique. On 18 April 1879 the city was bombarded and destroyed by the Chileans; and near the town, 19 Nov. 1879, occurred a battle in which the combined forces of Peru and Bolivia, numbering about 11,000, were defeated by a Chilean force of 6,000. Pisagua ships large quantities of nitre brought from the interior. Pop. (1902) 9,580.

**Pisano**, pē-zā’nō, a surname or appellation of several artists of Pisa, distinguished in the early history of Italian art; among them are: (1) Giunta Pisano, or G. di Pisa, also styled Giunta di Giustino: the earliest known Pisan painter (about 1190–1250). He is supposed to have been a pupil of the Byzantine painters who came to Pisa after the capture of Constantinople by the Venetians, and to him belongs the credit of reviving the art of painting in Italy. (2) Niccola Pisano (about 1200–1275), eminent alike in sculpture and architecture, the greatest artist of the 13th century, and one of the restorers of the ancient classic sculpture, getting his inspiration from the sculpture of an ancient sarcophagus brought from Greece. Three

works typical of his style are extant, namely, the pulpit in the baptistery of Pisa, the shrine of Saint Dominic at Bologna, and the pulpit of the Siena cathedral. (3) Giovanni Pisano (about 1235–1320), son of Niccola, an artist hardly inferior to his father as sculptor or architect. His most celebrated works are the Campo Santo of Pisa, the magnificent high altar and reredos in the cathedral of Arezzo, the splendid façade of the cathedral of Siena, and the church of Saint Dominic at Perugia, the north transept of which contains his beautiful tomb of Benedict XI. The little chapel of Santa Maria della Spina at Pisa was the most beautiful of his architectural works; but it has been spoiled by “restoration.”

**Pisano, Vittore**, commonly known as PISANELLO, Italian painter and medalist: b. San Vigilio, on Lake Garda, 1380; d. 1456. He exercised his art in Verona, Venice, Pavia, Rome, Ferrara, Rimini, Milan, Mantua, and Naples. Several of his paintings are still to be seen in Verona and among them an ‘Annunciation’ in the Church of San Fermo and a ‘Saint George’ in that of Santa Anastasia. These pictures are in fresco. His principal fame, however, comes from the fact that he was one of the first artists to model portraits and cast them in metal medals. His works are prized as among the most excellent historical memorials of his time.

**Pisanus**, pī-sā’nūs, **Leonardus** (LEONARDO DI PISA), Italian mathematician of the 13th century: b. Pisa; nothing is known of the date of his birth or his death. His father, called Bonaccio (probably a nickname), was in the employ of the merchants of Pisa, who had establishments for trade on the southern and eastern coasts of the Mediterranean, and Leonardo, whose nickname in his boyhood was Bigollone (dunce), was destined by his father to be a clerk or accountant in one of the factories. To fit him for this station he was sent to the town of Bugia in Algeria, a noted emporium at that time, resorted to by European and Arab merchants. Later, in his travels round the Mediterranean, he so improved his opportunities as to acquire an extraordinary fund of erudition. Returning to Italy in 1202 he published his ‘Liber Abaci,’ in which are set forth the most perfect methods of arithmetical calculation. It is a voluminous treatise, occupying 459 pages in the printed edition of the author’s works; and deals arithmetically and algebraically with the most difficult and complex problems. He had mastered the geometry of Euclid and the algebra of Mohammed ibn Musa. Besides the ‘Liber Abaci,’ he wrote ‘Practica Geometriæ; ‘Liber Quadratorum’; and some minor treatises.

**Pisay**, pē’zā. See PISE.

**Piscataqua**, pīs-kāt’a-kwā, a river on the boundary between Maine and New Hampshire. It has its rise in East Pond, between the towns of Newfield, Maine, and Wakefield, N. H. The upper part of its course is called Salmon Falls River. The Piscataqua enters the Atlantic three miles below Portsmouth. From Portsmouth to the sea there is but little obstruction by ice—the strong tide preventing. The harbor is one of the best in the United States. The river is about 82 miles long.



PISA.



BAPTISTRY, CATHEDRAL AND LEANING TOWER.







## PISCES — PISO

**Pisces**, pĭs'ēz, that group of animals called fishes; the term has been variously limited with varying views of affinity and classification. See FISH; ICHTHYOLOGY.

**Pisces**, in astronomy, a sign of the zodiac, which is entered by the sun about 19 February. The constellation which occupies the zodiacal region corresponding to the sign has the same name; it contains some interesting double stars.

**Piscicul'ture**. See FISH CULTURE.

**Piscina**, pĭ-sī'na, in Roman antiquities, a large water basin or pool in which fish were kept; a bath. In ecclesiastical architecture, the stone basin used to receive the water after it has been used for washing the chalice, subsequent to the eucharistic celebration. The piscina is supplied with a drain-pipe to carry the water out of the church, and is usually constructed in the southern wall of the sanctuary. It sometimes takes the form of a canopied niche decorated with carving.

**Pisco**, pēs'kō, Peru, a city and port of the department of Ica, on the bay of Pisco, where the Chunchanga River empties into it. A railroad connects it with the inland cities of the department. It exports cotton, sugar, silver, wine, salt, and spirits, and has a large distillery. Pop. (1889) 4,500.

**Pisé**, pē-zā', or **Pisay**, in architecture, a mode of forming walls of rammed clay. The conformation of the walls is given by means of boards on each side, and after one layer is formed and partially hardened the boards are lifted to form bounds for another layer.

**Pisemski**, pēs'sēm-skē, **Alexei Feofilaktovitch**, Russian novelist: b. Ramene, Kostroma, Russia, 20 March 1820; d. Moscow January 1881. He was educated in the University of Moscow and was for some years engaged in government service, resigning in order to devote himself wholly to literary pursuits. His work, which belongs to the realistic school, is of a most sombre and cynical type, betraying an entire lack of high ideals and a failure to recognize anything noble or good in humanity. His most successful novel, 'A Thousand Souls,' was published in 1858, and much of his work has been translated into German and French. Among his books are 'Boyarshchina' (1847); 'A Bitter Lot' (1853); 'The Stormy Sea' (1863); 'In the Whirlpool' (1871). His complete works were issued in 24 volumes in 1895.

**Pisgah**, pĭz'ga, a mountain in Palestine, in the Abarim Range, east of the Dead Sea. The name seems at times to have been applied to the whole range, and again limited to one of the summits. It is supposed to be identical with Mount Nebo (q.v.). It is not the highest peak of the range, but the one nearest to the place where the Israelites were encamped. From the summit may be seen to the west Samaria, Lower Galilee, as far as Tabor, and the chain of Gilboa. To the southwest may be seen the north half of the Dead Sea, the precipices of Engedi, and beyond, the desert of Judea.

**Pisistratus**, pĭ-sīs'tra-tus, a notable Greek "tyrant" of Athens: d. 527 B.C. In his time there were three parties in Greece: the party of the Plain, comprising the landed proprietors, then headed by Lycurgus; that of the Coast, or

wealthy trading class, headed by Megacles; and that of the Highlands, mainly made up of the laboring population. The latter being the party that seemed most likely to further his designs, Pisistratus threw in his lot with it, and secured its allegiance by coming forward as patron and benefactor of the poor. In all his public speeches he was the advocate of civil equality and a democratic constitution. On one occasion he appeared in the market-place with several slight self-inflicted wounds, and called upon his fellow-citizens to protect him against certain alleged enemies, who had, as he said, attacked his life on account of his adherence to the democracy. A bodyguard of 50 men was voted him; this force he soon greatly increased, and in 560 B.C. seized upon the acropolis. He was now master, or, as the Greeks termed it, "tyrant" of the city, while Solon departed from his enslaved country. But though a tyrant in the Greek sense, his use of power was by no means tyrannical. He was twice in exile, once for five years, once for 11, but regained his power. He forced many of the idle inhabitants to leave the city and cultivate the country around, which by these means was covered with corn-fields and olive plantations. Those who had no resources of their own he supplied with cattle and seed. He exacted from every one the tenth part of his income and earnings, and thus increased the revenue of the state which he expended in splendid public buildings. He established a public library, and collected and arranged the poems of Homer. As he well knew how tyranny was hated he carefully concealed his power under the exterior of a private citizen. He submitted like others to the jurisdiction of the Areopagus, before which he was accused of murder, and conducted himself with as much prudence as clemency. Consult the works by Flach (1885) and Töpffer (1886).

**Piso**, pī'sō, **Gaius Calpurnius**, Roman politician of the 1st century B.C. Cicero speaks very favorably of him as an orator. He became consul with Manius Acilius Glabrio in 67 B.C., and in 66-65 B.C. was proconsular administrator of Narbonese Gaul. Accused of extortion by Cæsar, he was defended by Cicero, whom he urged, to accomplish his own revenge, to bring charges against Cæsar as one of the Catilinarian conspirators.

**Piso**, **Gneius Calpurnius**, Roman politician of the late 1st century B.C. and early 1st century A.D. He was consul with Tiberius (q.v.) in 7 B.C. and when the latter became emperor was employed to thwart Germanicus (q.v.) in all ways possible, to which end he received the command of Syria. It was thought at the time that he caused the death of Germanicus by poison. Tiberius was forced to sanction an investigation by the senate; but before its termination Piso was found dead, whether by suicide or sacrificed by Tiberius to arrest popular indignation is uncertain.

**Piso**, **Lucius Calpurnius**, with agnomen **Frugi**, Roman statesman and historian of the 2d century B.C. He was tribune of the plebs in 149 B.C. and consul (with Publius Mucius Scævola) in 133 B.C. A staunch, though impartial, supporter of the aristocracy, he opposed the measures, especially the *lex frumentaria*, of Gaius Gracchus. He wrote several orations and



## PISO — PIT-RIVER INDIANS

the 'Annales,' a history of Rome from the earliest period to his own time, none of which has survived.

**Piso, Lucius Calpurnius**, Roman politician of the 1st century B.C. The most of our information regarding him is obtained through Cicero, who depicts him in the darkest of colors. Inasmuch as the great orator was both a personal and a political enemy, some reasonable modifications of his estimate must be made. As consul in 58 B.C. (with Aulus Gabinius), he obtained Cicero's banishment (see CICCERO), and in 57-55 B.C. as governor of Macedonia he certainly plundered that province most rapaciously. On returning from exile Cicero spoke his mind about him in the speeches 'De Provinciis Consularibus' and 'In Pisonem.' See CÆSAR.

**Piso, Marcus Pupius**, Roman orator and politician of the 1st century B.C. He held the prætorship at an uncertain date, was proconsular administrator of Spain, and on his return thence in 69 B.C. received a triumph. In 61 B.C. he was consul (with Marcus Valerius Messalla Niger). In his earlier period an excellent forensic speaker, and better versed than his predecessors in Greek literature, he was an instructor of Cicero.

**Pi'solite**, or **Peastone**, a concretionary limestone made up of grains or globules, each of which is about the size of a pea. Upon being split open these globules show a concentric structure. It is characteristic of certain parts of the Jurassic system.

**Pissaro, pē-sä-rō, Camille**, French artist: b. St. Thomas, W. I., 10 July 1830; d. Eragny, 12 Nov. 1903. He studied art under Melbye and Corot and his early work showed the influence of the latter. In choice of subject he is allied with Millet, though he does not invest his scenes of rustic life with the same pathos. In the luminous quality of light he surpassed Millet. This predilection for effects of light predisposed him to favor the departure of the so-called "impressionists" and about 1870 he allied himself with the group composed of Manet, Degas, Renoir, Claude Monet and a few others. After much ridicule the new departure won the day as a recognized method of technique. Though popular in France Pissaro's pictures are not so well known outside that country. Seven of his works hang in the Luxembourg. Special exhibitions were held at intervals in Paris after 1890. Views of Rouen, Paris and the country about Eragny besides studies made in London during a visit with Monet form his later subjects.

**Pista'cia**, a genus of trees of the order *Anacardiaceæ*. The ten or a dozen species are natives of western Asia, and the Mediterranean region, with one in Mexico. They have alternate, evergreen or deciduous leaves; small, apetalous, dioecious flowers in axillary racemes or panicles; and dry, drupaceous fruits with bony stones which split in two and expose the oily kernels. The pistacia,—or pisticio—nut or tree (*P. vera*) is a native of western Asia but is cultivated in the Mediterranean region and other warm climates, including California. It grows about 20 feet tall, bears pinnate leaves and fruits about as large as olives. The kernels, known also as green almonds, are widely used for flavoring and coloring confectionery, ices,

cakes, etc. The turpentine tree (*P. terebinthus*) yields Cyprian or Scio turpentine, a greenish-yellow, fragrant product which has been used by druggists and physicians since the days of Hippocrates. It is a native of the Mediterranean region, attains heights of about 30 feet, and pleasant, oily fruits. It is cultivated to a small extent in the southern and southwestern United States. The batoum tree (*P. atlantica*), a native of northern Africa, grows about 40 feet tall, bears an edible fruit popularly used by the Arabs, and an aromatic gum resin which is chewed as a dentifrice and breath perfume. The lentisk or mastic tree (*P. lentiscus*) yields mastic (q.v.), a gum resin; and the kernels of *P. oleosa* yield a fragrant oil used by the Orientals for perfuming ointments and other druggists' compounds. The tree is indigenous to eastern Asia.

**Pis'til**, in botany, the female organ of a phanerogamous flower, occupying almost invariably the centre of the flower. See FLOWER.

**Pistoia**, pīs-tō'yä, or **Pistoja** (ancient PISTORIA), Italy, city in the province of Florence; about 20 miles northwest of the city of Florence. The city is noted for its fine specimens of early art and architecture. Verrocchio's first work in marble is said to be the monument to Cardinal Forteguerri, in the cathedral. The cathedral was built in the 12th century. A pulpit by Pisano is in the church of Saint Andrea. Other remarkable art productions are here; the ancient churches and palaces are well-preserved and of great historic and artistic interest. In 62 B.C. Catiline was defeated here; and the name of the place occurs frequently in the history of the contentions between the Guelfs and Ghibellines. It is said to have received its name on account of fire-arms having been first made here. It has considerable manufactures of silk goods, fire-arms, glass, paper, iron and steel wares, linen and woolen goods. Pop. (1901) 62,606.

**Pistol**. See FIRE-ARMS; SMALL-ARMS.

**Pistole**, pīs-tōl', a gold coin formerly in use in Spain, Italy, Switzerland, and some parts of Germany. It was originally a Spanish coin, and was equivalent to \$3.65.

**Piston**, in machinery, a moveable piece, generally of a cylindrical form, so fitted as to occupy the sectional area of a tube, such as the barrel of a pump or the cylinder of a steam-engine, and capable of being driven alternately in two directions by pressure on either of its sides. One of its sides is fitted to a rod, called the piston-rod, which it either moves backward and forward, as in the steam-engine, where the motion given to the piston-rod is communicated to the machinery, or by which the piston is itself made to move, as in the pump. The piston is usually made to fit tightly by some kind of material used as packing, the piston-rod being also made similarly tight by material closely packed in the stuffing-box. See PUMP; STEAM-ENGINE.

**Pit and Gallows**, a term now obsolete, formerly, in feudal times, a privilege granted to barons by the crown, in virtue of which they were empowered to hang on a gallows men convicted of theft or other crimes, and to drown in a pit or well women guilty of those crimes.

**Pit-River Indians**, the name given several small American tribes of the Palaihnihan family.



## PIT VILLAGES — PITCHER-PLANTS

residing along the Pit River in northeastern California. The river received its name from the tribal custom of digging deep pits or wind-falls for capturing deer and other animals. These Indians are of a very inferior type, mentally and physically, and were formerly very warlike and hostile. About 1,000 of them roam about the Pit River region refusing to reside on the Indian reservations.

**Pit Villages**, a name applied in Great Britain to collections of earth caves, dug in the ground and covered with stones, wood, clay or sods of turf. They were used by prehistoric races or by races at the lowest stages of barbarism. A good example was unearthed during the latter half of the 19th century near Andover, in Hampshire, England. The pits are reached by entrance shafts, sloping downward. The pits themselves are oval or pear-shaped, varying between 22 and 42 feet in length, and are about 12 or 13 feet wide, and 5 feet high, with the fireplace in the centre. Flint and bone implements and rude pottery have been found in them.

**Pit-viper**, a venomous viperine snake of the family *Crotalidæ*, or subfamily *Crotalinæ*, prominently represented by the rattlesnakes, and characterized by a deep pit between the eye and the nostril, the function of which, if it has any, is not known. See VIPERS; RATTLESNAKES.

**Pi'ta**. See FIBRE.

**Pitaka**, pīt'a-ka, in the sacred literature of the Buddhists, the *tripit'aka* meaning the three great divisions of canonical works, the *Vinaya* (discipline), *Abhidharma* (metaphysics), and *Sutra* (aphorisms in prose), and collectively, therefore, the whole Buddhistic code.

**Pitcairn**, pīt'kār'n, **John**, Scotch soldier: b. Fifeshire about 1740; d. Boston, Mass., 17 June 1775. He seems to have been a soldier from his youth; was promoted to be captain of marines in 1765 and to be major in 1771; was stationed in Boston about 1772; and was popular there because of his just treatment of complaining colonists. He led the advance guard of the force sent from Boston to Concord 19 April 1775, met the minute men at Lexington, ordered them to disperse, and took part in the resulting battle, which is commonly believed to have been begun by his orders to fire, though his own story was that the minute men fired first. Pitcairn played a prominent part in the battle of Bunker Hill, was the first to mount the breastworks, and was mortally wounded by a negro as he was crying "Now for the glory of the marines."

**Pitcairn Island**, a British possession, in the Polynesian islands, belonging to the Low Archipelago; in lat. 25° 5' S.; lon. 130° 18' W.; about two and one half miles long and one mile wide. Its coast is almost perpendicular and is fringed with rocks and reefs making it impossible to land except at a few points. The interest which attaches to this island is derived from its history; beginning in 1790 when nine British sailors, mutineers of the British ship *Bounty*, together with 18 natives of Tahiti, 6 men and 12 women, landed on this island. Their subsequent contentions resulted in murders and various crimes. After 10 years John Adams (q.v.) and a few survivors were left. His reform, and his manner of teaching and supervising the little colony led to a complete change. They became

peaceable, moral, and industrious. In 1856 the community (194 in number) was removed to Norfolk Island, Pitcairn having become too small for their comfortable subsistence. Some of the number, about 40, returned to Pitcairn. In 1900 there were on the island 140 persons. A recent colonial office report describes the people as having degenerated from their former manner of living. The local government is administered by a president and a parliament of five persons, elected by the popular vote of the men and women. See BLIGH, WILLIAM.

**Pitch**, a term applied to a variety of resinous substances of a dark color and brilliant lustre, obtained from the various kinds of tar produced in the destructive distillation of wood, coal, etc. Pitch is extensively used in ship-building, etc., for closing up seams, also for keeping wood from speedy decay, or iron railings from rusting when exposed to the weather. See TAR.

In architecture, the rise or versed sine of an arch. In carpentry, the inclination of a roof.

In music, musical sounds give to the mind a feeling of acuteness or gravity according to the rapidity or slowness of the vibrations producing them; hence, the former are called acute or high, the latter grave or low. See MUSIC.

**Pitch-and-hitch**, a game for ten players, five on a side, usually played indoors. Disks of galvanized metal are pitched from a distance of ten yards into a receiver, a round rubber dish, having an opening at the top five inches in diameter. The game is similar to that of quoits (q.v.), the counts being the same.

**Pitch-and-toss**, a game played by throwing up a coin and calling heads or tails; hence, to play pitch and toss with anything is to be careless or wasteful about it; to play ducks and drakes.

**Pitch Lake**. See TRINIDAD.

**Pitch'blende**. See URANINITE.

**Pitcher**, Moll, American heroine. She was the wife of a soldier in the Continental army and at the battle of Monmouth, 28 June 1778, she saw her husband killed in the act of firing a cannon. She at once took his place, fired the already loaded cannon, and fought throughout the day. She was praised by Washington who commissioned her a sergeant in the army.

**Pitcher**, Thomas Gamble, American soldier: b. Rockport, Ind., 23 Oct. 1824; d. Fort Bayard, N. M., 21 Oct. 1895. He was graduated from West Point in 1845, served in the Mexican War and for gallantry at Contreras and Churubusco was in 1847 brevetted 1st lieutenant. He served on the frontier until the outbreak of the Civil War, defended Harper's Ferry in 1862 and later served in the Virginia campaign. From 1863-5 he was provost-general-marshal, and in the latter year was brevetted brigadier-general in the regular army for services throughout the war. He was mustered out of the volunteer service in 1866 and commissioned colonel of the 44th Infantry. In 1866-71 he was superintendent at West Point, governor of the Soldiers' Home near Washington in 1871-7, and in 1880-7 superintended the New York Soldiers and Sailors' Home.

**Pitcher-plants**, plants whose leaves resemble pitchers. These pitchers, which are more



## PITCHSTONE — PITMAN

or less filled with water, are thought to act as plant-food gatherers, especially of nitrogenous food, which they are believed to digest from the bodies of entrapped insects. Generally they have lids whose office is to keep out rain; honey-secreting glands, which attract insects; downward pointing hairs or bristles which permit the visitors to crawl down in the pitchers but prevent their return; digestive and even pepsin or enzyme-containing secretions which act upon the soft parts of the insects' bodies. After the nectar-hunting insects have commenced to decompose, the odor of decay frequently attracts carrion-feeding insects, so the plants may be said to have two harvests.

Mosquitoes have been known to breed in the water contained in the pitchers.

The best known species to Americans are *Nepenthes* (order *Nepenthaceæ*) of which about 35 tropical species, mostly Malayan, have been described. These are the pitcher-plants seen in greenhouses, the pitchers pendant upon the ends of rather narrow leaves. Two genera are American. The pitcher-plant or "side-saddle flower" of the swamps east of the Rocky Mountains, especially well known east of the Mississippi River, belong to the genus *Sarracenia*. The other genus has only one species (*Darlingtonia californica*), which is found wild only at high elevations on the Pacific coast. *Heliamphora nutans* is a unique species found in northern South America. These three genera constitute the order *Sarraceniaceæ*. *Cephalotus follicularis* is an Australian species, the only one of its genus. Its pitchers resemble those of *Nepenthes*, but it belongs to the order *Saxifragaceæ*.

**Pitch'stone**, a glassy volcanic rock, resembling hardened pitch in appearance. In color it is black, dark blue, yellow, reddish brown, or dark green. It is translucent on thin edges and breaks with a conchoidal or splintery fracture. It occurs in the form of dikes and as lava-flows and may be considered as a natural glass formed by the rapid cooling of those lavas of which common feldspar (orthoclase) forms a considerable part. Sometimes it is spherulitic, the spherules, which are occasionally of large size, showing a fibro-radial structure. It is found chiefly in Mexico, South America and southern Europe.

**Pith**, the cylindrical or angular column of cellular tissue at or near the centre of the stem of a plant, also called the medulla, of which a good example is afforded by Chinese rice paper, the pith of the *Aralia papyrifera*. The pith is at first succulent and of a greenish color, afterward it becomes dry, and in many plants its cells are broken up, leaving large cavities. In its primary state it appears to be a reservoir of nourishment for the embryo plant. See ANATOMY OF PLANTS.

**Pith'ecanthro'pus Erec'tus**, the name given by Dr. Eugene Dubois to the fossilized remains found by him in Java in 1891-2. These consist of the upper part of a cranium, a left femur, and two molar teeth, and indicate an animal midway between man and the higher apes, and of Pleistocene age. Much doubt and discussion was aroused at first in regard to it but the weight of scientific opinion is now in agreement with the opinion of its discoverer. The animal when erect must have stood 5½ feet high, "and the contents of the cranium," says Beddard,

"must have been 1,000 cm., that is to say 400 cm. more than the cranial capacity of any anthropoid ape, and quite as great or a trifle greater than the cranial capacity of some female Australians and Veddahs; but as these latter are not five feet in height, the ape-like man had really a less capacious cerebral cavity." The skull in form and capacity stands roughly midway between that of a young chimpanzee (with no crest), and that of the lowest human example known — the man of Neanderthal. Consult the discoverer's monograph, 'Pithecanthropus erectus' (Batavia, 1894, in German); reprinted in English in 'Smithsonian Report' for 1898; Haeckel and Gadow, 'The Last Link' (1898); and Beddard, 'Mammalia' (1901).

**Pithom**, pī'thōm, a town of northern Egypt, in the land of Goshen, built for Rameses II. by the children of Israel (Exodus i. 11). The town was discovered at Tell el Maschulah, between Ismailia and Tell el Kebir in 1882, and its ruins explored by Dr. Naville (1882-3). A statue of Rameses II. was unearthed as well as of other monarchs of up to the 22d dynasty to the time of the Ptolemies. Consult: Naville, 'The Store-city of Egypt and the Route of the Exodus' (1888).

**Pit'kin, Timothy**, American lawyer and historian: b. Farmington, Conn., 21 Jan. 1766; d. New Haven, Conn., 18 Dec. 1847. He was graduated at Yale in 1785; became a lawyer and a leader of the Connecticut Federalists, who elected him to Congress in 1805; served there for 14 years; and was one of the earliest political historians of the United States. He wrote 'Statistical View of Commerce of the United States of America' (1816), and 'Political and Civil History of the United States of America from the Year 1763 to the Close of Washington's Administration' (1828).

**Pit'man, Benn**, American phonographer: b. Trowbridge, Wiltshire, 24 July 1822. He was educated in the academy of his brother, Sir Isaac Pitman (q.v.), and for ten years engaged in lecturing on and teaching phonography in England. In 1853 he came to this country and established the Phonographic Institute at Cincinnati, Ohio, of which he has since been president. He was military recorder of State trials during the Civil War, invented the electro-process of relief engraving, and in 1873-92 was lecturer on art and teacher of artistic wood-engraving in the Cincinnati Art Academy. He has published: 'Manual of Phonography' (1854); 'History of Shorthand' (1858); 'A Plea for American Decorative Art' (1895); 'Phonographic Dictionary' (1899); 'Life of Sir Isaac Pitman' (1902); etc.

**Pitman, Sir Isaac**, English phonographer: b. Trowbridge, Wiltshire, 4 Jan. 1813; d. 22 Jan. 1897. He was educated in London at the Normal College of the British and Foreign School Society, and in 1832 was appointed master of the British school at Barton-on-Humber. In 1837 he published 'Stenographic Sound-Hand' which under the present title of phonography has become so widely used as to practically extinguish the earlier systems. The agitation for postal reform was about this time (1837) at its height, and Pitman eagerly looked forward to the establishment of the Penny-Post. The English government offered a prize of £200 for the



## PITRI — PITT

best suggestion as to the collection of amounts for prepaid letters, and Pitman submitted a proposal to collect postage by means of stamps, which should be engraved in small squares of an inch space, 240 of which, at one penny, would amount to £1. He further pointed out the advantage to the public of being able to transmit small sums by means of such stamps. The 'Phonographic Journal,' afterward named the 'Phonetic Journal,' was established by Pitman in 1842, and for a period of more than 50 years was personally edited by him. He issued numerous revised manuals and over 200 works in his system of shorthand, consisting of standard and general literature, ranging from the complete Bible to the Vicar of Wakefield, etc. His latest and most complete treatise on phonography is the 'Shorthand Instructor,' which has been extensively adopted by commercial and high schools. He was also intensely interested in the subject of reform in English spelling. In 1894 Pitman was knighted by Queen Victoria for "his eminent services to stenography." He died after having witnessed the introduction of his shorthand into every English-speaking country. For a description of his system, the one most generally used by expert practitioners, see **SHORT-HAND**.

**Pi'tri**, in Hindu mythology, an order of divine beings inhabiting celestial regions of their own, and receiving into their society the spirits of those mortals for whom the funeral rites have been duly performed. They include therefore collectively the Manes of deceased ancestors (see **LARES**); but the principal members of this order are beings of a superior nature.

**Pitt, William**, English parliamentary orator and statesman: b. Hayes, near Bromley, Kent, 28 May 1759; d. Putney 23 Jan. 1806. He was the son of the Earl of Chatham (q.v.). In 1773 he entered Pembroke Hall, Cambridge, where his knowledge of mathematics and the classics seems to have astonished ripe scholars. His acquaintance with modern literature was slight. Of living languages besides his own he was almost entirely ignorant; an imperfect knowledge of French was all he possessed. His whole education was directed to the end of making him a great parliamentary orator. In 1778 he entered Lincoln's Inn, and in 1780 was called to the bar. He attended the western circuit once and was introduced into Parliament by Sir James Lowther, as representative for his borough of Appleby. His maiden speech was delivered in support of Burke's financial reform bill. On the failure of Fox's India bill, which produced his dismissal of the North and Fox coalition ministry, Pitt, although at that time only in his 24th year, assumed the station of prime minister by accepting the posts of first lord of the treasury and chancellor of the exchequer. Although strongly supported by the sovereign, he stood opposed to a large majority of the House of Commons, and with the exception of Henry Dundas (q.v.), every other prominent debater in the House was against him. In spite of many defeats in the Commons he refused to dissolve Parliament or resign, until, having at last obtained a majority, he fixed the day (24 March 1784) on which the king dissolved Parliament.

At the general election which followed

the voice of the nation appeared decidedly in his favor, and some of the strongest interests in the country were defeated, Pitt himself being returned by the University of Cambridge. His first measure was the passing of his India bill, establishing the board of control, followed by much of that fiscal and financial regulation that gave so much *éclat* to the early period of his administration. The establishment of the delusive scheme of a sinking fund followed in 1786. In 1788 Pitt resisted the doctrine of the opposition that the regency, during the king's indisposition, devolved upon the Prince of Wales by right. The minister maintained that it lay in the two remaining branches of the legislature to fill up the office, but that the prince could not be passed over in nominating to this post. By the adoption of this principle he was enabled to pass a bill restricting the regent's power, which the king's recovery rendered unnecessary. The French Revolution now broke out, and in 1793 war arose between Great Britain and France. Great Britain was successful by sea, but during the life of Pitt the conflict on the Continent was in favor of France. In 1800 the Irish union was accomplished. In 1801 the opposition of the king to all further concession to the Irish Catholics caused Pitt to resign his post. The Peace of Amiens succeeded; and the Addington administration, which concluded it, Pitt supported for a time, and then joined the opposition. The new minister, who had renewed the war, unable to maintain his ground, resigned; and in 1804 Pitt resumed his post at the treasury. Returning to power as a war minister, he exerted all his energy to render the contest successful, and found means to engage the two great military powers of Russia and Austria as well as Sweden in a new coalition, which was dissolved by the battle of Austerlitz. Pitt, whose state of health was previously declining, was sensibly affected by this event, as he was also by the parliamentary attack upon his old associate, Lord Melville (see **DUNDAS**), not wholly parried either by ministerial influence or the merits of the case. Pitt has been much criticised as a war minister, but with great evident injustice. He wisely saw that the war on England's part must be naval. He formed coalitions with continental powers that were to act on land. He met the demands of these powers by large subsidies. If the coalitions failed, as they did fail, Pitt was not responsible for the self-seeking of his continental allies. In peace he sought parliamentary reform, strengthened the national credit, established an improved financial system, and followed a successful commercial policy. He was altogether above the meanness of avarice, his personal disinterestedness being extreme. His eloquence, if not more elevated or profound, was, upon the whole, more correct than that of any other orator of his time, and his language was remarkably copious and well arranged. On the whole Pitt was a minister of commanding powers. A public funeral was decreed by Parliament, and a grant of £40,000 to pay his debts. Consult Lord Stanhope's 'Life of Pitt' (2d ed. 1862); Sergeant, 'William Pitt' (1882); Walford, 'William Pitt: a Biography' (1890); Rosebery, 'William Pitt' (1891).

**Pitt, William** (1708-1778). See **CHATHAM, EARL OF**.



## PITT — PITTSBURGH

**Pitt, William** (1773-1857). See AMHERST, WILLIAM PITT.

**Pitt Diamond.** See DIAMONDS.

**Pitt, Fort.** See PITTSBURGH.

**Pit'ta**, a genus of small, brilliantly colored, short-tailed birds of the Oriental tropics, whose nearest relatives are the North American tyrant fly-catchers. They are noted for their terrestrial habits, and are sometimes called ground-thrushes and ant-birds, though they are not related to the thrushes nor do they eat ants.

**Pitti** (pīt'tē) **Palace**, a celebrated Florentine palace, the second in size in the world. See FLORENCE.

**Pittsburg**, pīts'bērg, Kan., city in Crawford County; on the Saint Louis and S. F., the Kansas City S., the Atchison, T. & S. F., and the Missouri P. R.R.'s; about 125 miles south of Kansas City. It was settled in 1876 by colonies from the eastern and southern States; incorporated as a city of the third class the same year, and as a city of the second class in 1880. It is in a productive agricultural region, and has considerable manufacturing interests. The chief manufacturing establishments are the Kansas City Southern shops, foundry and machine shops, three brick plants, packing house, planing mill, roller mills, glass factory, artificial ice plants, the electric-power plants, etc. About 550 men employed in industries in the city, and about 1,600 men, who live in the city, are employed in the coal mines in the vicinity. There is a large trade in manufactured goods, coal, and farm products. The educational institutions are the State Manual Training Normal School, a high school, five ward and one parish schools, and a public library. There are 13 churches, and one private and one denominational hospital. The two National banks have a combined capital of \$150,000 and deposits \$1,800,000. The government is administered by a mayor, who holds office two years, and a council of eight members elected from the four wards. Pop. (1890) 6,697; (1903) 11,138.

J. C. BUCHANAN,  
*Editor 'Kansan.'*

**Pittsburgh**, or **Pittsburg**, Pa. (the former spelling being the true name of the city used upon its great seal, the latter being the spelling arbitrarily adopted by the superintendent of public printing of the United States), the metropolis of the Ohio Valley, and county-seat of Allegheny County, Pennsylvania.

*History.*—The valleys of the Ohio and the Mississippi were originally claimed by the French in virtue of the explorations and discoveries of La Salle in 1669. Virginia laid claim to the valley of the Ohio in virtue of her charters; and in 1748 the Ohio Company was formed to exploit and take possession of the region. In 1749 a French expedition under Celeron was despatched to formally annex the Ohio Valley to the French crown. This expedition was followed by the French in the spring of 1752 by a small army of occupation, which did not advance further than the present site of the town of Venango, Pa. In the fall of 1753 Governor Dinwiddie of Virginia sent George Washington to warn the French against further intrusion, and in the spring of 1754 a force of Virginians was despatched to build a fort on the site of the present city of Pitts-

burgh. While engaged in this work the small body of troops, commanded by Captain William Trent and Ensign Edward Ward, was confronted by an overwhelming force of French and Indians coming from the north. The Virginians withdrew. The first armed encounter between the French and the Virginians took place on 27 May 1754, when Washington defeated and captured a body of French troops under Jumonville near the mouth of Redstone Creek. This engagement was followed by the battle of Fort Necessity, where the Virginians were defeated, but allowed to withdraw with the honors of war. In 1755 an attempt to retake the spot was made under the command of Major-General Braddock. It resulted in the terrible defeat at Braddock's Field, on 9 June. The French, who had in the meanwhile built Fort Duquesne, held the region until 25 Nov. 1758, when they fled before the advance of General Forbes, leading an army of 10,000 British and Colonial troops. In the dusk of the evening of that day Col. Armstrong planted the flag of Great Britain over the smoldering ruins of Fort Duquesne, which the French had fired as they abandoned it, and, at the suggestion of Washington, Forbes called the place Pittsburgh. "It is," says Bancroft, "the most enduring monument to William Pitt. America raised to his name statues that have been wrongfully broken, and granite piles, of which not one stone remains upon another; but long as the Monongahela and the Allegheny shall flow to form the Ohio; long as the English tongue shall be the language of freedom in the boundless valley which their waters traverse, his name shall stand inscribed upon the gateway of the west." The English occupation continued until the outbreak of the American Revolution and was made memorable by the series of engagements which took place on the spot, or near by, during the period of Pontiac's conspiracy and the events of the French and Indian war. The only remnant of the extensive fortifications erected by the British is "The old Block-house," which was a redoubt built by General Bouquet in 1763, and which is still standing. A town was laid out about Fort Pitt in 1764 under the authority of Col. John Campbell, and this plot, which was incorporated in subsequent surveys, is commonly known as "the old military plan." The "Manor of Pittsburgh" reserved to the Penns by Act of Assembly in 1779, had been originally surveyed in 1769, and was resurveyed in 1783 by George Woods. In the following year a portion of it was plotted as the site of the town of Pittsburgh. On 22 April 1794 the place was incorporated as a borough, and in 1816 it was reincorporated as a city. Numerous acts of reincorporation have been passed since then, and the original limits have been gradually enlarged, but the present corporate limits of the city do not fully represent the actual growth, for the two cities of Allegheny and McKeesport, and a score of large boroughs adjacent, represent the overflow of the energy and population of the original settlement. The population of Pittsburgh proper in 1904 was only about 375,000 souls, but on 7 Feb. 1906 the bill for "Greater Pittsburgh" was approved and signed by Governor Pennypacker, thereby absorbing Allegheny and adding a population of over 125,000 people, thus bringing the total in 1906 to approximately 500,000.





MAP OF  
PITTSBURG  
AND  
ALLEGHENY

Scale of Feet  
0 1000 2000 3000 4000 5000







## PITTSBURGH

*Location and Facilities for Transportation.*—Pittsburgh is located at the junction of the Allegheny and Monongahela rivers, which here unite to form the Ohio in lat.  $40^{\circ} 30'$  N., lon.  $80^{\circ}$  W. By the Monongahela access is had for a hundred miles southward to the immense coal-fields of West Virginia, and by the Allegheny for an equal distance to the coal- and oil-fields of western Pennsylvania. By the Ohio River access is given to the waters of the Gulf of Mexico and to thousands of miles of navigable riverways traversing no less than 20 States of the Union. Pittsburgh is located in the centre of the largest and most productive fields of coal, petroleum, and natural gas on the continent. The abundance of cheap fuel has made the city the centre for all those great industries, which depend upon fire for their successful prosecution. She is to-day the hearth of the nation, at which the spirit of Tubal Cain ministers to the wants of men. The facilities for transportation by water have been enormously supplemented by the construction of railways. At the present time there are 14 different railways entering the city, connecting with all the principal railway systems of the country.

The retail trade of the city and the office-buildings are mostly confined to the comparatively narrow area lying between the junction of the two rivers north of the eminence known as Grant's Hill. The manufacturing establishments extend in every direction from this centre along the rivers, wherever level land affords suitable sites. The principal residential section of the city is located in what is known as the "East End" in proximity to Schenley and Highland Parks. Communication between all parts of the city is facilitated by lines of electric railways, under the control of the Pittsburgh Railways Company, a corporation which operates 411 miles of track within the limits of Allegheny County, 250 of them within the limits of Pittsburgh proper. There are 267 miles of paved streets in Pittsburgh and 300 miles of streets opened by ordinance, but as yet unpaved, making a total of 567 miles of streets. In addition there are 22 miles of graded and superbly macadamized boulevards. There are 340 miles of sewers varying in size from 15 inches to 11 feet in diameter. Within the city there are 50 bridges belonging to the municipality, having an aggregate value of approximately \$3,000,000. This does not include railway bridges, of which there are a score or more of large size, nor the great bridges connecting Pittsburgh and Allegheny, which belong to private corporations and represent a valuation far exceeding that just given. There is no city in the United States in which there are so many bridges and of such various styles of construction. This is due to the broken topography of the site.

*Manufactures and Commerce.*—The manufacturing energies of Pittsburgh have resulted in enormous developments along certain lines. The Pittsburgh district produces 65 per cent of all the coke manufactured in the United States, the output in the year 1902 amounted to 14,138,740 tons, having a total value of \$33,508,714. Pittsburgh, in 1902, mined and sent to market over 40,000,000 tons of bituminous coal, valued at \$60,000,000. In the same year the city produced 25 per cent of all the pig iron, and 40

per cent of all the steel, and 57 per cent of all the structural iron and steel manufactured in the United States; that is to say: 4,260,719 tons of pig iron, and 5,138,539 tons of steel of various kinds. Pittsburgh makes more steel rails and more armor-plate for battle-ships than any other place on the continent. Pittsburgh is the centre of the glass manufacturing industry of North America. The product of table-ware in 1902 amounted to 95,000 tons; of window glass to 1,884,388 boxes; and of plate glass to 13,500,000 square feet. The manufacture of electrical machinery, of airbrakes, locomotives, steam-engines, and other forms of machinery has risen to large proportions. The largest manufactory of corks in the world (a corollary of the manufacture of glass bottles) is located here, and also one of the most famous establishments for the manufacture of instruments of precision. Pittsburgh is also engaged in the manufacture of salt, fire-brick, building-brick, stoves, brass-ware, bronze-ware, white lead, pottery, leather, paper, and lumber. Over 1,000,000,000 feet of lumber were sold in the Pittsburgh market in the year 1902. Pittsburgh is also the centre of large and important chemical industries, and is heavily engaged in the production of food products—meats, preserves, and pickles—the largest pickling and preserving establishment in North America being situated on the banks of the Allegheny.

Among the more colossal industries located here are those until recently under the direct control of Andrew Carnegie and his partners, now forming a part of the United States Steel Corporation, the American Iron Works, familiarly known as "Jones and Laughlin's" Iron Works, the great complex of industries controlled by George Westinghouse and his associates, the Pressed Steel Car Works, the works of the Pittsburgh and the Standard Plate Glass companies, the factories of the American Window Glass Company, and the National Glass Company. There are in Pittsburgh over 4,500 manufacturing establishments, and the aggregate capital employed in them is not far from half a billion of dollars.

The favorable location of Pittsburgh as a distributing point, within a night's ride by rail of all the leading cities of the eastern seaboard from Albany to Washington, and of the West from Chicago to Indianapolis and Louisville, has gradually led to the upbuilding of a very extensive trade in drygoods, groceries, and other merchandise. In fact, no other city on the continent is so favorably situated for distributive mercantile operations, as is shown by the following table of distances by rail: Distance of Pittsburgh to Wheeling, 67 miles; to Cleveland 150 miles; to Buffalo 270 miles; to Cincinnati 313 miles; to Baltimore 334 miles; to Philadelphia 354 miles; to Washington 360 miles; to Indianapolis 381 miles; to Louisville 423 miles; to New York 430 miles; to Chicago 468 miles; to Albany 535 miles. The facilities for cheap transportation by water have already been pointed out.

The aggregate tonnage of Pittsburgh carried into and out of the city by rail and water in the year 1902 amounted to the enormous total of 87,000,000 tons, vastly exceeding in volume that of any other city on the globe.

*Banking Facilities.*—For the prosecution of



## PITTSBURGH

this vast business a large capital is required. The banking institutions of Pittsburgh at the close of business on 31 Dec. 1903, reported aggregate resources amounting to \$414,253,161. The Bank of Pittsburgh is the oldest bank on the continent west of the Appalachian Mountains. The business transactions of the city represented by the exchanges made in her clearing-house during the year 1903 amounted to the enormous total of \$2,738,473,869.70. Pittsburgh in the amount of her traffic represented by the exchanges of her clearing-house stands sixth in rank among the great cities of the country, being outclassed only by New York, Chicago, Boston, Philadelphia, and Saint Louis, in the order named, though it frequently happens that the exchanges in the Pittsburgh clearing-house in a given week exceed those of Saint Louis. The pay-rolls made out in the banking institutions of the city average \$20,000,000 per month, representing only a portion of the immense sum that is annually paid out in the form of wages to those who are engaged in the manufactories and industrial establishments.

*Newspapers, etc.*—The *Pittsburgh Gazette*, established in 1786, is the oldest newspaper in the valley of the Mississippi having a continuous life. There are published in Pittsburgh over 60 newspapers, of which 10 are daily, the remainder weekly, trade, religious, and social. In addition to newspapers there are a number of other periodicals in the form of magazines devoted to various interests, which are published here. A number of books bearing Pittsburgh imprints have been issued beginning so far back as 1789, and, while publishing is not one of the leading industries of the place, a by no means inconsiderable amount of it is annually done in this busy centre.

*Churches.*—Pittsburgh is famous for its numerous and beautiful churches. There are over 300 houses of worship of all denominations in Pittsburgh and Allegheny. Almost every religious denomination is represented by a house of prayer, so that the early prediction of Arthur Lee, who visited the place in 1784 and found "not a priest of any persuasion, nor church nor chapel," and who therefore declared the people to be "likely to be damned without the benefit of clergy," is certain not to be fulfilled. Pittsburgh is the seat of a Roman Catholic and a Protestant Episcopal bishop, but being Scotch in its first settlement it is almost as strongly Presbyterian as Edinburgh or Glasgow. Among the more beautiful edifices may be mentioned the First, the Third, the Shadyside and the Bellefield Presbyterian churches, Christ Methodist Episcopal Church; Trinity Protestant Episcopal Church; the First and the Sixth United Presbyterian churches; and the new Roman Catholic Cathedral at the corner of Fifth Avenue and Craig Street. But these are only a few of the many beautiful and costly churches, of which scores have been erected in the past two decades.

*Schools, Colleges, etc.*—The public schools of Pittsburgh and Allegheny are numerous and many of the school edifices are stately and costly structures, especially some of those erected in recent years. The Western University of Pennsylvania, which had its beginning in 1787 as the Pittsburgh Academy and is the first institution of learning incorporated

west of the Allegheny Mountains, north of the Ohio River, has in the neighborhood of 1,000 students in the various departments of literature, law, engineering, medicine, dental surgery, and pharmacy. The Observatory belonging to the University is famous because of the splendid researches which were there carried on in former years by Professors S. P. Langley and J. E. Keeler. Theological seminaries of the Presbyterian, the United Presbyterian, and the Reformed Presbyterian Church are situated here, the oldest being that of the Presbyterian Church, known as "The Western Theological Seminary," which has educated many of the foremost clergymen of that denomination, and has reckoned in its faculty some of the leading theologians of America. The Pennsylvania College for Women is an important institution. There are a large number of denominational schools in the city, and private academies to fit youth for college are numerous. The leading Roman Catholic school is known as the Pittsburgh College of the Holy Ghost. Among the academies the Pittsburgh Academy and the Shadyside Academy are both excellent institutions of similar grade. At the entrance to Schenley Park, in Pittsburgh, is located the Carnegie Institute, with an extensive gallery of art, one of the largest museums in America, and an exceptionally beautiful and perfect Music Hall. Pittsburgh has in recent years achieved through this noble foundation a world-wide reputation as a centre of artistic and scientific activity. Connected with the Institute is a school for industrial training for which the generous founder, Andrew Carnegie, has given an endowment of \$2,000,000.

*Libraries.*—The Carnegie Free Library of Pittsburgh is the greatest establishment of its kind founded by the princely benefactor whose name it bears. The Central Library is supplemented by a number of branch libraries located in various parts of the city and beautifully and commodiously housed. There were in 1902 in the Carnegie Library about 150,000 volumes. The Allegheny County Law Library is one of the largest and most perfect libraries of its kind in America. It is located in the Allegheny County Court-house. The library of the Western Theological Seminary contains about 30,000 volumes, chiefly theological and historical. The libraries of the Western University and of the Allegheny Observatory, under the same control, are rich in classical and astronomical literature. There are several large and very valuable private libraries, and a number of the citizens of Pittsburgh have established for themselves national reputations as bibliophiles.

*Hospitals and Other Charitable Institutions.*—The hospitals of Pittsburgh are numerous and some of them are very large and well equipped. There are 14 hospitals in Pittsburgh of primary importance. Besides the hospitals of the city there are 80 other strictly charitable institutions, such as the Newsboys' Home, homes for nurses, widows, the aged, the friendless, incurables, for working girls, and for orphans; asylums for the deaf and dumb and the blind, for fallen women, and released convicts. Bath houses, Christian associations for young men and young women, and a host of other kindred enterprises show that the benevolence of the people of the city has expressed itself in



PITTSBURGH.



1. Carnegie Library.

2. Entrance to Highland Park.









The Carnegie Technical Schools (in process of construction). Ground Area 900x3000 Feet, Embracing 32 Acres. Building completed, in foreground to the right, length of two city blocks, constituting one-twelfth of the entire group.



New Carnegie Institute, Pittsburgh, Pa., Dedicated April 17, 1907.







## PITTSBURG LANDING—PITTSFIELD

multitudinous forms and ways. Pittsburgh is the seat of the philanthropies of the United Presbyterian Church, and the Presbyterian Board of Missions to the Freedmen.

*Parks and Cemeteries.*—The two largest parks in Pittsburgh are Schenley Park and Highland Park. The former was a gift to the city by the late Mrs. Mary E. Schenley of London, England, who was born in Pittsburgh; the latter was acquired by the city through a series of purchases. There are nearly 1,000 acres in these two parks, which are connected with each other by a system of boulevards. There are many smaller parks. In Highland Park are the Zoological Gardens, the main building of which was a gift to the city by the late Hon. C. L. Magee. In the West Park in Allegheny and in Schenley Park, Pittsburgh, are beautiful and extensive conservatories, the gift of Henry Phipps, Jr. The conservatories in Schenley Park are the largest in America.

The Allegheny and the Homewood Cemeteries are extensive and beautifully laid out. The display of commemorative statuary in the former is remarkable on account of its richness and costliness.

*Notable Buildings.*—Besides the churches, to which reference has already been made, there are many fine edifices in Pittsburgh. The Allegheny County court-house is one of the noblest public buildings in America, justly esteemed the masterpiece of H. H. Richardson, the architect. The United States custom-house and post-office building on Smithfield Street is a large, costly, but not especially attractive edifice. The Frick Building, the Carnegie Building, the Farmers Deposit Bank Building, and the building of the People's Savings Bank are a few of a multitude of imposing and splendid structures built in the "sky-scraper" style, which in recent years have been erected, and command attention by their great size and splendid interior finish.

The new buildings of the Carnegie Library and Museum at the entrance of Schenley Park, when they are completed, will be larger than any other structure of the kind in the New World, covering over six acres and costing nearly seven million dollars.

*Theatres, etc.*—There are 16 theatres and halls in Pittsburgh in which entertainment ranging from light vaudeville to heavy scientific lectures are provided for people according to their tastes. The Pittsburgh Exposition Building is a notable structure, and here, as well as in the Music Hall of the Carnegie Institute, there are annually given musical performances of a very high order, which are exceedingly well patronized, for Pittsburgh is a music-loving city. The Pittsburgh Orchestra, under the leadership at first of Frederick Archer and later of Victor Herbert, has achieved an international fame.

*Clubs, Hotels, etc.*—There are numerous clubs, the principal being the Pittsburgh, the Duquesne, the Union, the University, the Monongahela, the Allegheny Country, the Pittsburgh Country, and the Pittsburgh Golf Clubs. All of these organizations existing for social purposes are handsomely housed. There are numerous and commodious hotels. The social life of the community is marked by a generous hospitality which causes the city to be preferred by multitudes as a place of resi-

dence in spite of the somewhat gloomy skies which prevail in the late fall and in the early spring. The citizens of Pittsburgh who have risen to distinction in the various walks of life are legion. From her distinguished bar she has given to the bench of the United States Supreme Court several judges, to the capital of the nation many distinguished senators, representatives, and cabinet officers, to the capital of the State not a few of her governors, and has added to the long list of the world's most eminent inventors, financiers, philanthropists, artists, musicians, and men of science a striking array of names with which the student of her history is familiar. She is proud of her Stephen C. Foster, whose songs are sung the world over; of her Keeler, who wrote his name upon the stars; of her Westinghouse, prince of inventors; and her Carnegie, king of philanthropists. She is proud of her sons, a mighty army of them, the story of whose deeds would fill an encyclopædia, who in all the walks of human life have done honor to the great, gray city, which sits as the mother of prosperity at the fountain-head of the beautiful Ohio.

W. J. HOLLAND, LL.D.,  
*Director The Carnegie Museum, Pittsburgh, Pa.*

**Pittsburg Landing, Battle of.** See SHILOH, BATTLE OF.

**Pittsfield**, pĭts'fēld, Mass., city, county-seat of Berkshire County; on the New York, N. H. & H. and the Boston & M. R.R.'s; about 50 miles northwest of Springfield. It was settled in 1743, incorporated as a town in 1761, and chartered as a city in 1891. It was called at first Boston Plantation and Poontoosuck, but the name was changed to Pittsfield when it was incorporated. Within the present corporate limits are several small villages. The city is noted as the centre of a residential section among the Berkshire Hills; but it has considerable manufacturing; the chief industrial establishments are foundry and machine shops, electrical machinery and supply works, a silk mill, cotton and woolen mills, paper mills, and a shoe factory. The principal public buildings are the Berkshire Athenæum (cost \$100,000), the Crane Art Museum, the court-house, built of white marble at a cost of \$400,000; the Berkshire Life Insurance building, the County Savings Bank, and the County Home for Aged Women. The educational institutions are the high school, Saint Joseph's Academy, public and parish elementary schools, the Henry W. Bishop Training School for Nurses, the Berkshire Historical Society, the public library containing about 40,000 volumes and connected with the Berkshire Athenæum. Pittsfield is the headquarters of the Agassiz Association (q.v.). There are three public parks, in one of which is a statue, 'The Color Bearer.' The large exhibition grounds of the Berkshire Agricultural Society have been in existence since 1810.

The government, administered under a revised charter of 1895, provides for a mayor, who holds office one year, and a council. The mayor appoints the license commissioners and the council elects several of the administrative officials. The school committee is chosen at the popular election. The city owns and operates the water-works. Pop. (1890) 17,281; (1900) 21,766. Consult: Smith, 'History of Pittsfield'; Mul-lany, 'History of Berkshire Hills.'



## PITTSTON — PIUS

**Pittston**, pĭts'tŏn, Pa., city in Luzerne County; on the Susquehanna River, and on the Delaware & H., the Delaware, L. & W., the Lehigh Valley, and the Central of N. J. R.R.'s; about nine miles southwest of Scranton. On the opposite side of the river is West Pittston, which is mainly a residential town. Pittston is an industrial centre of considerable importance. It is connected by belt-line electric railroads with Nanticoke, Plymouth, and Wilkes-Barre. It was settled in 1770, laid out in 1768, incorporated as a borough in 1803, and in 1894 was chartered as a city. It was named in honor of William Pitt, when it was first laid out, but for some years it was called Pittston Ferry. It is in the midst of the Wyoming anthracite region and its chief industries are connected with the mining and shipping of coal. In the vicinity are deposits of fire-clay. The chief manufacturing establishments are flour and lumber mills, knitting mills, foundries, machine shops, brick and terra-cotta works, stove and engine works, breweries, tool works, ladies' underwear factory, dye works, and steel range works. The number of men engaged in the mining and shipping of coal is in the thousands. The principal educational institutions are the public and parish schools, and a fine public library. It has a hospital, which was opened in 1893. The banks, national and savings, have a combined capital of \$400,000. Pop. (1880) 7,472; (1890) 10,302; (1900) 12,556.

**Pituitary Body or Gland**, a small oval, reddish-gray, vascular mass lodged in a depression (pituitary fossa) of the sphenoid bone, and connected with the brain by a pedicle. It consists of two lobes. Its function is not clearly established. Some writers believe that the pituitary bodies destroy certain substances which have a toxic influence on the nervous system; others, that they secrete material needed for the proper action of the trophic apparatus; still others, that they influence blood-pressure. Acromegaly (q.v.) is believed by some authorities to be due to a modification of the functions of the pituitary bodies.

**Pityriasis**, an affection of the skin (*pityriasis simplex*), characterized by a scurfiness of the epidermis, with numerous branny scales. It is also a symptom of various skin diseases attended by accumulations upon the surface of the body of oily, waxy, or bran-like scales. *Pityriasis capitis* (dandruff), beginning as a mild affection, may become a part of *dermatitis seborrhæa*, an inflammation of the derma of the scalp; lichen pilaris (*pityriasis rosea*) is a hypertrophic disease with conical elevations of sebaceous material and epithelial cells about the orifices of hair-follicles; *pityriasis rubra* is an inflammatory disease of the entire skin with abundant thin white scales.

The favorite seats of pityriasis are the scalp, face, back, chest, umbilicus, and the genital organs, but it may involve the whole body. Though usually a mild affection, it may be severe and last for months. In many cases there is little inflammation, the skin being pale and either dry or greasy. Pityriasis occurs especially in anæmic and chlorotic individuals, and is often increased by care, anxiety, or dissipation. Treatment calls for tonics, attention to hygienic measures, and the application locally of fatty substances, especially stimulating ointments. In

pityriasis of the face, exposure to cold winds is often irritating; therefore before going into the open air apply a soothing lotion. Consult Kaposi, 'Pathology and Treatment of Diseases of the Skin' (1895).

**Pit'zer, Alexander White**, American Presbyterian clergyman: b. Salem, Va., 14 Sept. 1834. He was graduated from Hampden-Sidney College, Virginia, in 1854, studied theology, and was licensed to preach in 1856. After holding pastorates in Kansas and Virginia he was professor of biblical theology at Howard University, D. C., 1876-90 and is now (1904) pastor of the Central Presbyterian Church at Washington, which he organized in 1868. He has published: 'Ecce Deus Homo' (1868); 'Christ, the Teacher of Men' (1877); 'The New Life' (1887); 'Predestination' (1899); etc.

**Piura**, pē-oo'rä, a river, department or province, and city of northern Peru. (1) Rio de Piura, or Sechura, rises in the coast cordillera scarcely 100 miles from where it empties into the Pacific at a point nearly due west from its source, but by its great sweep to the north around the Sechura desert makes its actual length nearly 200 miles. It is called Huarmaca in its upper course, and near Sechura Bay and below Sechura desert is named the Sechura. It is navigable from February to June. (2) The department on the extreme northeastern corner of Peru, is bounded by Ecuador to the north, the department of Cajamarca to the east, Lambayeque to the south, and the Pacific to the west; and has an area of about 16,000 square miles. The mountains on the eastern border and the cordillera of the coast are rich with pasture grasses; the coast is practically a desert, but has rich mineral deposits of petroleum, salt and soda. Pop. (1896) 213,900. (3) The capital city of the department on the right bank of the river is connected by rail with Payta, its harbor, which has a population of 3,500. The surrounding country grows a fine grade of cotton, when there is any rainfall. The other exports of the city are salt, hides, and cinchona bark. Pop. (est.) 12,000.

**Pius**, pī'ūs, the name of ten popes, as follows:

**Pius I., Saint:** d. 155. Very little more is known of him than that he succeeded Hyginus in 142. His day is 11 July.

**Pius II.** (ÆNEAS SYLVIVS PICCOLOMINI, ē-nē'as sĭl'vĭ-ūs pĭk-kō-lŏm'ē-nē): b. Corsignano, near Siena, 18 Oct. 1405; d. Ancona 14 Aug. 1464. He belonged to an illustrious family and in 1431 assisted at the Council at Basel as secretary. He was subsequently secretary to the antipope Felix V., and then to the Emperor Frederick III., by whom he was employed on various embassies. Eugenius IV. made him apostolic secretary and by Nicholas V. he was made bishop of Trieste in 1447 and sent as nuncio to Bohemia, Moravia and Silesia. He became bishop of Siena in 1449 and Calixtus III. created him cardinal. Early in his career he was a liberal in ecclesiastical matters, but he now became a staunch upholder of papal authority both in opposition to the secular power and to the authority of councils. He was one of the most learned men of his day and distinguished by moderation and a conciliatory spirit. He suc-



## PIUS

ceeded Calixtus III. in 1458, and in the next year assembled a congress at Mantua to plan a crusade against the Turks, but nothing of importance was then accomplished. He is best known at the present day by his writings, and as author and scholar furnishes an excellent example of the learning of the Renaissance. His works include: 'History of Bohemia'; 'Cosmographia'; 'History of the Council of Basel'; 'History of Frederick III.'; etc. Consult: Lives by Voigt (1856-63) and Weiss (1897); Creighton, 'Historical Essays and Reviews' (1902).

**Pius III.** (FRANCESCO TODESCHINI, frän-chës'kō tō-dës-kē'nē): b. Siena 1439; d. 18 Oct. 1503. He was a nephew of Pius II., by whom he was made bishop of Siena and subsequently cardinal. He was elected Pope in succession to Alexander VI. on 22 Sept. 1503, but died only 26 days afterward.

**Pius IV.** (GIOVANNI ANGELO DE' MEDICI, jō-vän'nē än'jā-lō dā mā'dē-chē): b. Milan 31 March 1499; d. 9 Dec. 1565. He studied medicine and law, but subsequently entered the church and was made an archbishop in 1545, and cardinal in 1549. Ten years later he succeeded Paul IV. in the papal chair. The most important event of his pontificate was the re-opening of the Council of Trent. In 1564 he published a bull confirming the decrees of this council. The confession of faith known as the Creed of Pius IV. (q.v.) was put forth by him as a statement of the dogmas defined in the council.

**Pius V., Saint** (MICHELE GHISLIERI, mē-kā-lā gēs-lē-ā'rē): b. Bosco, near Alessandria, Italy, 17 Jan. 1504; d. 1 May 1572. He entered the Dominican Order at 14 and was so distinguished by austerity of his life, and his zeal against heresy, that he was appointed inquisitor in Lombardy, and in 1558 inquisitor-general. He was created cardinal in 1557, and succeeded Pius IV. in 1566. He at once began to enforce reforms with great vigor and aroused much opposition by his seizure, imprisonment, and burning of persons convicted or suspected of heresy, among whom were several men of note. He reissued the bull, "In cœnam Domini," and expelled the Jews from the States of the Church, excepting only the cities of Rome and Ancona. The victory over the Turks at Lepanto was largely the result of the efforts of Pius V., who organized with Venice and Spain the Holy League against them. He was canonized in 1712. Consult: Falloux, 'Histoire de Saint Pie V.' (3d ed. 1858).

**Pius VI.** (GIOVANNI ANGELO BRASCHI, jō-vän'nē än'jā-lō bräs'kē): b. Cesena, Italy, 27 Dec. 1717; d. Valence, France, 29 Aug. 1799. He was made a cardinal in 1773 and succeeded Clement XIV., in 1775. He immediately instituted reforms in the public treasury, and next completed the museum in the Vatican, but his greatest work was the draining of the Pontine marshes. When the Austrian emperor, Joseph II., decreed that all the religious orders in his dominions were free from papal jurisdiction, Pius, apprehensive of the consequences of such a measure, went in person to Vienna in 1782, but his remonstrances were futile. At the time of the French Revolution the Pope having favored the allies, Bonaparte entered the papal dominions and compelled him to purchase a peace. Basseville, an agent of the republic to

Rome, aroused so much hatred that he was presently slain by the populace. The French forces under Duphot attempted to restore order, but the papal soldiers routed them, and Duphot was slain. Bonaparte accordingly entered Italy, made the Pope prisoner, and plundered the city. The aged pontiff was then carried away by the victors, and hurried over the Alps to Valence, where he died.

**Pius VII.** (GREGORIO BARNABA CHIARAMONTI, grā-gō'rē-ō bār'nā-bā kē-ā-rā-mōn'tē): b. Cesena, Italy, 14 May 1742; d. 20 Aug. 1823. He was a Benedictine monk who became bishop of Tivoli and was created cardinal in 1785. He succeeded Pius VI. in March 1800 and the next year concluded at Paris a concordat with France. In 1804 he went to Paris and crowned Napoleon emperor, but after the seizure of Ancona the quarrel between Napoleon and the Pope began. On the annexation of the States of the Church to the French empire in 1809 the Pope published a bull of excommunication against the perpetrators of the invasion. He was then arrested and sent to Savona, and afterward to Fontainebleau, and was not permitted to return to Italy until January 1814. The Congress of Vienna restored the States of the Church to the Pope, who applied himself thenceforth to internal reforms. He re-established the Order of the Jesuits in the year of his return to Rome. The character of Pius VII. was such as to win him the esteem and sympathy of men of views the most diverse. Consult: Artaud, 'Histoire du Pape Pie VII.' (1836); Celani, 'Il viaggio di Pio VII. a Parigi' (1893); and 'Life' by Allies (1901).

**Pius VIII.** (FRANCESCO XAVIERO CASTIGLIONE, frän-chës'kō zä-vē-ā'rō kās-tēl-yō'nā): b. Cingoli, near Ancona, Italy, 20 Nov. 1761; d. Rome 30 Nov. 1830. After being successively bishop of Montalto, Cesena and Frascati, he became cardinal in 1816 and pope in succession to Leo XII., in 1829. During his short pontificate of one year he condemned the slave trade in Brazil, opposed civil marriages in Prussia, denounced Freemasonry and secured the organization of an Armenian archbishopric at Constantinople. Consult Artaud, 'Histoire du Pape Pie VIII.' (1844).

**Pius IX.** (GIOVANNI MARIA MASTAI-FERRETTI, jō-vän'nē mā-rē-ä mäs'tā-ē-fēr-rēt'tē): b. Sinigaglia 13 May 1792; d. Rome 7 Feb. 1878. He belonged to a noble Lombard family. He was educated at the College of Volterra, and in 1815 became one of the Guardia Nobile of the Vatican, but soon after entered the church, and lived for a few years in Rome as the head of a large orphanage. Not long after the death, in 1823, of Pius VII. he was appointed by Leo XII. a prelate in his household; in 1827 was created archbishop of Spoleto, and five years later transferred to the see of Imola. At Imola he showed himself zealous in good works and possessed of liberal convictions. He was raised to the cardinalate in December 1840, but continued to reside in his diocese till 1846, when, on the death of Gregory XVI., he was elected pope. In honor of his patron, Pius VII., he assumed the name of Pius IX. (Pio Nono). He ushered in his reign by liberating 2,000 political offenders imprisoned by his predecessors, and granted a general amnesty, restoring all prisoners and exiles to their civil rights on their signing a



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declaration of allegiance. He also (in 1848) drew up a scheme of representative government, with two chambers, a free press, and a national guard. These and similar measures for a brief period secured him boundless popularity. But the Italians wished to drive out the Austrians. The Milanese overpowered Radetzky, Charles Albert led the Piedmontese to the Mincio, and the youth of all Italy rose to the rescue. Matters were now going too fast and too far for Pius, who refused to countenance the revolutionary movement, and as a result Charles Albert was overpowered in Lombardy, while Naples, Tuscany, Parma, and Modena had their newly acquired freedom quenched in blood. The Pope now entirely lost the favor of the Roman populace. Threatened by the mob in his own palace he fled to Gaeta, and a Roman republic was proclaimed in February 1849, with Mazzini at its head. Louis Napoleon, determined to restore the Pope, sent an expedition to Rome under Oudinot, by whom the Italian patriots, led by Garibaldi, were overpowered. Rome surrendered on 3 July; but the Pope did not return to his capital till April 1850. After his return his government lost much of its personal character, and became reactionary. He now placed his whole confidence in Antonelli, a prelate who had risen to distinction under Gregory XVI., and whom Pius had made a cardinal and a member of his council of state in 1847. Antonelli preserved the ascendancy in all matters of state till his death in 1876. The Pope himself now bestowed his whole attention upon the church. He recalled the Jesuits, canonized saints, and defined two dogmas. The doctrine of the immaculate conception of the Virgin Mary was defined in 1854; that of the infallibility of the pope, when speaking *ex cathedra* on a question of faith or morals, was proclaimed in the great Ecumenical Council held in the Vatican in 1870. Previous to this time the Pope's temporal dominions had become sadly shrunken in extent, owing to the gradual unification of Italy under Victor Emmanuel. (See ITALY.) The temporal power of the Pope, however, was still secured by the presence of a body of French troops at Rome. But after the defeat of Napoleon III. at Sedan these were withdrawn. On 20 Sept. 1870 the Italian troops entered Rome, and the temporal power was at an end. The Vatican was left to the Pope; and free diplomatic intercourse, the honors due to a sovereign, and a civil list of £129,000 yearly, secured to him. But these he declined, and confined himself to the Vatican and its garden, declaring that he was under restraint and a prisoner in his own palace. Consult: Pougeois, 'Histoire de Pie IX.' (1877-86); and Lives by Maguire (1878); Shea (1878); O'Reilly.

**Pius X.** (GIUSEPPE SARTO, joo-sěp'pā sār'tō): b. Riese 2 June 1835. He was elected to the papacy by the College of Cardinals 4 Aug. 1903, after the conclave had been in session five days, and assumed the title of Pius X. He was born in a small Venetian town, of a humble peasant family. His father died 4 March 1842, and his mother, Margarita Sanson, 2 Feb. 1894, after a life of labor and sacrifices, entailed in rearing her family of nine children, eight of whom were living at the time their brother was made pope, all in humble circumstances. There were two brothers and

seven sisters. The Pope's brother is a shopkeeper and postman. His sister Theresa is married to an innkeeper named Paolin, whose *Trattoria delle Due Spade*, in Riese, is only a few steps away from the modest two-storied house in which the Pope was born. Another sister is married to a sacristan; a third to a dealer in wines. When young Sarto became a parish priest his mother was too humble to live with him, but his unmarried sisters resided with him at the patriarchal palace in Venice. He made his elementary studies at Castelfranco, a small town not far from Venice, and thanks to the interest shown in him by Cardinal Monico, patriarch of Venice, was enabled to continue his education. He was ordained priest 18 Sept. 1858 by special dispensation of Pius IX., and was appointed assistant priest at Tombolo, from which place he was transferred, in 1867, to Salsano, as parish priest. His zeal, piety and well-directed energy led to subsequent appointments to such important ecclesiastical dignities as spiritual director in the seminary, judge of the ecclesiastical tribunal and vicar-general of Treviso.

In 1884 he was consecrated bishop of Mantua, in Lombardy, where he remained for nine years. On 12 June 1893 Pope Leo XIII. created him cardinal with San Bernardo alle Terme as his titular church, and very shortly after this he was made patriarch of Venice, whence, nine years later, he was summoned to Rome to elect a successor to the papal throne, made vacant by Leo's death, and was chosen as that successor.

Pius X. is a striking example of the bestowal of the highest dignity in the Roman Catholic Church upon one of the lowliest origin, utterly void of ambition, whose career had been marked only by the sincerest piety and indomitable zeal in the practice of his ecclesiastical profession. His elevation is an apotheosis of the parish priest. There could be no more marked contrast than that presented by this pope and the pope whom he succeeded. Leo XIII. was of aristocratic birth, a scholar, a diplomat. Pius X. has the lowly peasant spirit which characterizes his whole family. He deprecated his elevation to the bishopric of Mantua and was prostrated by his election to the papacy, accepting it only through sense of duty. Although speaking and knowing his own language with classical finish, he is familiar with no other except for a slight knowledge of French and German. But he is a man of wonderful charity, with a gift for organizing, and is full of active zeal, notably in preaching. He insisted upon this strongly with his priests. He was known throughout Italy by his work for societies and for his schools. He is utterly opposed to nepotism. His ardor for missionary work drew to him the attention of all who were interested in this field. He exacted observance of discipline although he is indifferent to ceremony and the punctilious observance of mere form and conventionalities. He is a staunch advocate of the Gregorian chant, which is in keeping with his insistence on liturgical observance. Since his accession to the Chair of Peter, Pius X. delivers a simple sermon to the people Sunday afternoons. In his first encyclical, given two months after his accession, the Pope declared that "we have no other programme in the Supreme Pontificate but that of restoring all things in Christ (Eph. i. 10), so that 'Christ may be all in all' " (Col. iii. 2).





*From Stereograph. Copyright, By Underwood & Underwood, New York.*

HIS HOLINESS POPE PIUS X. WITH PAPAL CROWN AND ROBES OF STATE.







## PIUS — PIZARRO

One vigorous measure of Pius X. shortly after his elevation to the papacy was to abolish the "veto" which three Catholic Powers enjoyed in the election of a pope. He drew up a document in which excommunication is pronounced *ipso facto* against any one who acts as the intermediary of any power in proposing a veto against any cardinal during a conclave. Despite his unflinching attitude toward all that involves the authority, teaching and dignity of the Church, Pius X. is personally friendly toward Queen Margherita, with whom he became acquainted when bishop of Mantua, and toward King Victor Emmanuel and Queen Helena, whom he received at the patriarchate in Venice on their visit to that city.

The Venetians were surprised that the Pope did not assume the title of Benedict, as one of the seven popes who, like himself, were from the province of Venice, was Benedict XI. (Boccassini, 1303-4). This pontiff was born at Treviso, with which town Cardinal Sarto had been connected by his labors as priest. Benedict also, like himself, was of humble origin and of lowly spirit.

Pius X. is a handsome man of fine physique, with blue eyes, and silvery hair, and possesses a sonorous voice of great volume, something of special value to one who is distinguished by zeal for preaching. The arms of the Pope are an anchor resting on the waters, and a radiant star. This and the fact that he was elected on the day of Saint Dominic have recalled the title applied to this Pope by the prophecy of St. Malachy: "Ignis Ardens" (a blazing fire). The arms of the Dominicans have a dog (Domini Canes) bearing a blazing torch.

J. J. À BECKET.

**Pius IV., Creed of**, a dogmatic formula of the Roman Catholic Church, announced by Pope Pius IV. in his bull 'In Sanctosanta' (1564). It was prepared by a commission of the Tridentine Council. A formal acceptance of it is required by the Church from all converts, teachers, and priests. The contents may best be ascertained by consulting the full text given in Schaff's 'Creeds of Christendom' (1877-8).

**Pius IX., Order of**, a papal order of merit of two classes founded by Pius IX., in 1847. It is conferred on the nobility in recognition of virtue and desert. The uniform is of blue with red facings and gold embroidery, and the decoration is a hexagonal blue star with gold flame between the arms, bearing upon the obverse, "Pius IX.," surrounded by the motto "Virtuti et Merito."

**Piute** (pī'üt) **Indians**, a name given various small tribes of American Indians of the Shoshone family, residing in southwestern Utah, Nevada, Arizona and southeastern California. There are about 5,000 of them, two thirds of whom are beyond the jurisdiction of the Indian agencies. The Piutes in different localities are known as Paviotos, Chemehuevis, Pautis and Numas. See SHOSHONE INDIANS.

**Pizarro**, pī-zä'rō (Sp. pē-thär'rō), **Francisco**, Spanish adventurer, the discoverer and conqueror of Peru: b. Truxillo, Estremadura, about 1471; d. Lima, Peru, 26 June 1541. The spirit of adventure which in his time pervaded Spain induced him to seek his fortune in the newly found continent of America. He was in

Darien in 1509 and afterward was connected with Balboa when the latter discovered the Pacific (1513). Subsequently he became associated with Hernando Luque, a priest possessed of some money, and Diego de Almagro, an adventurer like himself, and having jointly fitted out an expedition the associates set sail from Panama on a voyage of exploration and conquest along the coast to the southward (1524). Their first voyage was unsuccessful, but learning the existence of the rich empire of Peru they were not long in making a second voyage, with the intention of conquering this country. Their forces were too few, however, for this object, and Pizarro determined to seek assistance in Spain. After encountering tedious delays and obstacles he obtained from the queen a commission bestowing on him the right of discovery and conquest in Peru, with the rank and title of governor and captain-general of the province. Raising a small force in Spain, he recrossed the Atlantic (in 1530), and January 1531 sailed from Panama with three vessels and a force of 185. Taking advantage of a civil war then raging in that country, the Spaniards became the allies, and eventually the enslavers of Atahualpa, the successful contestant for power. What has been ascribed to treachery on the part of Pizarro in dealing with Atahualpa, has proved, in the light of recent historical research, to have been a justifiable and necessary policy in the Spaniards' defense against the Indian chief's fully planned conspiracy against their lives. The ransom offered and paid by Atahualpa for his release amounted to some \$8,000,000, and not to \$17,000,000 as commonly and erroneously stated. The news of their success brought a considerable accession of strength from Europe to the invaders. The inca Manco was allowed to reign as a do-nothing monarch. Pizarro was made a marquis, and in order to consolidate his empire, founded, in 1535, the city of Lima, which he intended as the capital of his possessions. But the discord which had long existed between Almagro and Pizarro at last broke out into open violence, and in the struggle which ensued Almagro was defeated, taken prisoner, and killed. This catastrophe, which took place in 1538, was avenged by partisans of Almagro, who conspired against Pizarro and murdered him in his palace at Lima. The character of Pizarro has been largely rehabilitated by the new school of the historians of the Spanish conquests. He is now acknowledged to have been not only a man of remarkable military genius, but of great integrity and high moral purpose. Consult Prescott, 'Conquest of Peru' (1847); Markham, 'Peru' (1893); Lummis, 'Spanish Pioneers' (1893).

**Pizarro, Gonzalo**, Spanish adventurer: b. Truxillo, Estremadura, about 1506; d. Cuzco, Peru, April 1548. He was half-brother of Francisco Pizarro (q.v.) whom he accompanied on a second visit to Peru in 1531. In early life he had signally distinguished himself as a soldier, and when he reached the New World was acknowledged to be the best lance in Peru. His talents were exclusively those of a guerrilla chief, as he lacked the military and civil capacity of Francisco. He subdued Charcas (Bolivia), obtained a grant of the mineral district about Potosi, and grew rich. In 1540 he was appointed by Francisco governor of Quito, and directed to under-



## PLACENTA — PLAGUE

take an expedition toward the east, where a land supposed to be extremely rich in spices was reported to lie. He set out on the expedition across the Andes, during which he was deserted by Orellana (q.v.), who discovered the headwaters of the Amazon, and descended that stream to the ocean. The expedition occupied two years, and greatly thinned the ranks of the adventurers by its hardships. After the assassination of Francisco, Gonzalo raised an army and advanced upon Lima to attack Nuñez Vela, the new and unpopular viceroy sent out from Spain. He was warmly supported by the bulk of the colonists and many of the royal troops. On 18 Jan. 1546 a battle took place at Anaquito near Quito, in which Nuñez was defeated and slain. But in the following year Pizarro was attacked by an army sent from Spain under Pedro de la Gasca and was eventually defeated, taken prisoner, and executed.

**Placen'ta.** See EMBRYOLOGY; OBSTETRICS.

**Placet**, plā'sēt, or **Placitum**, plās'ī-tŭm (*placitum regium*), the assent of the civil power to the promulgation of pontifical ordinances within its jurisdiction; called also *exequatur*. The right to exercise supervision over communications of the Holy See with bishops, clergy and people of sovereign states and to prevent or suspend the promulgation of bulls, letters apostolic and other papal instruments, unless they have received the approval of the secular state itself, is asserted in the famous 'Declaration' of the Gallican clergy (1682); and in the various German states it is embodied in the constitutional law: this is no less true of Catholic states than of Protestant. The exercise of the right was carried to extreme lengths by the Emperor Joseph II. (reigned 1765-90) who asserted for himself a supremacy in the administration of church affairs. And not only ordinances emanating from Rome but even those of the local bishops were made subject to censorship by the secular authority. The See of Rome has never admitted as a matter of right the claim of the state to impede the execution of papal ordinances; but to prevent greater evils it has generally acquiesced in the exercise of this power. All the Catholic states of the continent of Europe claim and exercise the right. In the kingdom of Prussia in the years 1873-5 very stringent laws were enacted (Falk laws, May laws) to control the Catholic bishops and clergy, the Catholic theological seminaries, and the Catholic Church discipline. A newly ordained priest was made liable to fine and imprisonment if he proceeded to the work of his ministry without the *placet* or *exequatur* of the minister of worship; or confessors incurred the like penalties for refusing absolution under certain circumstances to penitents: in 1884 there were in the one diocese of Breslau 119 priests who had incurred the penalties; but the government intervened and the penalties were remitted; afterward all of the Falk laws were either repealed or mitigated essentially.

**Placetas**, plā-sā'tās, Cuba, town, province of Santa Clara; 20 miles southeast of the city of Santa Clara. It is in a fertile sugar district, is connected with Camajuani, and the seaports of Sagua La Grande and Caibarren by rail. Pop. (1899) 5,409.

**Placoidei**, plā-koi'dē-ī, the name of an obsolete grouping of fishes, including those with placoid scales. See FISH.

**Pla'gal**, in music, the name given by Gregory the Great to the four collateral scales which he added to the four authentic scales of Ambrose. The term plagal is now applied to melodies in which the principal notes lie between the fifth of the key and its octave. The plagal cadence consists of the chord of the subdominant followed by that of the tonic. See MUSIC.

**Plagiaulacidæ**, plā''jī-â-lās'ī-dē, a group, ranked as a family, of primitive, multituberculate mammals, whose fragmentary remains occur in formations of Jurassic age in both Europe and North America. These remains are chiefly of jaws and molar teeth, in many respects foreshadowing those of the marsupials. The typical genus is *Plagiaulax*; others are *Allodon*, *Bolodon*, and *Ctenacodon*. This family, says Woodward, does not seem to have become extinct until early Tertiary times, the genus *Ptilodus* occurring in the Puerco (Eocene) beds of New Mexico. Whether the South African genus *Microlestes*, often associated with these genera, really belongs here is disputed, many palæontologists regarding it as reptilian. Consult: Woodward, 'Vertebrate Palæontology' (1898); Beddard, 'Mammalia' (1901).

**Pla'gioclase**, a group of triclinic feldspars (q.v.) in which the two prominent cleavage-directions are oblique to each other. The designation was adopted by Breithaupt. In the group are included: anorthite albite, oligoclase, labradorite.

**Plagios'tomi.** See FISH; ICHTHYOLOGY.

**Pla'gium**, in Roman law, the crime of stealing the slave of another, or of kidnaping a free person in order to make him a slave. According to German law it is the getting forcible possession of a man's person, so as to restrain him of his liberty. By Scotch law the crime of stealing an adult person was punishable with death, and the same punishment has been applied to the stealing of children. The word has given origin to the term *plagiarism*, used for the act of stealing the thoughts and words of another by publishing them as one's own.

**Plague, History of the.** In regard to the origin of the plague, the nature of which is elsewhere described (see BLACK DEATH; BUBONIC PLAGUE), and concerning the modes of its communication, very different opinions have been entertained, according to the state of medical science. In early times, when calamitous events, the causes of which were not understood, were attributed to spirits and demons, the plague was also ascribed to their influence. At a later period it was accounted for by changes in the air, by poisonous vapors which descended from the atmosphere, or was attributed to clouds of insects which were received into the body by inspiration, or in the food, or by absorption through the skin, and thus corrupted the blood. There are certain conditions which have always attended outbreaks of the plague. The chief of these are unwholesome and insufficient food, overcrowding, bad ventilation, accumulation in the neighborhood of dwellings of decaying animal and vegetable refuse. In short, these conditions may be summed up in the words, "poverty



## PLAGUE

and bad sanitation." The plague appears to be unknown within the tropics, and the cold weather of northern latitudes has been observed to check its advance. In Europe the late summer and autumn months have been marked by its deadliest ravages. It is endemic in certain localities of Asia (parts of Mesopotamia, India, China), and when it has appeared in Europe it seems always to have been traced to the East. It has often been carried by ships, no doubt by one or other of the crew being infected, and not by the merchandise.

There is little doubt that the plague appeared in the most ancient times, particularly where a numerous population was crowded together in the warm climates; but we must not consider every disease as the plague which has been so called by historians, as they often mean by the term nothing more than a malignant disorder prevailing over a considerable extent of country. Among the most famous instances is the plague described in so masterly a manner by Thucydides, which, in the second year of the Peloponnesian war (430 B.C.), ravaged Athens, then besieged by the Spartans. A large number of the inhabitants of Attica had fled into the city. Fear, anxiety, want, or badness of provision, and the corruption of the air caused by the crowded state of the population, produced and propagated the disease in the city. Death generally ensued on the seventh or ninth day. This epidemic does not seem to have been the real Oriental plague, however, any more than that which prevailed in Jerusalem (72 A.D.) when it was besieged by the Romans, as described by Josephus. In Rome the plague existed (77 A.D.) in the reign of Vespasian; of Marcus Aurelius (170), when it raged over almost all Europe and Asia (but this was probably not the real plague); of Commodus (in 189); and particularly of Gallienus (in 262), when 5,000 persons are said to have died daily in Rome. In Constantinople, in the reign of Justinian (in 544), it raged so violently that 1,000 grave-diggers are said to have been insufficient for the interment of the dead. This terrible plague continued its ravages for 50 years with but short intervals. In 565 it appeared under the name of *pestis inguinaria* in Trèves; in 588 in Marseilles. From the descriptions of this visitation given by contemporary writers it was evidently the true Oriental plague, and it had spread over Egypt before reaching Europe. Great mortality from it resulted not only in Constantinople but also in Italy, Gaul, and other countries, including northern Africa. In the 7th century the plague or other serious epidemic raged in Saxony; in 823 it prevailed all over Germany, and from 875 to 877 was particularly malignant in Saxony and Misnia, as was also the case in 964. In the 11th century it broke out in Germany at least six times, mostly after or during a famine, and raged with so much violence that it was believed that all mankind was doomed to be swept away by it. This unfortunate belief prevented the taking of effectual means to check it, and apathy in suffering was considered as an act of piety. In some cases, however, the Jews were suspected of having poisoned the wells, as in a time not very remote the Hungarian peasantry suspected the nobility when the cholera swept away so many of the poorer classes. In the 12th century the plague prevailed in Germany

above 25 years. In the 13th century it was brought into Europe by the Crusaders. At the middle of the 14th century it traversed all Europe, and was then called the Black Death. The black death was carried to Europe from the East, having been transmitted, it is said, from Tartary, and ultimately from China, to the Crimea, whence it was carried to Italy by certain Genoese. It also reached Egypt and thence northern Africa. In England it broke out first in the west in 1348, and then spread over the rest of the country, including Ireland and Scotland; its ravages being severest in the towns. After causing an immense number of deaths it reappeared in 1361 and 1369. The black death was the most serious epidemic ever known to have afflicted Europe. In England the proportion of deaths amounted to a third, or even a half, of the whole population. Some towns lost almost all their inhabitants; in Oxford two thirds of those connected with the educational institutions perished; in London the deaths amounted to 100,000, in Norwich to 60,000. The mortality was naturally greatest among the lower orders; while the clergy and religious orders suffered to an equal or greater extent, no doubt from their efforts on behalf of their suffering brethren. Of those attacked some died almost immediately, others within 12 hours, almost all succumbed within three days. It appears to have been at its height in the summer of 1349. The consequences it left behind it were great and far-reaching. One was that laborers were now so scarce that wages went up to double their former rate, thus leading to the passing of acts intending to regulate them, which had little result except to stir up ill-feeling, ultimately culminating in Wat Tyler's insurrection. Another consequence was the breaking up of many estates into farms let on lease, owing to the scarcity of hired labor by which they could be cultivated under their owners' management. A great accession to the land owned by the Church was another consequence of the black death, which long remained a landmark in English social history. Since that time the plague has never raged with so much violence. Boccaccio, in the introduction to his 'Decameron,' has given a vivid description of its physical and moral effects in Florence in 1348. In the 15th century it raged in Europe on several occasions, and was accompanied with dreadful sufferings. The historians of that time give terrible pictures of distress. London suffered severely both at the beginning of the century and again in 1428, while a serious outbreak took place in 1472 and subsequent years. In the 16th century the plague again raged, and in 1563 was introduced into England by the return of an English army from the Continent. Though some means were already taken against the plague—for instance, lazarettos built—yet it raged in Europe on various occasions and in different countries during the 17th century. Holland suffered from it in 1603; in the same year Egypt lost by it about 1,000,000 of its inhabitants. In 1630 Milan was ravaged by it; in 1635–7 Holland again suffered; in 1656 Italy had a dreadful visitation, during which 300,000 persons are said to have died in Naples, 60,000 in Genoa, but only 14,000 in Rome, owing to superior sanitary measures and precautions. On this occasion it spread also to Spain, Germany, and Holland. In 1603, 1625,



## PLAGUES OF EGYPT—PLAICE

1636, and 1665 it made great ravages in England. In 1603 there are said to have been 38,000 deaths in London; in 1625, 35,000; in 1636, over 10,000; while 1665 is known as the year of the "great plague" in London, so graphically described, with perhaps some coloring, by Defoe. During the year the deaths are given at nearly one seventh of the population. The disease spread somewhat widely over the country both in this and the following year. The cessation of the plague in London was attributed to the great fire, and though this no doubt had its local effect, still there was a similar disappearance of the epidemic not long after this time in western Europe. In 1679 Vienna lost 76,000 of its citizens by this scourge; in 1681 Prague lost 83,000; and various German cities suffered severely. Early in the 18th century the plague caused many deaths in eastern and central Europe, the number in Prussia and Lithuania being set down at 283,000. On this occasion it extended its ravages into northern Europe, Copenhagen and Stockholm having both suffered, the latter to the extent of 40,000 deaths. In Constantinople and other places in the Levant it frequently raged during this century, and in 1720-1 Marseilles and part of southern France were ravaged by the epidemic brought from this quarter. The deaths in Marseilles alone are said to have numbered from 40,000 to 60,000; thousands of corpses lay unburied in the streets. In 1770 it raged in Moldavia, Wallachia, Poland, and other adjacent regions, and in 1771 it carried off over 40,000 persons in Moscow, or one fourth of the whole population. During the 19th century it made itself felt on several occasions in Constantinople and other parts of eastern Europe, in Asia Minor, Syria, Mesopotamia, Arabia, Persia, Egypt, and northern Africa, but nowhere has it affected a very wide area. In 1834-5 great mortality was caused by it in Egypt. It also carried off many thousands in Mesopotamia between 1873 and 1877. In 1878-9 the plague made its appearance on the lower Volga, where it caused a considerable number of deaths.

India has often been visited by this terrible disease, and hundreds of thousands have at various times succumbed to it in that country. In September 1896, several cases were recognized in Bombay, and during the succeeding nine months the disease raged in the city with such severity that the majority of the inhabitants fled to neighboring towns and villages. Poona and Karachi were attacked by the end of 1896, and the disease also spread to more distant parts. A special commission of experts was appointed by the Indian government, and vigorous measures, such as house-to-house visitation, thorough disinfection, and enforced isolation, were adopted. The native municipality of Bombay was for plague purposes superseded by a plague committee. In February 1897, an international sanitary conference regarding the plague sat at Vienna, and after discussion came to the conclusion that the disease was caused by a bacillus discovered in 1894 by Kitasato and Yersin. They also gave countenance to the view that rats, mice, and certain other animals, which were liable to attack, probably contributed largely to spread the disease. Bombay was again visited by a serious epidemic in the autumn of 1897, which reached a climax in February of the following year, when the deaths from plague num-

bered 250 per day. This outbreak also spread to other parts of India, especially in the Bombay presidency, but it was virtually over by June. The sanitary measures of the authorities came into collision with native beliefs and prejudices at various points, and on 9 May 1898 serious riots broke out in Bombay and elsewhere. This led the government to abandon all the more stringent and severe of their preventive measures, and the fact that no harm resulted from their action seems to justify the statement that the disease takes its own course whatever may be done. Calcutta was first visited by the plague on 16 April 1898, and soon a considerable number of cases were recorded. Bangalore and some other places in southern India suffered severely, and in August Bombay was again seriously affected. This renewed outbreak passed off in due course only to be succeeded by another, extending from February to July 1899. In 1899 Calcutta was revisited, and other parts of India still continued to lose many lives by this scourge. The plague reached Madagascar in November 1899, and this is the first authentic record of its appearance south of the equator. It was soon afterward reported from Réunion, Mauritius, German and Portuguese East Africa, and West Africa. In July of that year some Spanish sailors arriving at Oporto died of the plague, and it also carried off others in this part of Portugal. The first instance of the plague in the New World was recorded from Brazil in November 1899. Early in 1900 the first case of it was recorded in Australia, but by September that country was practically free from the disease. It has since visited South Africa, and in 1900 there were a few cases at Glasgow. The spread of the plague in India during recent years is shown by the following official figures: In 1897 there were 56,000 recorded deaths; in 1900, 93,000; in 1901, 274,000; in 1902, 577,000. During the single month of March 1903 no less than 136,000 in that country perished from this disease.

**Plagues of Egypt**, a succession of afflictions, usually regarded as having been 10 in number, which, according to the Old Testament, were divinely sent upon the Egyptians to compel them to emancipate the Israelites from bondage and allow them to quit the land of Egypt. (Ex. vii. 14, xii. 30. For the use of the word plague, see ix. 14, xi. 1.) The first plague consisted in the turning of the waters of Egypt into blood; the second, of frogs that covered the land; the third, of lice annoying both man and beast; the fourth, of grievous swarms of flies; the fifth, of murrain that attacked the live stock; the sixth, of boils "breaking forth with blains upon man and upon beast"; the seventh, a severe thunderstorm accompanied by destructive hail; the eighth, a plague of locusts that ate what the hail had spared; the ninth, a darkness that could be felt; the tenth, the death of the firstborn of man and beast among the Egyptians.

**Plaice**, a European flatfish (*Pleuronectes platessa*), allied to the turbot, and highly esteemed as food. It attains an average length of 12 or 18 inches. The dark or upper side is colored brown, spotted with red or orange. They are caught chiefly by means of trawl-nets.



## PLAID — PLAIN

**Plaid**, in textile manufacture, goods of any quality or material of a tartan or checked pattern. Also, a garment of tartan or checked woolen cloth of various colors, worn by both sexes of the natives of Scotland, of which country it is an important part of the national costume. Plaids of a peculiar black and white check, known as shepherd's tartan, or of a plain gray, are largely worn by the rural population of Scotland, and are sometimes called mauds.

**Plain** (Lat. *planum*, level ground), a tract of land which is level or undulating. That portion of the earth's surface not covered by water may be classified into two great divisions, namely, mountains and plains. This broad classification includes under plains all broad tracts whose surfaces are not so elevated as to be included among mountains. The plains may be classified as the narrow tracts of land, with high land or mountains bordering the sides, as valleys; the broad expanse of level or rolling land of an altitude of 1,000 feet or over, as a plateau, and all the broad plain-lands below 1,000 feet are classified as plains. This classification is not always followed, as many of the plateaus of the world are called great plains. Another method of classification is by the nature of the formation of the plain. The rivers of the world which enter the ocean deposit each year a large amount of débris brought down from the mountains. The ocean currents and tides distribute this deposit over the ocean bed and, in some places, a constant process of plain-building is in progress. As the amount of soil accumulates, the plain grows higher until it becomes a part of the continental land mass. Such tracts of land are called marine plains. The North Atlantic marine plains formed on both the east and west coasts are now so broad that the coast plain on both sides extends far out, below the surface of the water. The fossils found in the strata indicate the origin of the Atlantic Coastal Plain. Tracts of land that were once the beds of great lakes, but which have dried up, are called lacustrine plains. Lacustrine plains exist around Great Salt Lake in Utah, and in Nevada, the valley of the Red River of the North, the vale of Kashmir in northwestern India, and the great Hungarian Plain. The deposit of silt at the mouths of rivers, and sometimes along the banks make fluvial plains, or flood-plains. The Mississippi, Po, Ganges, Nile, and other large rivers have constructed great fluvial plains, and the mighty builders still continue their work. Still another origin for plains is erosion, by means of which the mountains are lowered and the broad tract of rolling or hilly land forms. Such formations are called plains of denudation. Where considerable of the former mountain area remains, the lowland formed by erosion or denudation is called a peneplain. In respect of fertility plains show all gradations from wholly barren salt plains, such as the salinas of Argentina, in South America, and almost wholly barren deserts, such as are represented chiefly in Africa and Asia, to the highly productive alluvial plains of such great rivers as the Mississippi and the Ganges. Various special kinds of plains in different parts of the world are distinguished by special local names. Among these are the landes, or sandy plains in the southwest of France; the treeless steppes of southern Russia in Europe and Central Asia;

the marshy tundras of northern Siberia; the arid karroos of Cape Colony; the savannahs and prairies of North America; the grassy llanos of the Orinoco Valley; the forest plains or selvas of the Amazon basin; and the treeless and partly barren pampas of Argentina. The great desert plain of the world is the Sahara (q.v.) in Africa, extending from the west coast of Africa to the Red Sea, a distance of over 2,500 miles; and over 1,000 miles wide from north to south. This desert plain is made of bare ledges of rock miles in extent, oceans of sand, white in some places on account of the salt. Beyond the Red Sea the desert lands extend, including the Arabian plain, and plains in the interior of Asia, into China almost to the Pacific Ocean. The great plains of the interior of Africa, south of Sahara, are covered with dense vegetation. The interior of Australia, so far as known, consists of extensive low plains upon which the waters of the rivers become stagnant amid gigantic reeds and herbaceous brushwood. The long dry seasons to which the country is subject make the plains vast deserts. The falling of the rains, however, speedily converts these dusty wastes into verdant pastures. Central Asia is a region of immense mountain chains supporting table-lands of great extent. The northern parts of the same continent and of Europe present in a range of more than 6,000 miles a succession of broad plains, covering the greater part of Siberia, a large part of Russia, Germany, and Holland. On this range, from the Pacific to the Atlantic, are no elevations exceeding a few hundred feet. These plains in Siberia and Russia are called steppes, and large portions of them are rich pasture lands, without trees, and much resembling the prairies of the Mississippi Valley. The American continent, north and south, is eminently a land of plains. They form full two thirds of the whole surface of the country, extending on the Atlantic side from one extremity of the continent to the other, with only occasional interruptions by mountain ranges of little extent. In South America are distinguished three great regions of plains separated from each other by low ranges of mountains, which run from the Atlantic coast toward the Andes. The northern of these regions, having an area of 260,000 square miles, comprises the valley of the Orinoco and its tributaries, and the elevation of this great territory nowhere exceeds 300 feet above the sea-level. So smooth is the surface that over hundreds of square miles the land is almost as unbroken by any unevenness as the water itself, and the rivers are so sluggish that their current is diverted in any direction by light winds. This is the region of the llanos (Lat. *loca plana*). In the dry season the ground is parched and barren, and clouds of fine dust and sand incessantly rising fill the air. The grasses, which in the rainy season suddenly spring up and grow to the height of four feet, are withered and crumble into dust. But as the vegetation appears with the return of the rains, the plains are soon overrun by vast herds of horses and wild cattle, which then find a rich pasturage; and from the jungles of the river banks, to which they had retired during the drought, the great serpents and alligators make their appearance and overspread the plains. The only interruptions to the dead level of the surface, beside the depressions of the beds of the rivers and creeks, appear to be occasional banks



## PLAIN

of limestone or sandstone, called bancos, standing four or five feet above the general surface, flat at the top, and several leagues in length. Slight undulations, called mesas, imperceptible to the eye, are indicated by the water courses which are turned by them in different directions. The plains of the Amazon extend up the course of that river and its branches to the Andes, and include, with all the waters they enclose and some ranges of hills, an area of 2,340,000 square miles. About one third of this vast territory is covered with dense forests, the principal portions of which have not been explored. So luxuriant is the vegetation and enervating the climate, that to reclaim any considerable extent of these wilds is a task almost beyond the ability of man. From their wooded character the plains here are called selvas; but open tracts like the llanos are scattered among the forests, and numerous broad rivers occupy large areas and afford the only means of gaining access to the distant interior. The plains of the southern portion of South America, lying beyond lat. 15° S., are termed pampas, from an Indian word signifying a flat. They resemble the steppes of Russia, being open grass-covered tracts of vast extent, interspersed with barren areas composed of rocks and sand. Their total extent from north to south is about 1,800 miles, and from east to west from 300 to 900 miles. On the north they reach the region of tropical productions, and at the extreme south their surface is in many places concealed beneath the never-melting ice and snow of those frozen latitudes. Across their range from the coast to the Andes three belts are recognized in their northern division, distinguished from each other by their peculiar productions. The first is strongly marked by its singular growth of tall thistles succeeded by clover. The former come forth with wonderful rapidity in the early summer, shooting up to the height of 10 or 11 feet, and bearing a profusion of rich blossoms. So close are the stems, that even if unarmed with their prickles they would still present an impenetrable barrier. As the summer passes away this vegetation dies down, and luxuriant crops of clover spring up, and invite the return of the countless herds of cattle which were expelled by the thistles. To the west of this is a belt of plains covered with long grass, which from season to season undergoes little change except as the green of summer changes to the brown hue of winter, and this gives place to the verdure of the succeeding spring. Beyond this is a region of more elevated plains lying along the range of the Andes, and covered with low trees and shrubs, all evergreens. The plains of North America, while no less extensive than those of the southern part of the continent, are distinguished from them by greater diversities of level, which, together with the climate, render the country better adapted to the necessities of man. Excepting the parts covered by the Rocky and Alleghany Mountains and their spurs, all the rest are plains uninterrupted by mountain elevations. Near the mountains the surface is hilly and more or less broken, but receding from the Alleghanies westward it gradually assumes the distinctive character of plains, which are developed upon a grand scale in the boundless prairies of the northwest, and in the barren territories commonly known by the name of plains which stretch away from the prairie

region in the states of Arkansas, Missouri, and Kansas to the foot of the Rocky Mountains. Throughout these immense territories the differences of level are sufficient to produce a steady flow in the mighty rivers, not so rapid as to obstruct their navigation, but sufficient to insure salubrity to the country by a healthy drainage; and thus is secured a system of easy intercommunication between all sections of the country, unsurpassed in importance by any similar system in the world. In the first volume of the geological report of Iowa Prof. James Hall has presented a full account of the northwestern prairies. The region they occupy is the western part of Ohio, nearly the whole of the States of Indiana, Illinois, and Iowa, the southern part of Michigan, the northern part of Missouri, and portions of Kansas and Nebraska, in which, near the meridians of 97° and 100° W., they gradually pass into the arid and desert plains. Throughout this territory a great sameness exists in the varieties of the topography, the vegetable productions, the soil, and geological features. The surface is drained by streams which commence in almost imperceptible depressions of the high prairies, and flow in beds and valleys of gradually increasing depth between vertical walls of limestone or sandstone, through the horizontal strata of which the current has in past times made its channel. What are called bottom lands lie between the rocky bluffs and the stream, and upon the Mississippi and the Missouri, these attain in places a width of six to eight miles; they are, however, often wanting entirely, the bluffs on each side coming close to the river banks. On the upper Mississippi the bottom lands are in general well wooded, but along the State of Missouri they spread out into open prairies. These low or wet prairies are distinguished from the high or rolling prairies, which form the general upper level of the country upon the summit of the bluffs. The elevation of these above the rivers is very variable. Near Prairie du Chien in Wisconsin, it is about 400 feet above the Mississippi, and the bluffs themselves present a vertical face of about 300 feet. At Cairo in Illinois, the upper surface is from 100 to 250 feet above the river, or 400 to 550 feet above the sea-level. In the central portion of the State, near the Illinois Central Railroad, the average elevation is from 650 to 750 feet above the sea, and near the northern border of the State this increases to 800 or 900 feet, and some of the highest swells of the prairie are 1,000 feet high. In southern Wisconsin the more elevated portions of the prairie are about 1,100 feet above tide water. In Iowa the *plateau du cotéau des prairies* of Nicollet, dividing the waters of the Mississippi from those of the Missouri, is from 1,400 to 1,500 feet above the sea. On the head waters of the Illinois and Wabash, and south and west of Lake Michigan, the prairies are very level and smooth, and are termed flat. Elsewhere the surface is undulating and broken by the depressions of the streams, and they are known as rolling prairies. The depressions where there are no streams are often 50 feet below the mean level, and in the bottom the soil is wet and marshy and forms "swales" or "sloughs," which render the roads almost impassable. In these places the grass grows very rank and tall, but upon the upper and drier surface the natural growth is finer and the



## PLAIN — PLAIN SONG

sod dense and closely interwoven. A great variety of flowering plants are interspersed among the grasses, and during the summer the whole surface of the prairies is gaily decked with bright colors. The characteristic herbs, as described by Prof. Gray in a paper on the "Flora of the Northern States," published in the 'American Journal of Science' (2), xxiii. p. 397 (1857), would seem to be compositæ, especially helianthoid compositæ, of many species. Trees are in scattered groups, or along the larger streams, or occasionally on low rocky ridges, which are sometimes met with. West of the Mississippi they become less frequent, and near lon. 98° W. they disappear altogether. The soil of the prairies is remarkable for its finely comminuted condition. It is generally free from stones, though in some localities boulders or fragments of rock are found upon the surface and scattered through it. In the swales and in some of the bottom lands the rich black vegetable mold is very deep, but on the upper prairies its depth is usually from one to two feet. The subsoil is almost invariably an argillaceous loam, more or less mixed in its lower portions with sand and occasional pebbles. The total thickness of clay, sand, and loam amounts in some places near the larger rivers to 200 feet, but the rock is often found in other places very near the surface. Water is generally found in the sandy stratum 15 to 30 feet below the surface. Throughout the prairie region the underlying rocks are soft sedimentary strata, especially shales and impure limestones. Most of these on exposure disintegrate readily and crumble to soil, and the whole soil of the prairies appears to have been produced from such materials not removed far from their first beds. To the finely comminuted condition of these materials Professor Hall ascribes the treeless character of the prairies. Where such soils are found in portions of the western part of North America, covering tracts of limited area even enclosed in thickly wooded districts, they are commonly without trees; and as is the case with the vast treeless plains of the Mississippi Valley, no ancient trunks buried in the soil indicate that the localities were ever covered with trees.

**Plain, Fort, or Fort McKean**, a former fort of Revolutionary days, located at the junction of the Mohawk and Osquaga creeks, in New York State.

**Plain Song** (Plain Chant, *Cantus planus*, Gregorian Chant), the most ancient and simple form of church music, consisting of easy progressions in one of the church modes, suitable for use by priests or a congregation. When counterpoint was introduced, it was customary to compose parts above or below a portion of ancient plain song; hence the term plain song is often synonymous with *canto fermo*, or the fixed melody to which counterpoint is added. It differs from modern music, (1) in its recitativo-like character, as opposed to barred music; it has no marked and regular rhythm; the rhythm of a piece of modern music is indicated by the signature as being either in common or in triple time or some variety of these, and the stave is divided into bars or passages equivalent in length; but in plain song there is no such division, and the rhythm of the music is derived from the metrical

rhythm of the psalm or hymn rather than *vice versa*. (2) The *modes* or scales in which plain song is written are more numerous and varied than the modern major and minor. (3) The notation of plain song is by means of a stave of four lines, on any one of which either of the two received clefs (C and F) may be set and so determine the sound of all other notes, above and below. Originally the notes in plain song were all of one length; they are now of three kinds, longs, breves and semibreves, the long being equal to the breve and semibreve. The *modes* of plain song are named after the ancient Greek modes — Dorian, Phrygian, Lydian, etc., but beyond the name there is no relation between the two systems. The principle of the plain song modes is that each of the seven natural sounds of the diatonic scale forms the key-note or "final" of a mode, which comprises that note and the seven above it. (The melodies rarely exceeded an octave, and no flats or sharps are used except an occasional B flat.) This gives seven modes; but to each of these is attached another, in which the melody, while having the same "final" or key-note, instead of rising to the octave above, ranges from the fourth below it to the fifth above; these are the *authentic* and the *plagal* modes respectively. The difference between an authentic and a plagal melody may be illustrated from the two psalm tunes *Newton* or *New London* and the *Old Hundredth*; in the first the melody lies between the key-note and its octave, but in the other between the fourth below and the fifth above the key-note. Of these 14 modes two are universally rejected in practice as defective — the 11th and 12th. In the following table the notes of the scale are indicated by the letters of the alphabet according to modern notation; the "final" or key-note in each mode is distinguished by full-face type.

AUTHENTIC MODES		PLAGAL MODES	
1. Dorian, <b>D</b> , E, F, G, A,	B, C, D.	2. Hypodorian, A, B, C,	<b>D</b> , E, F, G, A.
3. Phrygian, <b>E</b> , F, G, A,	B, C, D, E.	4. Hypophrygian, B, C,	<b>D</b> , <b>E</b> , F, G, A, B.
5. Lydian, <b>F</b> , G, A, B,	C, D, E, F.	6. Hypolydian, C, D, E, <b>F</b> ,	G, A, B, C.
7. Myxolydian, <b>G</b> , A, B,	C, D, E, F, G.	8. Hypomyxolydian, D, E,	<b>F</b> , <b>G</b> , A, B, C, D.
9. Æolian, <b>A</b> , B, C, D, E,	F, G, A.	10. Hypoæolian, E, F, G,	<b>A</b> , B, C, D, E.
11. Locrian, <b>B</b> , C, D, E, F,	G, A, B.	12. Hypolocrian, F, G, A,	<b>B</b> , C, D, E, F.
13. Ionian, <b>C</b> , D, E, F, G,	A, B, C.	14. Hypoionian, G, A, B,	<b>C</b> , D, E, F, G.

The Ionian is the modern major mode. In one or other of the twelve approved modes every plain song melody is composed. The psalm tunes are written in the eight modes 1, 3, 5 and 7 (authentic), and 2, 4, 6 and 8 (plagal); the 114th psalm, *In Exitu Israel*, has from ancient times been sung to a peculiarly beautiful melody in mode 9, the *Tonus peregrinus*: ancient tradition traces this tune back to the time of the Maccabees and the purification of the Temple after the first victories of Judas Maccabæus (165 B.C.) on which occasion were sung the psalms of the Hallel (Ps. cxiii.-cxviii.); and it is highly probable that all the psalm tones used by the church had their origin in the Jewish Temple-service. From the beginning vocal music was employed in the church service and formed an important part of it. At first the tones and melodies were handed down orally, afterward



## PLAINFIELD — PLANE

some crude system of notation was devised, but it was very defective, and was reformed by Saint Ambrose, bishop of Milan (4th century), who brought to the West the mode of chanting which he had learned during his residence at Antioch: the 'Ambrosian chant' was founded on the first four authentic modes, and was sung antiphonally. Till the pontificate of Gregory I. it was widely in use in the Western churches; but after Gregory's reform the Ambrosian chant was disused, and is now practised only in the cathedral and diocese of Milan. How Gregory noted the music is uncertain: the early notation and rules of plain song were so complicated that it is said ten years' study was necessary to acquire mastery of them. Among the plain song melodies used in the Roman church service of the Holy Week, those of the Lamentations of Jeremiah and of the *Exultet*, a portion of the Holy Saturday service are by musicians declared to be "beautiful beyond all description"; and the *Exultet* has been regarded as the finest example of plain song in existence.

**Plainfield, Conn.**, town in Windham County; on the Quinebaug and Moosup rivers, and on the New York, New Haven & Hartford railroad; about 42 miles in direct line east by south of Hartford. The town includes within its corporate limits several villages. It was settled in 1690 and at first was called Quinebeag. It was incorporated as a town in 1699. The chief manufacturing establishments are a foundry, wagon and carriage shops, cotton and woolen mills, thread and yarn factories, and creameries. The old Plainfield Academy is in the village of Plainfield, and there are public libraries in the villages of Plainfield and Moosup. The government is by annual town meetings. Pop. (1890) 4,582; (1900) 4,821.

**Plainfield, N. J.**, city in Union County; on the Central of New Jersey railroad; about 15 miles west by south of Newark, 24 miles west by southwest of New York city, and 12 miles west-southwest of Elizabeth. It is at the base of First Mountain, a ridge or uplift in the northeastern part of the State. It was first settled in 1684, incorporated as a township in 1847, and chartered as a city in 1869. It is a residential city, but it has a number of manufacturing establishments, chief of which are machine shops, wagon and carriage factories, silk and cotton mills, kid glove factories, lumber mills, furniture factories, and aluminum works. Chamois, men's clothing, and printing-presses are also manufactured here. The notable public institutions are the Muhlenberg Hospital, 25 churches, eight public schools, one parish school, several private schools, a public library which has about 30,000 volumes, and the Young Men's Christian Association building. The three banks and one trust company have a combined capital of \$450,000, exclusive of the savings bank. The government is vested in a mayor and a council of 11 members who appoint or elect the administrative officials. Pop. (1890) 11,267; (1900) 15,369.

E. L. ADAMS,  
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**Plana'rian Worms.** The term is usually employed to designate free living flatworms included under the *Turbellaria*. They are distinguished by the presence of a triclad or

polyclad alimentary canal. The fresh-water forms (triclads) are abundant in ponds or streams, where they occur on stones, sticks, and water plants. The soft body is elongate and moves in a gliding manner by the action of the ciliary coating of the epidermis. Marine planarians (polyclads) are broader, leaf-like, and much larger. Land planarians are rare beyond the tropics and sub-tropics, where they occur abundantly in moist regions and are photophobic in habit. In form they are much elongated, cylindrical and of considerable size, while the body is often brilliantly marked by colored bands. The food usually consists of higher worms, mollusks and insects, although a few have become true parasites. Consult: Graff, 'Monographie der Turbellarien' (Leipsic 1882-99); Woodward, 'Bulletin Harvard Museum' (XXXI., 1898).

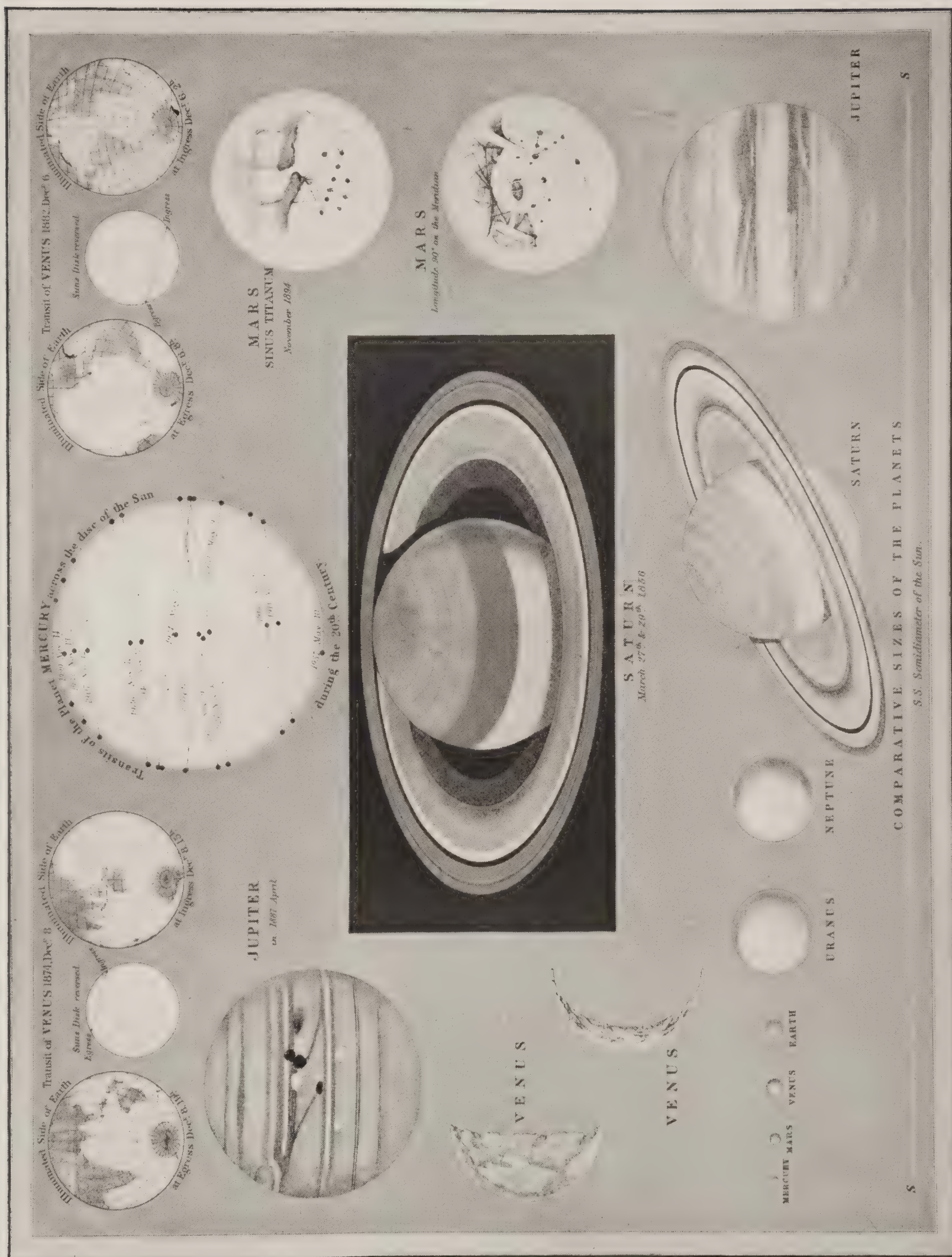
**Planchette**, plăn-chět' (Fr. plăn-shět), the name given a thin heart-shaped piece of wood supported on two castors at the ends of the base and on an ordinary pencil at the apex. If the finger-tips be placed upon the instrument the pencil may readily be made to trace characters even without conscious movement on the part of the operator. When used by some persons it seems to begin to move of its own accord after a little space of time, and if the person wishes, for instance, to have an answer to a certain question, writing may be formed on the sheet of paper on which the instrument is placed, containing something more or less pertinent to the matter—but probably never anything that is not more or less consciously in the operator's mind. It has figured much in spiritualistic exhibitions.

**Plançon**, plăn-sôn, **Pol**, French bass singer: b. in the Ardennes, France, 1860. He studied music at the Ecole Duprez in Paris and in 1881 made his début at Lyons in 'Les Huguenots.' In 1883 he appeared in the Paris Grand Opéra as Mephisto in 'Faust' and scored a great success, which was followed by an equally praiseworthy presentation of Ramfis in 'Aïda.' He has been warmly received at the Metropolitan Opera House in New York. He has created roles in Saint-Saëns' 'Ascanion'; Massenet's 'Le Cid'; etc.

**Plan'cus, Lucius Munatius**, Roman politician and soldier: b. Tibur, near Rome, 1st century B.C. He was a pupil of Cicero and an officer under Cæsar in the Gallic war, and was shown much favor by that general. After Cæsar's assassination he favored Brutus, but soon deserted to Antony and in 42 B.C. was consul. Later he fell into disfavor with Antony and became a partisan of Octavius. The 7th ode of the first book of Horace is dedicated to him.

**Plane**, a popular name for several trees of the genus *Platanus*, which alone constitutes the order *Platanaceæ*, which includes six or seven species, all natives of the northern hemisphere. The American plane, sycamore, buttonwood, or buttonball (*Platanus occidentalis*) is similar to the preceding but larger, often attaining heights of 130 feet and occasionally more than 150 feet. The diameter is frequently more than eight feet. It is a native from Maine to Minnesota and southward to the Gulf States, and is a familiar object in low grounds along streams, especially in the Middle States. Its





### COMPARATIVE SIZES OF THE PLANETS.







## PLANE — PLANQUETTE

brownish timber is less valued than that of the preceding species, but it is sometimes used for interior finish and frequently for fuel. The California sycamore (*P. racemosa*) and the Arizona sycamore (*P. wrightii*) are smaller than the American, which they resemble more or less. They are confined to the Southwestern States. The name "plane" is also often applied to the sycamore maple or great maple (*Acer pseudo-platanus*) because of the resemblance of the foliage to that of the true plane tree.

The Oriental plane is *P. orientalis*, a native of India, southwestern Asia and southeastern Europe. It grows about 80 feet tall, has a rather short, thick trunk, and a broad round head; grayish or greenish bark which annually flakes off; large, palmate, deciduous leaves; and monœcious flowers crowded in globular heads, pendulous on long stalks. The bristly fruit-heads persist during the winter. The tree was popularly planted by the Greeks and Romans as an ornament, and specimens are still extant which are reputed to be more than 2,000 years old. It thrives best in moist, rich alluvial soil. The timber of young trees is cream-colored; that of old trees brownish. Being fine-grained and easily polished it is popular for cabinet making and for interior finishing.

**Plane**, in geometry, a surface characterized by the property that the straight line joining any two points in it lies wholly in the surface; a level surface. Two such surfaces cannot have three points, not in a straight line, in common without coinciding throughout, and any two planes intersect in a straight line. Parallel planes are those whose line of intersection is at an infinite distance, or such as can have a common normal or perpendicular. The angle between two non-parallel planes is that formed by two intersecting straight lines, one in either plane, perpendicular to the line of intersection. There will always be two such angles, each being the supplement of the other, but in ordinary cases the acute one will be most naturally regarded as the angle formed by the planes. One plane is perpendicular to another when the angles thus formed are right angles, or, to put the same thing in a simpler way, when it contains a straight line perpendicular to that other. Three planes will always have one point in common, but this point may be infinitely removed; and they form a solid angle, which is measured in a special way. Three mutually perpendicular planes, known as the co-ordinate planes, are used in analytical geometry of three dimensions for determining the position of points in space. See GEOMETRY.

**Plane.** See METAL-WORKING MACHINERY; WOOD-WORKING MACHINERY.

**Plane Curves.** See CURVES, HIGHER PLANE.

**Plane-table Surveying.** See SURVEYING.

**Planet**, a member of the solar system, one of the solid spherical bodies which revolve around the sun. See EARTH, JUPITER, MARS, MERCURY, NEPTUNE, SATURN, URANUS and VENUS; and SOLAR SYSTEM.

**Planeta'rium.** See ORRERY.

**Plan'etoids.** See ASTEROIDS.

**Planim'eter**, an instrument by means of which the area of a plane figure may be measured. See SURVEYING.

**Planing Machine.** See METAL-WORKING MACHINERY; WOOD-WORKING MACHINERY.

**Plank, Fort, or Fort Blank**, a former fort, of Revolutionary days, located in Montgomery County, N. Y., about two miles northwest from the village of Fort Plain.

**Plan'kinton**, S. Dak., city, county-seat of Aurora County; on the Chicago, Milwaukee & Saint Paul railroad; about 80 miles northwest of Yankton. It is in an agricultural and stock-raising region; wheat is the chief farm product. Pop. (1900) 604.

**Plank'ton**, a term given by Haeckel to the life, both animal and plant, which occurs floating at the top of lakes and seas, in contrast to the forms of the shores or bottoms. The vegetable element in the plankton is largely diatoms while the animals show a much greater variety. In the fresh waters the plankton is very inconsiderable as compared with that of the sea and to the latter most of these statements apply. The marine plankton consists of both young and adult animals. The adults are largely protozoans, jellyfish, tunicates (especially *Salpa*, *Doliolum*, *Pyrosoma*, *Appendicularia*), together with a few worms. The young include representatives of almost every group of marine animals, for the larvæ of many shore or bottom animals are free-swimming for a time. One marked feature of these surface forms is their great transparency and almost total absence of color, except the black pigment in the eyes of the eyed forms.

The plant life of the oceanic plankton includes diatoms, bacteria, blue-green algæ and similar low organisms. The first are especially conspicuous in very cold waters. In some cases the prevailing organism is so abundant that the water is distinctly tinted by it, as in the Red Sea, where a red alga is especially numerous. Many of the plants have powers of locomotion well developed, a feature peculiar to low forms of plant life. The fresh-water vegetable planktons are less noteworthy than the marine because of their smaller extent, the much smaller number of species generally represented, etc. These formations are of particular interest from an economic point of view because they constitute the pastures of the deep. The minute animals feed more or less upon the plant life, great numbers of free-swimming, surface-inhabiting marine animals feed upon the plants or the animals or both, and are in turn the food of other pelagic animals or birds. At certain seasons the leading forms of the plankton disappear and others take their places. Generally they sink to lower levels to reappear after a more or less definite time. To the student of zoology the plankton is of great interest both from its importance as a food supply for marine forms and as a means of obtaining the larvæ of many animals. It is studied by collecting the life in a net of bolting cloth drawn along the surface and then examining the catch with the microscope. The plankton varies greatly from day to day, and is markedly more abundant at night than in the day. Many of the forms, notably the medusæ, worms and young crustacea, are markedly phosphorescent, and to them is due the light in a vessel's wake.

**Planquette**, plän-kët, **Robert**, French composer: b. Paris 21 July 1850; d. there 28 Jan.



## PLANT BREEDING—PLANT GEOGRAPHY

1903. He studied at the Conservatoire and with Duprato, gained some popularity by numerous chansons and chansonettes, in 1873 began the writing of operettas, and in 1877 achieved a notable success with 'Les Cloches de Corneville,' which ran for 400 performances in Paris, and later as 'The Chimes of Normandy' was almost equally popular in London. It has been often heard in both the French and English versions in the United States. Planquette did not attempt any more serious form of music, but wrote 18 other operettas, including two, 'The Old Guard' (1887) and 'Paul Jones' (1889) for the English stage.

**Plant Breeding.** See BREEDING, PLANT.

**Plant-bug,** a bug of any of several families of *Hemiptera* which obtain their food by sucking the juices of plants through beak-like mouths. The largest group is the family *Coreidae*, consisting of at least 1,500 species, some of which are dreaded pests of cultivated crops and trees. Two well-known species are the box-elder plant-bug (*Leptocoris trivittatus*), which is especially troublesome in the western States where the box-elder is largely planted as a windbreak and for timber: and the squash-bug (*Anasa tristis*) which is an incorrigible enemy of squashes, pumpkins, cucumbers, etc. (See SQUASH.) The *Lygaeidae* include fully 1,300 species, nearly 200 of which are known in America, and of which one of the most widely destructive is the little chinch-bug, a pest upon certain cereal crops. The *Pyrrhocoridae* is a small family, but contains several serious pests, of which the cotton stainer or red-bug (*Dysdercus suturellus*) is a pest in the southeastern United States. It feeds upon orange fruits and cotton. Consult: Comstock, 'Manual for the Study of Insects' (1895); Smith, 'Manual of Economic Entomology' (1896); Howard, 'The Insect Book' (1902).

**Plant Geography.** The relation of the plant covering to the surface of the earth is the basis of that division of botany which is called plant geography. This does not confine itself to the geographical distribution of plants, as was formerly the case, but comprises all the out-of-door relations of plants to each other, and to their environment. The subject falls somewhat naturally into several divisions with respect to the point of view. Floristic botany deals with the geographical distribution of species, and with the character of the plant population of different regions and countries. Ecology concerns itself especially with the relation existing between the plant and its environment, and with the grouping of species in particular areas called formations, such as meadow, prairie, forest, etc. Experimental ecology is merely a phase of the latter, in which changes in the form and behavior of plants are brought about by changing the physical conditions of the environment. It is of great importance because of its bearing upon the origin of species.

**Environment and Plant.**—The essential points of inquiry in plant geography are the environment, or home of the plant, usually called habitat by botanists, and the plant, either as an individual, or as a member of the vegetation. The habitat is to be regarded as the cause, the plant as the effect. This is true of the present relation between any habitat and the plants

which grow in it only to a certain degree, for probably no plant of the present day owes its entire structure to one habitat. Each habitat, however, does have a modifying influence upon the plants in it. This influence will be great where the physical conditions are extreme, and it will be slight where they are more moderate. In either case this modification will leave its distinctive stamp upon the plant in such a way that one may readily tell whether it grew in pond, meadow, forest, or desert. Of the many factors which make up a habitat not all are of the same importance. In some situations the water of the soil will be most important, in others light will be the controlling factor, while in still other places wind will have the most striking effect. Habitats show great differences also in the amount of water, light, wind, and other factors. If one will know the causes of plant structure and distribution, it is necessary to look into the habitat with great care, and to determine the relative importance and the amount of each factor.

The factors of a habitat which are most intimately connected with the form of the plant are those that have to do with the water-supply, and with the food-making activities of the leaf. These are water and light. They have a direct influence upon the plant form, while all others affect the structure indirectly, as a result of their action upon the water of the soil, or the air, or upon light. Every habitat comprises the following factors: water-content, humidity, light, temperature, soil, wind, precipitation, physiography, dead vegetation, and animals. Of these, water-content, soil, soil temperature, and physiography belong to the soil, and are in consequence called edaphic. Humidity (air moisture), light, air temperature, wind, and precipitation pertain to the air, and are termed atmospheric, or climatic. Dead vegetation and animals are biological or biotic factors. Living vegetation has a marked effect upon its habitat, but this is to be regarded more as a reaction than as a cause.

**Water as a Factor.**—The simplest plants grow in water, and are in every way dependent upon it. Terrestrial plants—for example, practically all flowering plants and ferns—have adapted themselves to two media, air and water, and their dependence upon water is not so marked. The active root-hairs are still really aquatic, and must always be in contact with an adequate supply of water. The stems and leaves are aerial, but their behavior and form are largely determined by the water in the air, that is, the humidity. The water-supply is used by the root-hairs, while water-loss is the result of evaporation from the surface of the leaves. The excess of supply over loss will determine the form of the plant; it is evident that plants cannot grow where the loss exceeds the supply. The balance between these is so nice that plants grow well only where it is maintained. The most luxuriant vegetation is the forest, where both supply and loss of water are great. An excess of supply over loss is almost as certain to produce stunting and dwarfing, as seen in the plants of ponds and marshes, as is an excessive water-loss, which is the condition typical of deserts and high mountain peaks. The total amount of water present in the soil will vary with the rainfall, and with the behavior of sur-



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face and underground streams. Much of the rainfall runs off the surface, while a part of it sinks below the roots and is carried off by underground drainage. What is left remains in contact with the soil-particles as a thin film, and it is this which is absorbed by the root-hairs. The pull exerted by the absorptive power of the hair upon the water-film is greater than the attraction of the soil-particle, and the latter loses its water. If this continues, however, the ratio lessens, and in soils that are drying out the particles hold the water-films with increasing tenacity. In consequence, plants will wilt and die in soils that still contain water. Loose soils, such as sand and gravel, will give up all but 5 per cent of their water content, while compact clays retain as high as 8 per cent. An abundance of salts in the soil, or of the so-called humus-acids which arise from incomplete decomposition, have a similar effect. They decrease the absorptive power of the root-hairs, and lead to the production in marshes and bogs of plants showing the effects of an insufficient water-supply.

*Air Humidity.*—The humidity of the air exerts a direct control upon the amount of water evaporated from the leaves. It is evident that the water-loss of the plant will be slight where the amount of moisture in the air is great, and that the evaporation will be great where the air is dry. This effect of humidity is so marked that plants which grow in moist climates often have structures designed to increase water-loss, while those living in desert-like places regularly protect themselves by thickening their epidermis, and decreasing the amount of surface exposed. The relative humidity of lowlands and seacoasts, especially in the tropics, is above 80 per cent; in deserts and upon high mountains it is rarely more than 30 per cent; and often falls below 15 per cent.

*Influence of Light.*—The amount of light present in a habitat influences directly the food-making activities of the plant. The green coloring matter of plants, the chlorophyll, is formed readily and abundantly only in the light, and the combination of crude materials, water, carbon dioxide, and salts, into foods available for the protoplasm can occur only in the presence of this pigment. Light thus bears a peculiar relation to the nutrition and growth of plants, and in a large degree determines their form and size. Sunlight produces vigorous, stocky stems, and thick leaves, as a rule, while plants grown in the shade have tall slender stems, and broad thin leaves. Plants that occur underground, in caves, or grow within organisms, do not develop chlorophyll, and without exception belong to the flowerless forms known as fungi. The intensity of the light varies throughout the day and year; it is greater in the tropics than at the poles, and on the tops of high peaks than at their bases. In forests and thickets the light is often very diffuse, varying from .01 to .003, summer sunlight being 1.

*Temperature.*—This is directly concerned with the nutrition and growth of plants. Heat is necessary for the germination of seeds, and for the sprouting of bulbs and tubers. It must be present in a considerable degree for the food-making activities of plants, and upon it in a large part depends the size of individuals, and the luxuriance of vegetation. The growing

period is the season during which temperatures favorable to plant growth prevail; the length of this period determines in great measure the native vegetation of a country, and the cultivated plants which can be grown there. Indirectly, temperature exerts a pronounced effect upon the form of plants, by decreasing the moisture of the air, and thus increasing the water-loss. In tropical and subtropical deserts this indirect action of heat is a predominant factor. Soil temperatures are of much less importance, though they have much to do with germination and the activity of underground parts.

*Wind Effects.*—Wind influences plant life both directly and indirectly. Its mechanical action is marked in regions where forceful and constant winds prevail, notably seacoasts and high mountain peaks. Shrubs and trees become bent or prostrate, and their branches are developed almost wholly on the leeward side. Over great open stretches where strong winds prevail, for example, prairies and steppes, the plant forms are largely grasses and grass-like plants, which are not easily torn or whipped by the wind. As is well known, winds play an extremely important part in carrying the pollen of trees and grasses, and in scattering seeds and spores. Like heat, wind decreases the humidity of the air, and correspondingly increases the evaporation from leaf-surfaces. It does this by removing the more or less saturated air in contact with the plant, replacing it with air containing less moisture. This action is characteristic of the dry southwest winds in the corn-belt, which rapidly carry away the moisture of the leaves, causing the latter to curl, thus decreasing the surface and affording some measure of protection. The stunted forest vegetation of arctic and alpine timber-lines is largely due to the drying action of almost constant winds. The direction, force, and duration of the wind must all be taken into account in the study of vegetation.

*Soil Action.*—The soil acts directly upon the behavior and form of plants by reason of its influence upon water-content and temperature. In plant geography, all inorganic strata upon which plants grow are termed soils. The extreme types are rock and water, between which are found all manner of gradations from gravel to mud. The weathering of rocks produces two kinds of soils quite different in their behavior with respect to water. The one is loose and composed of large particles—for example, sands and gravels; the other is composed of fine, compact particles, clays and loams. Sands and gravels absorb nearly all of the rain falling upon them, but much of the water taken up passes through and is carried away along some impervious stratum. What remains as water-content is readily absorbed by the root-hairs, or is lost by evaporation from the soil. On account of the large air-spaces between the grains, the water in the lower layers is raised with difficulty by capillary action. Plants withdraw from loose soils nearly all of their water-content. Compact soils, especially clay, do not absorb rain rapidly, and much of the latter is carried away by surface drainage. Water once absorbed is held tenaciously, and the loss by underground drainage is slight. The pores of the soil are fine, and capillarity plays



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an important part in raising water from the lower levels. The particles attract the water-films strongly, and in consequence clay yields its water to plant or air very slowly. Ordinary plants will wilt in clay soils when they still contain as high as 8 per cent of water. Rock is all but absolutely impervious to water. Mosses and lichens alone can grow upon it, in consequence of their power to decompose the surface and their ability to withstand drying out. The amount of soluble material in the soil has a direct effect upon the growth of plants. Nearly all ordinary soils contain an adequate supply of soluble minerals; a few, however, are deficient in these, and are unable to support more than a scanty vegetation. Other soils contain in excess soluble salts and acids which are harmful. The sparse, desert-like vegetation of salt basins and alkali wastes is due to the large quantities of sodium chloride, sodium carbonate, and other salts present. In swamps and bogs the partial decay of plant and animal remains produces certain acids which hinder the absorptive powers of the roots. The kind of material in the soil and the fineness and compactness of the grains determine its behavior with reference to the absorption and radiation of heat. The color of the soil, the amount of water present, and other conditions have also to do with this matter. Rock is warmed most readily in the sunshine, and at night most readily parts with its heat. Water is at the other extreme; it warms up slowly and, conversely, yields its heat reluctantly.

*Utilization of Moisture.*—It is a well-established fact that plants in general are unable to absorb water-vapor from the air. The moisture must be condensed into water, and then must regularly find its way into the soil before it can be used by the plant. A comparatively small number of plants, lichens, mosses, and tree-dwelling orchids absorb rain or dew directly through their leaf or thallus surfaces, but with the great majority of plants the water can only be taken in from the soil or substratum. The moisture of the air is condensed or precipitated in various forms, rain, dew, snow, sleet, hail, frost, and fog. With the exception of the last, all of these contribute sooner or later to the water-content of the soil, the important difference being that the solid forms usually melt gradually and are in consequence absorbed more completely. The water which falls upon the surface of the soil is partly absorbed, and partly carried away by drainage. The latter is known as "run-off"; its amount will depend upon the compactness of the soil and the steepness of the slope. The absorbed water passes into the lower layers in part, where some of it is drained off as gravitation water, and some is retained as capillary water to be raised by capillary action into the upper layers of the soil. That which remains in the soil about the roots forms thin films about the soil-grains, and is known as hygroscopic water. This alone can be used by the root-hairs. Part of it, however, is lost by direct evaporation from the soil. Rain has little or no mechanical action upon plants, except perhaps in the tropics, where it falls in torrents. In the form of "run-off," however, it acts powerfully upon the surface of hills and mountains, and plays in consequence an extremely important part in the development of

vegetation. Sleet and hail are very destructive in the breaking of twigs and branches and the cutting and tearing of leaves, but are of little importance because of their relative infrequency. Snow, on the other hand, has had a great deal to do with the forms of trees, particularly the pines, spruces, and firs, in northern and mountain regions. It is a poor conductor, and for this reason affords much protection to plant parts covered by it. Unlike rain, it is often unequally distributed by the wind, and therefore produces important local differences in the water-content of the soil.

*Physiography.*—The surface features of a region—its physiography—affect directly several of the physical factors of habitats. Altitude not only influences the rainfall, but it also increases water-loss by reason of the reduced air-pressure and the decreased humidity. The sunlight is stronger, as the rays pass through fewer air-layers, and are absorbed in a less degree. The degree of slope is especially important, as it determines very largely the ratio between "run-off" and absorbed water. In mountain regions particularly, it modifies the angle at which the sun's rays strike the surface, and increases the amount of heat and light received. The exposure of the surface, that is, the direction in which it lies, affects the amount of heat and light, the intensity of the wind, and the snowfall. Furthermore, the character of the surface itself, whether level or uneven, will influence all of these factors in a less degree. Physiographic changes, such as elevation and subsidence, the erosion of river-valleys, and the upbuilding of swamps, deltas, etc., have a profound effect upon the distribution of plants, and the development of vegetation.

*Vegetable, Animal, and Human Factors.*—Dead vegetation increases the water-content of a habitat by checking the movement of the "run-off," and thus increasing the absorption, and by protecting the surface of the soil from excessive evaporation. It equalizes the soil temperature by hindering the warming action of the sun's rays, and the cooling effect of radiation. It also diminishes the force of the wind, and, finally, by its decay, returns to the soil much of the nutrient material that it has taken from it. Living vegetation has the same effect, but it is different in that it constantly draws water and nourishment from the soil, and often reduces the amount of light present. The activities of animals and man are extremely diverse. Earthworms and burrowing mammals enrich the soil by working it over repeatedly. Grazing animals have more or less effect upon grasslands. Insects are fundamentally important in fertilization, and doubtless often act decisively in the struggle for existence by destroying some plants and not others. Man is a biological factor of the first importance, even if we leave out of consideration all the changes that he has brought about in plants and vegetation in consequence of cultivation. He changes habitats fundamentally by the removal of forests, by fires, by the construction of railroads and canals, by drainage, by irrigation, etc.

*Classification of Habitats.*—Habitats are usually grouped with respect to the two direct factors, water and light. They are first classed as wet, moist, and dry, and the moist habitats



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are further divided into sun and shade. Wet habitats comprise all bodies of water, oceans, lakes, ponds, springs, streams, swamps, marshes, river-banks, seashores, tanks, etc. Dry habitats are principally deserts, sandhills, prairies, gravel-slides, strands, dunes, bad lands, cliffs, rocks, heaths, humus-marshes, moors, alpine and polar barrens. Sunny moist lands are meadows, pastures, grain-fields, and waste places. Shady moist habitats are forests, groves, woodlands, and thickets.

*Effects of Habitat.*—These, as regards the individual, are either evident or demonstrable, as in the case of the habitat form seen in bog-plants, shade-plants, etc., or they are obscure and remote, and can in consequence no longer be traced. The latter is true of vegetation forms—trees, shrubs, bulb-plants, etc. Three well-defined groups of habitat forms are recognized, based upon the water-content of habitats. These are water-plants (hydrophytes), moist-land or middle plants (mesophytes), and desert plants (xerophytes). Upon the basis of light-differences, mesophytes are further divided into sun-plants (heliophytes), shade-plants (scio-phytes) and darkness-plants (scotophytes). Water plants owe their peculiar stamp to the fact that the water-supply is always greatly in excess of the water-loss. The roots are superficial in position, owing to the abundance of water at or on the surface of the soil. Root-surfaces are slightly developed, and root-hairs often lacking, because the amount of water renders absorption easy. The surplus of water is a disadvantage, however, as it reduces the amount of air in the soil, and hence cuts off the supply of oxygen necessary for the activity of the roots. This lack of aeration is compensated by the development of large air-passages leading down from the leaves through the stem and roots. Stems and leaves are almost invariably smooth, and without any sort of protective covering. Breathing-pores are usually abundant, and the necessity that the plant should lose a large amount of water has led to the development of water-pores and papillæ. This structure is typical of amphibious plants, that is, those that grow in the mud, or in shallow water. Floating plants are usually much the same, with the exception that the breathing pores become useless and disappear on the under surface of the leaf, which is in contact with the water. Certain plants, such as the duckweed, have become greatly reduced in consequence of the floating habitat, and consist merely of a tiny, leaf-like disk, with a few rootlets. Submerged plants grow entirely beneath the water, and are not subject to water-loss. As a result their leaves and stems are greatly reduced. The leaves are thin and divided into narrow segments; in structure they are almost uniform. The characteristic air-passages of the other water forms are lacking, as all the air absorbed must be dissolved in water.

Desert-plants are in most respects the exact opposites of water-plants. Not only is the water-supply scanty, but all the factors which increase water-loss are present in a large degree. Such plants must use all their power of adaptation to absorb and store all the water they can, and to lose just as little by evaporation as possible. The roots of desert-plants are for the most part deep-seated tap roots, which branch only near

the tip, which is in moist soil, and are covered elsewhere with a corky layer to prevent the loss of water where the root passes through the dry upper layers. In the moist soil, root-hairs are produced in large numbers. In many cases, the upper portion of the root consists of tissue especially adapted to the storage of water. The stems of xerophytes are short and stout. The leaves are thick and much reduced in size; in extreme forms, they are entirely lacking. Both leaves and stems are covered with a thick coating of hairs, or wax, or the epidermis is greatly thickened, all for the purpose of protection against water-loss. The breathing-pores are generally confined to the underside of the leaf, and are often sunken far below the surface for still greater protection. In the cactus the leaves are reduced to mere scales, and the stem often contracted into a cylinder or ball, thus decreasing the exposed surface to the minimum. Succulent plants, such as the live-for-ever and ice-plant have, on the other hand, been modified so that the leaves serve for the storage of water. Lichens and mosses which grow on rocks are capable of withstanding extreme dryness, a faculty seemingly inherent in their protoplasm, as they are without ordinary protective contrivances.

Moist-land plants, or mesophytes, stand as intermediate between the two preceding groups. The water-supply, though not excessive, is usually sufficient, and the humidity of the air is great enough to preclude the danger of excessive water-loss. In consequence, mesophytes have well-developed, more or less branched, root-systems, which are intermediate in position, that is, are neither deep-seated nor superficial. The development of surface is moderate, as well as that of the protective cork. Stems are for the most part tall and vigorous, and much-branched. The leaves are large and mostly entire, or at least never finely dissected. Hairs are common, but seldom compacted into a dense covering. The epidermis is not greatly thickened, and while the breathing-pores are often more abundant on the lower side, they are present in large numbers on both surfaces. The leaves of mesophytes are characterized regularly by compact rows of oblong cells placed at right angles to the surface, which are called palisade-tissue, and by loose irregular cells with large inter-cellular spaces, the sponge tissue. The former is usually in the upper, the latter in the lower half of the leaf. The palisade is differentiated in response to the action of strong light, while sponge-tissue results from the need of the rapid diffusion of the carbon dioxide and oxygen absorbed from the air.

Sun-plants and shade-plants are especially different in their leaves; this is to be expected, as the leaf is the organ most dependent upon light. The root-system will be more superficial in shade-plants, as the moisture is nearer the surface of the soil in shaded than in sunny places. The stem will be more slender, taller, and often more branched, since it is necessary to place the leaves in the position to receive the most of the diffuse light. The leaves are broad, thin, and entire, increasing the exposed surface, while in sun-plants they are thick and more or less divided. In typical shade-leaves, the palisade-tissue is reduced to a single row, or is altogether absent. The cells are not crowded



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closely, and their longest axis often coincides with the epidermis of the leaf. Sun leaves have one or more rows of typical palisade on the upper side, and are frequently palisaded on the lower side also. The epidermis develops more wax and hairs in the sun; the breathing-pores are more numerous on the lower than upon the upper surface, while there is little difference in the shade.

*Origin and Distinction of Forms.*—Vegetation-forms doubtless originated in response to physical conditions, but this relation is hardly evident to-day. We can only see in trees, shrubs, herbs, etc., an expression of the success which different plants have obtained in the struggle for existence. It is also evident that the vegetation form of a plant has much to do with its persistence, and hence with its importance in vegetation. The main groups of vegetation-forms are woody plants, herbs, and thallus (flowerless) plants. The former are the largest, the most dominant, and the most persistent of all forms; the latter are tiny, subordinate, and fleeting. The various woody forms are trees, shrubs, bushes, and climbers; the first are the most important, the last the least so. Trees constitute the most permanent type of vegetation, the forest, to which shrubs, bushes, and climbers also contribute. The relation between these forms is easily seen in the development of a forest, in which bushes precede and are followed by shrubs; these give way to the trees, the climbers coming in after the latter.

Herbs are especially distinguished from woody plants by their lack of woody stems and by the fact that their persistent parts are underground. They can never be very large, for their stems lack support, though they may persist for years. They are either perennial, blooming each year, or annual-biennial, blooming at the end of the first or second year, and then dying. Various forms of herbs are distinguished with reference to the position of the stem and leaves. In some, like the dandelion, the leaves are grouped in rosettes in response to light and heat. In others, such as the everlasting, the plants are set close together for somewhat similar reasons and perhaps for mutual protection also. Climbers, sweet peas, vetches, etc., develop partly for increased support, partly to secure more light. Grasses form sod because of their abundant rootstalks; it is this faculty which enables grasses to control the vegetation of meadows and prairies. Bunch-grasses are an exception, but they generally grow where the formation of a sod is impossible on account of unfavorable physical conditions. The position and abundance of herbs in a formation will depend also upon the character of the underground parts. Species with underground runners or rootstalks will be more abundant, and more widely distributed than those with nearly stationary bulbs or tubers. The vegetation forms of thallus plants play a very subordinate role in vegetation. Mosses, liverworts, and lichens are regularly present in tree and herb formations, but their small size, and transient nature make them of little importance. They are significant of the early stages of vegetation on rocks, new soils, etc., but they soon disappear before the grasses and other herbs. Fungi are entirely dependent upon their host plant or stratum, and are relatively

insignificant, except where they are necessary to the nutrition of the host, as in the case of certain trees.

*Areas or Formations.*—The vegetation of the earth's surface is not at all uniform, but consists of a multitude of different areas, each corresponding to a habitat. These areas are called formations, and each is composed of an association or group of plants determined by the physical factors of its habitat. A pond will be occupied by a formation composed of water-plants; a forest formation will consist of mesophytes, and desert plant formations will be found in dry, sandy regions. Even within each formation, it will be found that the plants are not uniformly distributed; some will occur in masses, while others are scattered singly, and one species will be met again and again, while another will be found but once. Furthermore, formations are not fixed groups of plants. One species will find that the conditions of life become more and more difficult; and will gradually disappear. Other species will prosper and increase rapidly in number, this very prosperity often producing the conditions unfavorable to another. The seeds of species from other places will be brought in by the wind, by birds or by animals, and will find a new home, or, after struggling for a while, the plants will disappear. Frequently, new plants come in to such a degree that they finally replace the original species entirely, and the formation is replaced by a new one.

The development of a formation may be readily followed where rocks are disintegrating, or where an original vegetation has been removed by fire. In the first case, the pioneer plants are small crust-like lichens, which decompose the surface of the rock, and by their decay prepare a thin soil for the larger leaf-like forms, which sooner or later appear. With these usually enter the rock mosses, and the two by their activity and ultimate decay finally form a soil sufficient for some of the grasses and other herbs which are able to withstand extreme dryness. Meanwhile, the action of rain and frost has produced rifts in the rocks, which are first filled with mosses, and then by a soil deep enough to support larger plants. The ultimate result of the activity of these various factors is the breaking down of the rock into soil. In the case of the harder rocks, this will be a coarse sand or gravel; with the softer ones, it is a fine sand or marl. At this stage, leaf-like lichens and mosses play some part in binding the soil-particles together, but they soon disappear before the grasses, which in their turn yield in a few years to other herbs. These are sooner or later displaced by bushes and shrubs, and the latter make way for the trees which mark the close of the process. Such a succession of formations takes place very slowly, and may often extend over a century or more. When a forest is burned, the re-vegetation is much more rapid, as the soil is already prepared. Tiny mosses and fungi first appear, and in a year or two at the most are replaced by low herbs. These disappear before the invasion of grasses and "fireweed," and these are replaced by fast-growing trees, such as the birch and the aspen. Such trees are usually short-lived, and are displaced after a decade or so by pines, spruces, or firs, which in many cases are



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at last conquered by the hardwoods. It is significant of the plants of each stage of such successions that they bring about conditions in their action upon the habitat which finally cause their own disappearance. Each stage represents a formation, but the change from one stage to the next takes place so slowly that it is not at all uncommon to find associated with the plants typical of one stage some survivors of the preceding formation, as well as a few pioneers of the next stage.

*Migration of Plants.*—The movement of plants in vegetation is known as migration. In the case of the simple water-plants, the algæ, the whole plant moves of its own accord, or is carried by some agent. The same holds for a few of the flowering plants of floating habit. All terrestrial plants are fixed, however, and migration must act regularly upon the spore or seed. In tumbleweeds, the whole plant is frequently carried away by the wind, but it is no longer in a living condition. Spores are readily scattered by the wind on account of their lightness, but seeds and fruits have been especially modified for migration on account of their greater weight. Plants growing in or near the water often have fruits with corky or inflated envelopes, which serve to keep them afloat. The great majority of the modifications for securing migration, however, are concerned with wind and animals. In the former, the contrivances are uniformly for the purpose of lightening the fruit or seed, so that it may readily be carried by the wind. Fruits that are to be distributed by animals are provided with spines, hooks, or glands for attachment, or are made attractive by a bright or edible envelope. Wind-carried fruits are especially common; they are provided with wings, as in the maple, with hairs, the milkweed, and with parachute-like tufts, the dandelion. Man plays the most important part of all distributive agents, if voluntary as well as involuntary carriage be considered. He has carried cultivated plants and weeds all over the globe, and to thousands of places where they could never have gone of themselves.

The movement of the seed or fruit of a species into a new formation or country is often determined by natural barriers. Winds bear seeds for long distances, but they are powerless to carry them across oceans, or over high mountain ridges. Similarly, a desert region is a barrier to seeds brought from a moist climate, and a cold climate prevents the naturalization of species coming from a warm country. The chance that seeds will germinate and grow is greatest when they are carried into a habitat similar to the original one, and it is least when they are left in habitats very different from it. It is unquestionable that seeds have often been carried into many places where they were unable to secure a foothold. This fact explains why many species are found only in certain countries, or localities, and why it is that each formation retains a more or less distinctive impress.

*North American Vegetation.*—The vegetation of the North American continent owes its general features to the gradual decrease of heat to the northward, and the more or less constant decrease in the rainfall in passing from the coasts to the interior. The greatest development of forests is found in the warm coast-

regions of the southeast, and of the Pacific. The poorest vegetation is found in the north, and on high mountains, where the temperatures are low, and in the interior where the rainfall is slight. The character and distribution of vegetation are chiefly determined by heat and water. As a result, the vegetative covering falls into zones corresponding in a general way to zones of temperature. If the distribution of moisture were uniform over the continent, the series of zones would be as follows: (1) the zone of evergreen tropical and subtropical trees; (2) the zone of deciduous trees; (3) the zone of cone-bearing trees; (4) the zone of grasses and other herbs; (5) the zone of mosses and lichens; (6) the zone of ice and snow. The rainfall decreases regularly from the coast inland, while a high mountain range makes an abrupt change in the amount. The Appalachian, Rocky Mountain and Sierra Nevada ranges act as barriers to the passage of moisture-laden winds, and turn into grassland or desert, regions that are sufficiently warm to be forested. The Appalachian barrier is too low to be very effective, and the forests yield to prairies only slowly and far inland. The Sierra Nevada and the Rocky Mountains are almost complete barriers, and they enclose a parched desert. The height of these ranges causes an abundant condensation on their slopes, and in consequence they are more or less heavily wooded. On account of the altitude, the temperature is low, and the forests are merely southerly extensions of the great boreal zone of pines and spruces. A general survey of the North American continent would show it to be wooded on the eastern, western, and southern coasts. In the north, there is a zone of grass and moss-covered barrens. In the interior there is a region of plain and prairie, stretching unbroken from Athabasca to Texas, and between the two great Cordilleran ranges from Washington to Central America lies a great desert region, broken repeatedly by intersecting lines of mountains. Running southward from the great northern forest mass of the continent are the three mountain systems. In the low Appalachian system, the arctic vegetation of the north is found on a few alpine peaks alone, but in the higher Rocky Mountains and the Sierra Nevada this long southward extension of dwarf herbaceous vegetation is almost continuous. All carry the northern pines and spruces far south, but in the lower range, these disappear in Virginia, while on the higher ranges they persist almost to the Mexican boundary. North America is thus seen to be covered with belts of vegetation running east and west, which are completely interrupted in the interior by high mountain ranges, which, together with the Appalachians, also serve to carry the northern forests southward in three long tongues.

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**Plant Lore.** Quite apart from all the fancies connected with flower language and symbolism (see FLOWERS, SYMBOLISM OF), there is an abundant stock of traditionary lore associated with all kinds of trees, plants, and flowers. The study of this throws much light on many puzzling survivals in folk-lore, and some writers have shown its importance for part of the prob-



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lem of primitive religion. Among Australians and red Indians the totem often takes the form of a plant or tree, for which the individual shows his reverence by refusing to gather or destroy them. The worship of trees is widely prevalent among savages everywhere, and there is ample evidence that it was an important element in the religion of all the families of the Aryan stock. Grimm thinks the oldest sanctuaries of the Germans were natural woods, and hints at a historical connection between the ancient sacred inviolate wood and the later royal forest.

The oak-worship of the ancient Druids, the sacred fig-tree of Romulus in the centre of Rome, the *Ficus religiosa* of India, and the sacred groves of the Semitic and pre-Semitic races still surviving at Carthage a century after Augustine, are ready examples of tree-worship from sufficiently wide centres of civilization. The primitive mind of the savage readily conceives of a tree as animated by a conscious soul cognate with his own, and he may regard the tree either as its permanent outward organism or merely as its characteristic dwelling-place. Hence trees have their place in fetishism, idolatry, and the upward development of religion. Buddhists do not include trees among sentient beings possessing mind, but recognize the existence of the genius of the tree, and Buddha himself was regarded as such no less than 43 times during his transmigrations. The reverence paid to the famous bo-tree shows how fundamental a fact is tree-worship, which undoubtedly formed a large part of the old Hindu religion amalgamated by the new philosophical faith.

But the sacred tree and grove are likewise to be found within the range of Semitic and Aryan influences. From all sides appears evidence at once of the great antiquity and uniformity of the worship of trees, whether for the services they render to man, for their venerable antiquity, their form, for particular qualities ascribed to them as containing the seeds of fire, for their situation, as on sombre and lonely mountain tops, or for their association with certain phenomena, as plagues and pestilences, or certain events in the history of the homestead. In the growth, life, decay, and death of the plant the primitive man easily sees an analogue to his own life-history, and herein we may find the philosophy of the widespread rustic rites associated with marriage and with the birth of children. The custom of scattering flowers and the fruits of the field over the footsteps of a newly married pair conveys an obvious reference to the belief in the reproductive powers of vegetation. Primitive ideas of the fertilizing and fruit-bearing powers of nature led to the belief that each tree or plant possesses spiritual as well as physical life, being tenanted either by semi-divine spirits or by the ghosts of the dead, and a natural generalization of this notion made plants and trees collectively the abode of particular inhabitants—an example of animism developing into polytheism.

A forest-god has been deduced from a mere tree-soul, both alike regarded as powerful to produce rain or sunshine, to cause fruits to spring and cattle easily to bring forth their young. A still higher generalization gave a

belief in a genius of plant-life or forest-life, or, higher still, a genius of growth or fertility in general. This universal genius of growth was symbolized by a bush or tree, brought in triumph from the forest, gaily decked, and solemnly planted near the homestead or in the village. In many cases the tree-spirit was regarded as detached from the tree and clothed in human form as a man or a girl decked with flowers—the May-king, Queen of the May, the Old Woman or Corn-mother of German harvest-fields, the Jack-in-the-Green of young London sweeps, and the like. The existence of those corn spirits which especially haunted and protected the waving corn is dimly recognized in characteristic ceremonies of an English harvest-home, and in the French and German observance of the Harvest May, in which a branch or tree decked with ears of corn is carried home in the last wagon from the harvest-field and hung on the roof of the farmhouse till the next year.

Sympathetic affinities between plant and animal life strongly impress the primitive imagination and play an important part in many cosmogonies, as in the Iranian account of how the first human pair grew up as a single tree, the fingers or twigs of each one folded over the other's ears, till the time came when they were separated, and endowed with distinct human souls. Other mythical cosmogonic trees are the heavenly fig-tree of the Vedas, and the ash-tree Yggdrasil of Norse mythology. The belief that a child's rickets can be cured by passing him through a cleft ash-tree till lately lingered in corners of England, and stories of trees giving forth human groans and exuding human blood are common in folk-tales everywhere. Families, as well as individuals, have tutelary or guardian trees.

Even the Christmas-tree, which originally made its way into England and France principally through the influence of Prince Albert and the Duchess Helen of Orleans, is really a survival of an ancient German custom of heathen origin. Many plants have received a kind of religious consecration from the name of some saint whose festival fell on the day on which they were gathered. Christianity, like Buddhism, early showed a marvelous adaptability in the way in which it adopted popular rites of an earlier religion and rebaptized them as its own. Many remnants of primitive superstitions survive in the local English names of plants and flowers, chiefly in connection with the fairies, the devil, the Virgin, and the Cross, and we have a great wealth of association from one cause or other between saints and flowers, as Saint Agnes with the Christmas rose, Saint Joseph of Arimathea with the Glastonbury thorn, Saint Patrick with the shamrock, the Virgin with the white lily, just as Thor had his oak-tree, Venus her myrtle, the Indians the lotus, and the Druids the mistletoe. Again, historical personages and families are frequently associated with particular flowers—it is enough merely to name the orange lily, the red and white roses, the fleur-de-lis, the planta genista, and the violet. Family and clan crests frequently take this form, as the fir, holly, juniper; also national badges, as the rose, thistle, shamrock.

More curious and interesting, though ob-



## PLANT-LOUSE — PLANTATION

scure, are the notions of magical properties connected as persistently with some plants as medicinal properties are with others. Most prominent in European folk-lore are the elder, the thorn, and the rowan or mountain ash; but strange properties are still ascribed to the rosemary, vervain, Saint-John's-wort, mandrake, asphodel, and to fern-seed; and many flowers lend themselves through some obscure inherent fitness to special methods of divination. The doctrine of signatures, so important in the history of medicine, opens up a special chapter of sympathetic magic, involving the belief that plants bore by nature marks indicating plainly for what diseases they were medicinally useful. The trees of Paradise, of Chaldæan and other cosmogonies, the oracular oaks of Dodona, those trees of healing spiritually allegorized in the Apocalypse, the trees of Liberty and the French Revolution, and the trees round which an Indian bride and bridegroom walk hand in hand point as unmistakably to a real sympathetic affinity between the human and the vegetable world as did the Dryads, Fauns, and Satyrs of the ancient Hellenic mythology, with their analogues the elves and fairies of the woods, the transformation-myths, the Orpheus whose lyre laid its charm on beasts and trees alike, or the Pan at the report of whose death all nature mourned aloud. Consult: Dyer, 'Folk-lore of Plants'; Frazer, 'Golden Bough.'

**Plant-louse.** See APHIS.

**Plant Physiology.** See BREEDING, PLANT.

**Plantagenet**, plăn-tăj'ě-nět, a family whose various branches occupied the throne of England from the reign of Henry II. (1154) until the accession (1485) of Henry VII., the representative in the female line of the Lancastrian branch of it, who, by his marriage (1486) with Elizabeth of York, daughter of Edward IV., representative of the York branch, united its various branches in the house of Tudor, of which he was the direct descendant. On the death of Henry I. the crown was claimed by his daughter, Maud or Matilda, first married to Henry V., emperor of Germany, and afterward to Geoffroi V., count of Anjou, surnamed Plantagenet, on behalf of her son by the latter, Henry Plantagenet. Stephen obtained it during his lifetime, and was succeeded on his death by Henry, who became the first of the Plantagenet kings. The name is said to have been derived from the circumstance of the count of Anjou wearing a branch of broom (*plante de genêt*) in his cap. The direct line became extinct in Richard II. (1399), before whose death the crown was usurped by Henry IV., son of John of Gaunt, duke of Lancaster, 4th son of Edward III., in prejudice of Edmund and Anne Mortimer, the descendants of Lionel, duke of Clarence, 3d son of the same Edward. He was succeeded by his descendants Henry V. and Henry VI., and during the reign of the latter, Edmund Mortimer having died without heirs, Richard, duke of York, son of Anne Mortimer, who had married the heir of Edmund, duke of York, 5th son of Edward III., claimed the crown. This occasioned the wars of the Roses, which terminated in the accession of Henry VII. as above mentioned. See ENGLAND, *History*; and articles on individual monarchs.

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**Plan'tain**, several species of *Plantago*, a genus of the order *Plantaginaceæ*. Most of the 200 or more widely distributed species are weedy herbs or subshrubs. Probably the best known is ribwort (*Plantago lanceolata*), in America a pernicious lawn weed, but sometimes used in Europe upon sterile and dry soils as a fodder plant, the hot, dry summers favoring its growth in the United States and reducing the resistance of the grass. The only safeguards against it are thorough preparation and enrichment of the ground before planting to lawn; careful selection of pure lawn-grass seed, and persistent care both in annual attention to the needs of the grass and the weeding. The seeds are used for bird-feeding. Buck's-horn plantain (*P. coronopus*) is used somewhat as greens.

**Plantain, Adam's Fig, or Cooking Banana**, a tropical herb of the order *Scitamineæ*, considered as a distinct species (*Musa paradisiaca*) by some botanists, and as a variety of the common banana by others. From India, where it is native, it has been taken by man to all tropical countries, and it forms a staple food both eaten raw and cooked in a variety of ways. It is, however, less palatable in the fresh state than the banana. The plants are propagated by suckers or cuttings of the rootstock. The former are cut from the parent plant with a spade and set where desired. The latter are transplanted from a propagating bed when they have one or two leaves. They succeed best in moist rich soil. When about 18 months old they should bear a cluster of fruits, after which the stalk dies and new sprouts take its place and so continue for years.

**Plantain-eaters**, a family (*Musophagidæ*) of African picarian birds, classified near the parrots, with notched or saw-edged bills, and usually of brilliant colors. The genus *Musophaga*, in which the base of the bill spreads over the forehead like a broad plate, includes the most typical West African forms. These birds feed chiefly upon the fruit of the banana and plantain. The members of the genus *Turacus* (or *Corythaix*) called "touracos," possess a bill of ordinary size and conformation, and an erectile crest, borne on the head. The general color is green, the quills of the wings and tail being colored red by a peculiar pigment containing copper and named turacin. They feed on insects, in addition to fruits, and are said to be exceedingly familiar and tame in habits, even in a wild state. They attain a size averaging that of the common pigeon or crow. Consult: Newton, 'Dictionary of Birds' (1893-6).

**Planta'tion**, a term anciently used to designate a colony. Plantations, according to Blackstone, are colonies where the lands are claimed by the right of occupancy only, by finding them desert and uncultivated, and peopling them from the mother country; or where, when already cultivated, they have been either gained by conquest or ceded by treaties. The term came into use in the United States in colonial times, and is still preserved in the official title of the State of Rhode Island, namely, "Rhode Island and Providence Plantations." It became popular in an extended and different meaning in the South where it is still used to designate a large section of cultivated land.



## PLANTIGRADE ANIMALS — PLANTS

**Plan'tigrade Animals**, those which in stepping place the heel and whole sole of the foot upon the ground, for example, bears; as opposed to *digitigrade* animals, for example, cats, dogs, which step upon their toes. The term was applied by Cuvier to a section (*Plantigrada*) of the *Carnivora*, but has now no significance in classification.

**Plantin**, plän-tăn, Christophe, French printer: b. Saint Avertin, France, 1514; d. Antwerp 1 July 1589. He established at Antwerp in 1555 a printing-press which became famous for the character of the work produced and later founded presses at Leyden and Paris. His most celebrated work is the 'Biblia Polyglotta' (8 vols. 1568-73). His office in Antwerp was purchased in 1877 by the city and now constitutes the Musée Plantin-Moretus. Consult: 'Life' by Rooses (1892).

**Plants, Diseases of.** See DISEASES OF PLANTS.

**Plants, Morphological Evolution of.** The living things in the world are commonly divided by science into two groups, plants and animals; but it is probable that more accurate knowledge will eventually assign them to several, if not many, groups. Haeckel, foreseeing this emergency many years ago, proposed an intermediate group, *Protista*, but this suggestion has not met with much favor, probably because it does not go far enough. It is plain, nevertheless, that there are two great biological branches "plants" and "animals," which exceed all others in the number and diversity of the organisms which they include; and in addition there are several groups, each with a relatively small number of much less differentiated organisms. Among the organisms which at present are called plants, in spite of their unlikeness to plants, are the slime-molds (*Myxomycetes*), the flagellates (*Flagellata*), the peridines (*Peridineæ*) and the flint-swimmers (*Silicoflagellata*), and these should probably be set off as so many distinct branches. Were this done, it would be much easier to frame a definition which should sharply separate plants and animals.

**Definition of Plants.**—Plants may be defined very generally as living things whose cells secrete cellulose walls externally, and chlorophyll internally. To this rule there are many exceptions, as in the fungi, whose cells secrete no chlorophyll, but these are now regarded as plants which have become degenerated as a result of feeding upon other organisms.

**Stages of Evolution.**—Down at the beginning of the vegetable kingdom are the minute single-celled protophytes or water-slimes (*Chroococcus*, *Glæocapsa*, etc.), in which each plant consists of a bit of faintly colored protoplasm surrounded by a thin wall. There is no definite nucleus here, and the only indications of nuclear matter are a few granules scattered in the protoplasm. We can scarcely conceive of simpler living things. Near them and a little higher are the blue-green water-slimes (of the families *Oscillatoriaceæ*, *Nostocaceæ*, *Scytonemaceæ*, and *Rivulariaceæ*) in which the cells cohere in elongated filaments. In the lowest of these the cells are quite undifferentiated, all the cells of a filament being apparently exactly alike, but in the subsequent families some differences appear. Thus in the nostocs there are here and there

larger cells (heterocysts) among the otherwise similar cells. In the rivularias the differentiation is carried a step further, the cells gradually diminishing in diameter from one end to the other. In all these plants the individual cells are yet very simple. The walls are a little more defined in the higher forms, and the nuclear matter, while still consisting of separate granules, is a little more condensed.

In the lower green-slimes (*Protococcaceæ*) are found evidences of marked improvement. The most significant advance is in the development of a distinct nucleus. Instead of a collection of granules lying in the protoplasm, here is a rounded body sharply set off from the surrounding cytoplasm. Here, also, the coloring matter of the cell is no longer diffused throughout its protoplasm, but it is restricted to one or more protoplasmic masses (chromatophores) which lie in the colorless cytoplasm. But the greatest advance is made in the methods of reproduction. While in the protophytes new plants are formed only by the fission of the cells, in these green-slimes we find for the first time that cells may divide into several motile zoospores; these may swim about for a time, and then come to rest, when they form walls and are quite like the cells from which they sprang. This motility is clearly a device for the distribution of the plants, and in fact each zoospore is to be regarded as a young plant which is able to move away from the plants among which it originated, and thereby to live in a less crowded environment. Some of these zoospores, however, do not settle down in the manner described, but when two meet they fuse into one cell, which is consequently larger and stronger, and more capable of enduring adverse conditions, than either of the cells which enter into its composition. In this simple fusion of zoospores is seen the beginning of that series of mechanisms which gradually increases in complexity up to such wonderful structures as the flowers of the lilies, orchids, roses, and thistles. What a distance from this primitive sexual mechanism to that of the higher plants! and yet between these widely separated extremes there is such an easy gradation that it is not difficult to trace the path by which the most complex flower was evolved from this simple beginning.

The brook-silks and water-flannels (*Confervoideæ*) show again how from the single-celled condition plants pass easily to the filamentous structure. Here is a repetition of the evolution of the filamentous plant body from the single cell observed in the protophytes. Here, however, the filaments are composed of cells which are considerably differentiated. While in the lower brook-silks the cells as a rule are both vegetative and reproductive, in the higher forms there is a pretty sharp distinction between the cells having these two functions, and with this development is seen the setting aside of some cells whose function is neither vegetative nor reproductive, but merely mechanical, as in the "holdfast cells" of many species.

In many of the *Confervoideæ* the sexual mechanism closely resembles that of the green-slimes, consisting of two equal, free-swimming zoospores, which fuse into a single cell that ultimately develops into a new plant. In other



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Species the two fusing zoospores (now called gametes) are differentiated into two sizes, both still ciliated and motile, while in still others the larger gamete is non-ciliated and motionless, and the smaller is ciliated and very active. In fact, the activity of the smaller gamete (now called the male gamete) appears to be increased directly as the female gamete becomes less active, and when the latter ceases activity altogether the former becomes extremely active. This change in the activity of the gametes involves the permanent inclusion of the female gamete in the cell in which it originates, thus affording it some protection before and after its union with the male gamete. Here is the beginning of a series of protective devices which show a gradually increasing complexity, and admirably illustrate the principle of increasing parental care as a factor in evolution. Compare, for a moment, the zygote of *Protococcus* or *Conferva*, with no parental protection whatever, with that of *Ædogonium*, in which the wall of the parent cell affords some protection, and then contrast these with the amount of protection afforded by the parent flowering plant in the thistle, for example, where coats of thick-walled cells surround the zygote and, later, the embryo plant.

In the brook-silks we have further illustrations of the modification of the plant body through the influence of a particular environment, whereby from them the group of the pond-scums (*Conjugatæ*) has arisen. Through living in quiet waters some brook-silks became sluggish in habit. They no longer produce zoospores, since simple fragmentation of the filaments answers every purpose of zoospores; and to this sluggishness we may also ascribe the peculiarities of the conjugative sexual act of the pond-scums. From the filaments of the pond-scums it is a short step to the desmids, most of whose filaments break up still more easily than do those of the pond-scums. This easy fragmentation of the filament results in the unicellular condition of most desmids. By a similar easy fragmentation of the filament the diatoms have been evolved from the pond-scums, and here the deposition of silica in the cell-wall makes necessary some peculiar structural changes, of much complexity, but of minor morphological importance. Desmids and diatoms are pond-scums in which the filaments suffer early solution.

In like manner may be traced the origin of the green-felts and their allies (*Siphonæ*) from the water-flannels (*Cladophoraceæ*), by a continuation of the modification which has taken place in passing from the brook-silks to the water-flannels. While in the brook-silks the filaments are composed of cells separated by partitions, in the water-flannels the cell-like segments of the filaments are cœnocytes in which there are no partitions between the component cells. In the green-felts this lack of partitions is carried one step further, and as a consequence the filaments are tubular, with partitions at long intervals only. In this way, it may be assumed, there arose the group of plants constituting the order *Siphonæ*, all of whose members are characterized by tubular and little-septated filaments. Even in those species in which the filaments are compacted into somewhat massive plants this tubular character prevails.

It is instructive to glance at the chlorophyll-

lacking members of the class of the green algæ (*Chlorophyceæ*) which have been considered. The more important of these are in the families of the water-molds (*Saprolegniaceæ*), downy mildews (*Peronosporaceæ*), and black-molds (*Mucoraceæ*). (See FUNGI.) The first of these show comparatively little modification in the structure of the plant body from that of a green-felt, like *Vaucheria*. The differences are those which are related directly to the parasitic or saprophytic habits of the water-molds. Thus, of course, there has been a disappearance of the chlorophyll, and a reduction in the size of the plant body, both of which modifications are such as should be expected under these conditions. With these are observed also the production of numberless minute zoospores, which may be contrasted with the single large zoospore of *Vaucheria*; yet here again, this is quite what should be looked for in plants which through parasitism or saprophytism have become dependent upon a particular host or substratum. The great number of zoospores is directly correlated with the dependent habit of the plants.

The downy-mildews, which are mainly aerial (that is, non-aquatic), and are parasitic in the tissues of higher plants, show first of all, those modifications which are due to change of habitat. The aquatic adaptations are here replaced by aerial adaptations, as seen in the firmer walls, the substitution, temporarily or permanently, of conidia for zoospores, and the entire suppression of antherozoids. When these structural changes are thus accounted for few others remain. In fact the downy-mildews, although parasitic, have retained so many of the characteristics of the green-felts that their relationship is most evident. The downy-mildews may be regarded as green-felts which have become parasitic on higher plants, and which for this reason have become modified as here indicated.

The black-molds (*Mucoraceæ*) have often been regarded as related more closely to the pond-scums (*Conjugatæ*), but they are probably not so related; on the contrary, their origin is most likely to be sought in the green-felts, with which they are evidently related in the structure of the plant body. As the black-molds are mostly saprophytic, and aerial, their reproductive apparatus is correspondingly modified. Thus there is a complete suppression of zoospores, which is effected by the simple device of the walling in of every little cell (zoospore) resulting from the division of the terminal segment (sporangium) of one of the branches. The zoosporangium has easily been modified into a sporangium containing walled spores. The spores are the homologues of the zoospores, and doubtless were derived from them. In the sexual apparatus, the greatest modifications have taken place. The gametangia, instead of being quite unlike in size and shape, as they are in the green-felts, water-molds, and downy-mildews, have suffered such degenerative modification that they are little unlike. This is, perhaps, to be correlated with their saprophytic habit, and there is little doubt that these sexual organs are on the way to extinction. The infrequency of their occurrence in the ordinary species shows that they are obsolescent, to say the least.

In passing, it may be said that the group of the brown seaweeds (*Phæophyceæ*), although



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related to the green algæ, constitute a side line ending abruptly with the rockweeds and the kelps, and no higher forms have sprung from them. No higher forms can be traced back to the brown algæ. Their evolutionary line ends with their own higher members.

Coming back to the line of the green algæ, we find at the highest point the interesting plants which constitute the genus *Edogonium*. Here is the highest development thus far reached, especially in the reproductive apparatus; yet this is easily seen to be based directly upon the structure characteristic of other green algæ. From *Protococcus*, with its free-swimming isogametes, to *Conferva*, *Sphæroplea*, and *Edogonium* there is an easy gradation by which from the first very simple sexual act there has evolved the much higher act as seen in the last genus. In *Edogonium* the gametes are quite unequal in size, and the minute antherozoid is highly motile, while the large egg is entirely wanting in motility, and remains within the wall of the egg-cell. After fertilization the egg becomes a thick-walled zygote, protected somewhat by the surrounding wall of the egg-cell. There is to be observed here some care of its offspring by the parent plant, inasmuch as the egg is at no time without the protection afforded by the wall of the egg-cell.

This parental care is notably increased in the closely related plants of the genus *Coleochaete*, in which, after a fertilization in all essentials like that in *Edogonium*, the parent plant covers the egg-cell, and with it the egg, with a layer of protective cells, thus constituting a primitive kind of fruit. Essentially the same structures occur in the red seaweeds, in which the parental care of the results of fertilization is often considerably more marked. Fertilization is no longer confined to the egg alone, but its stimulation extends to cells and tissues which are not at all sexual in nature, but rather accessory, and belonging not to the new structure, but to the structure of the parent plant.

Passing to the liverworts and mosses it is to be noted that the protective tissue, which in the cases cited grows around the egg-cell only after fertilization, is now developed by the parent plant long before fertilization. Yet this notable modification was anticipated in the stoneworts (*Characeæ*), the highest of the green algæ, where the egg as it develops becomes surrounded by a protective envelope in every essential like that which surrounds the fertilized egg of *Coleochaete*.

From the liverworts to the lower ferns is but a short step, as is shown in the essential identity of the sexual organs. The egg-cell is surrounded before fertilization by a layer of protective tissue exactly as in the liverworts, and so evident is the identity of structure that egg and protective tissue have long been given the same technical name, "archegone." In the higher fernworts its sole modification is that it is sunken for nearly its whole length into the tissues of the parent, thus affording still greater protection to the egg before and after fertilization. In the pines and flowering plants there is no essential change from the structures found in fernworts, but in them the young plant early separates from the parent, in the seed. This is made necessary by the fact that the fertilization takes place on the parent plant.

In like manner there has been gradual evolution of the plant body from the liverworts to the ferns, and flowering plants, in which step by step simpler structures are modified into those with greater and greater complexity. From one end of the series to the other there is a close continuity, and the complex structures of the thistle and sunflower, including roots, stems, leaves, flowers, and fruits, are easily derivable from the simple plant body characteristic of the lower liverworts.

The immediate ancestors of the seed-bearing plants appear to have been the ground-pines. It is probable that the pines and their relatives (*Gymnospermæ*) and the flowering plants (*Angiospermæ*) originated independently from their ground-pine ancestors. They appear to represent parallel lines rather than genetically connected lines. The pines have a simpler structure, and are therefore lower than the flowering plants; accordingly in the struggle for place they have been gradually driven back, so that they no longer occupy the first place, although they appeared much earlier in point of time.

The flowering plants parted very early into two lines, the monocotyledons, and the dicotyledons. The earlier plants of each subclass must have had simple, separate pistils, as in the water plantains, buttercups, and cinquefoils. From the first originated the lilies, the irids, and the orchids by successive fusions of the flower parts. From the lilies there originated also the three great groups, the aroids, the palms, and the grasses, by the suppression of flower parts. In like manner from the buttercups there came the crucifers, pinks, mallows, and geraniums by various fusions of the pistils, and from the pinks by still other fusions came the primroses, phloxes, figworts, and mints, with ebonyworts, heaths, and gentians as side-lines. From the cinquefoils came the spindle-trees, umbelworts, madderworts, and sunflowers, with the beanworts, myrtles, soapberries, and bellworts as side-lines.

There are thus three culminating groups among flowering plants; namely, the orchids, the mints, and the sunflowers, and these are to be regarded as the highest in their respective lines. All in all the sunflowers (*Compositæ*) must be regarded as the highest group of plants.

*Evolutionary Unity.*—The vegetable kingdom is a unit as to origin, and its multitudes of forms are connected by an unbroken series of evolutions of structure to structure. To the discerning mind there are no exceptions, no forms which are not related to others earlier than they. This evolution has not been confined to a single line, but has given rise to a multitude of branches and branchlets of the genealogical tree which represents the plant kingdom. Yet from the lowest plants there is a continuous series to each ultimate form, whatever its position. Evolution has been in many directions, and while the general trend has been upward, it has often been outward, and even downward, resulting in divergence and even degeneration. See VEGETABLE KINGDOM.

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**Plants, Poisonous,** those inflicting toxic disease upon men or animals. The most widely



# AMERICAN POISONOUS PLANTS.



1. Poison Ivy (*Rhus radicans*): *a*, spray showing aerial rootlets and leaves; *b*, fruit.
2. Poison Hemlock (*Conium maculatum*), showing flowers and seed.
3. Water Hemlock (*Cicuta maculata*), showing section of spindle-shaped root and lower stem, the leaves, flowers, and fruit.
4. Pokeweed (*Phytolacca decandra*).
5. Stemless Loco-weed (*Aragallus lambertii*), in flower.

6. Broad-leaf Laurel (*Kalmia latifolia*): *a*, flowering spray; *b*, vertical section of flower showing peculiar attachment of stamens (enlarged); *c*, fruiting capsules.
7. Poison Sumac (*Rhus vernix*), showing leaves and fruit.
8. Jimson-weed (*Datura stramonium*); *a*, flowering spray; *b*, fruiting capsule.
9. Woolly Loco-weed (*Astragalus mollissimus*).







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dreaded toxic plants in America are probably those poisonous to the touch. Such are the poison ivy, the poison oak, and the poison sumac, otherwise known as the poison elder or poison dogwood. All of them affect certain constitutions most disastrously, containing, even when dried, an oil which, soon after touching the skin, raises a severe inflammation, and produces an intolerable itching, especially where the skin is callous, or there is friction. Immediate washing after contact with the plant will sometimes prevent the trouble, and very hot soap suds, or sugar of lead, will alleviate the suffering. The poison seems most virulent when the plants are blooming.

The above all belong to the *Rhus* genus, and are continually being confused with innoxious plants, the Virginia creeper, for instance, often being destroyed with the poison ivy, the two vines sometimes growing together. This poison ivy is a climbing or trailing shrub (sometimes erect), with variable three-foliate leaves, aerial rootlets, and greenish flowers. The smooth, waxy white berries often remain on it until late in the winter, forming a food for birds, which disseminate the plant. The leaves differ from those of the Virginia creeper in having only three leaflets instead of five, and they are of a peculiar dark green, and glossy as though waxed. The poison ivy grows everywhere, in open brush, in ravines and on the borders of woods; it climbs tall trees, and luxuriates in fence corners, often rearing its head high above the posts. In autumn it assumes brilliant colors, and is oftentimes picked for ornament,—with unfortunate results.

The poison sumac grows in swamps from Florida to Canada and westward to Louisiana. It is a tree-like shrub, 6 to 30 feet high, with long pinnate leaves having from 7 to 13 smooth and glossy leaflets, on red petioles, and without marginal teeth. The wood has a faint sulphurous odor, which, together with the leaf scars, which are very prominent, enables one to distinguish the plant from other shrubbery in the winter. The loose, grape-like bunches of silver-gray berries are also visible in the winter and are a frequent source of poisoning, being picked for ornament.

The western poison-oak has the same unpleasant toxic characteristics, and differs from the poison ivy mainly in the character of its leaves, which are thicker and smaller, and less sharply lobed.

Other plants, less common, but quite as virulent to some people, are the handsome ladies' slippers, the largest, the crimson and white *Cypripedium reginæ*, growing in sphagnum swamps, producing almost identically the same symptoms as the sumacs. The juice of several spurges (*Euphorbia*) excites similar inflammations.

Plants having poisonous fruits are perhaps the most dangerous, especially to investigating children. There are several kinds of berries, like those of the pokeweed, bitter-sweet and night-shade, and the black cherry kernels, which are poisonous, when eaten rashly, but the most destructive fruit is probably that of the thorn-apple, or Jimson weed (*Datura*)—a fruit most unappetizing in appearance, covered with spines, and holding hard black seeds, containing several poisonous alkaloids. The plants are rank and ill-smelling, smooth and bushy annuals, with

large irregularly flaccid leaves, and large flowers, white or purple according to species, blooming at night, and resembling half-opened, long-tubed morning-glories. They are naturalized from Europe and Asia, and are found on waste lands and rubbish heaps.

The water-hemlock (*Cicuta maculata*) is also responsible for many deaths. It belongs to the great carrot family, which contains both edible and poisonous roots and seeds. It is a smooth erect perennial, 3 to 8 feet high, with a rigid, hollow stem, marked with purple lines, numerous branches, finely dissected leaves, tiny white flowers, disposed in the familiar flat umbels of the wild carrot or sweet cicely and a cluster of spindle-shaped roots, which vary in length from 1½ to 3 inches, and are very characteristic. This is one of the most poisonous native plants in the United States, being rapidly fatal to both man and animals. The roots are especially dangerous, because the taste, being aromatic and to some people suggesting that of horseradish, parsnips, artichokes, or sweet cicely, is apt to lead children to eat them when they are found forced out of the soil by washing, freezing, or other causes in early spring. Cattle sometimes eat the tubers, and in marshes they are poisoned by drinking water contaminated by the juice of roots which have been crushed by being trampled upon. No estimate can be made of the amount of damage done to live stock, but it is very considerable. The human victims average several per annum.

Another species of the genus *Cicuta* has glaucous leaves springing directly from the ground, and a fleshy root with two distinct parts; a vertical rootstock, divided into numerous chambers by horizontal partitions, containing a poisonous aromatic oil, and fleshy tubers, sending out rootlets.

The historic poison hemlock of Greek fame is another violently poisonous plant, in all its parts. Similar in appearance to the other hemlock, with purple spotted stems, and a mouse-like odor when bruised, it is becoming naturalized in waste places, and is dangerous when seeds, or foliage or roots are eaten.

The beautiful evergreen mountain laurels (*Kalmia*) conceal a strong poison in their leaves, as do other closely related species of the Heath family, such as the *Rhododendron*. The smaller laurel, *K. angustifolia*, carries the suggestive name of lambkill. Live stock are the principal sufferers from these plants, scores being poisoned and killed by them annually, but children are sometimes poisoned by eating young shoots, which grow with and closely resemble wintergreen, but are without the spicy flavor of the latter. Honey is said to be rendered poisonous when bees feed upon the *Kalmia* pollen.

Livestock are also often killed by eating the poisonous fruits of the buckeye (which with the young shoots were bruised and thrown into ponds, stupefying fish and rendering their capture easy); they are also poisoned by the leaves of the black cherry, especially when wilted.

In the West the sneezeweed (*Helenium*), the larkspurs, rattlebox and the loco- or crazy-weeds are the dread of stock-raisers. The latter (*Astragalus*), silvery-white, silky-leaved perennials, have a most peculiar effect on horses. It is not an acute disease and has two recognized stages. The first, which may last several months, is a period of hallucination or mania ac-



## PLAQUEMINE — PLASTERS

accompanied by defective eyesight, during which the animal may perform all sorts of antics. After acquiring a taste for the plant it refuses every other kind of food, and the second stage is ushered in. This is a lingering period of emaciation, characterized by sunken eye-balls, lustreless hair, and feeble movements. The animal dies as if from starvation, in periods ranging from a few months to one or two years.

Human beings occasionally poison themselves by cooking various plants in mistake for the harmless "greens" or salad plants. Poke-weed shoots and American false hellebore are the principal plants used in this manner. Toadstools, perhaps, cause as many poisoning cases as any other plants. The attractive-looking *Amanitas* are continually being gathered by careless or ignorant people in mistake for the true edible mushrooms, and very often cause death.

**Plaquemine**, plāk-mēn', La., town, parish-seat of Iberville Parish; on the Mississippi River, and on the Texas & Pacific railroad; about 80 miles northwest of New Orleans. It is in a productive agricultural region, and is the trade centre for a large part of Iberville and adjoining parishes. The chief manufactures are lumber and lumber products, sugar, and cotton products. It has considerable trade in manufactured articles and in the raw products of the farms. The town owns and operates the water-works. Pop. (1890) 3,222; (1900) 3,590.

**Plarr, Victor Gustave**, English librarian: b. 21 June 1863. He was of German and English parentage, removed from Strasburg to Scotland with his parents in 1870 and was educated at Oxford. He was librarian of King's College, London, 1890-7 and has been librarian of the Royal College of Surgeons from the last named year. He has edited 'Men and Women of the Time,' 14th and 15th editions, and has written 'In the Dorian Mood' verse (1896); etc.

**Plas'ma**, (1) in mineralogy, a leek-green silicious mineral, found in angular pieces associated with chalcedony. It is feebly translucent, and has a somewhat oily lustre. It is somewhat rare and was wrought into engraved ornaments by the Romans to a considerable extent. (2) In biology, the liquid part of nutritive animal fluids, such as blood, lymph or milk as distinguished from the organized solids contained in them, as for instance the corpuscles of the blood.

**Plassey**, pläs'sē, India, a village on the Bhagirathi River, 96 miles north of Calcutta, celebrated in the history of India for the great victory gained by Clive over Suraj ud Dowlah, subahdar of Bengal 23 June 1757, a victory which laid the foundation of British supremacy in India. The site of the battle is now covered by the river. See INDIA.

**Plaster of Paris**, a name given to powdered gypsum when prepared for taking casts, etc. If one part of powdered gypsum be mixed with two and a half parts of water, a thin pulp is formed, which after a time sets to a hard, compact mass. By adding a small quantity of lime to the moistened gypsum a very hard marble-like substance is obtained on setting. Substances other than lime are also employed for the purpose of rendering the mass hard and very compact; thus Parian cement consists of plaster of Paris mixed with borax; marble-

cement is the same plaster mixed with alum and soda. See GYPSUM.

**Plastering** is the art of covering the surface of masonry or wood-work with a plastic material in order to give it a smooth and uniform surface, and generally in interiors to fit it for painting or decoration. Technically the term plastering is used only when the plaster is spread over a screen of laths fixed to the wall. The chief preparations used by plasterers are known as *coarse stuff*, *fine stuff*, *plasterers' putty*, and *gauged stuff*. The first of these is composed of sand and lime, mixed with long ox hair; the second is slaked lime, usually without hair; the third is not unlike the second; and gauged stuff is a mixture of plasterers' putty and plaster of Paris. Three kinds of plastering are distinguished, namely, one-coat (lath and lay), two-coat (lath, lay, and set), and three-coat (lath, lay, float, and set). In one-coat work a layer of coarse stuff is spread over the laths, and pressed well into the spaces so as to form a *key* to hold the coat in place. When a second coat is to be applied, the first is not smoothed, but roughened with a birch-broom so as to retain the second one in place. The second coat consists of fine stuff, putty, or gauged stuff. In plastering the interior of houses a first coat is laid on of coarse stuff, the process being known as *pricking-up*. The face of the first coat, which should be of considerable thickness, is troweled, or indented diagonally with the point of a lath, to form a key for the finishing coats. The second coat is applied to this when it is thoroughly dried. It consists of fine stuff, and is rubbed in with a flat board so as thoroughly to fill the indentations and cover the unequal surface of the first coat with a smooth and even one. In plastering walls great care must be taken to have the surface perfectly vertical. This second coat is called the *float* coat, because wooden boards, known as *floats*, are used in rendering the surface plane. Before drying, this coat is scraped with a birch-broom to form a key for the next. The setting coat is applied to the second after it has become perfectly dry. If the wall is to be papered, this coat is of fine stuff, but other mixtures are used for other purposes. Walls cannot be rendered unless they are rough. See BUILDING.

**Plasters**, preparations for local application to the surface of the body, kept in place by means of a supporting texture of leather, muslin, linen, silk, etc., or merely of paper and frequently with the aid of some adhesive substance. Plasters may be intended simply to give protection, support, or warmth, as in the case of wounds, bruises, or local weakness, or they may be actively medicinal. In most of the recognized medicinal plasters the adhesive property is due to the combination of oxide of lead with fatty acids, though india-rubber is also used. Olive-oil and litharge are used in the compound which most frequently forms their base. The 13 plasters of the United States Pharmacopœia are: ammonia and mercury, arnica, belladonna, cantharides, capsicum, iron, isinglass, lead, mercury, opium, pitch, resin, and soap. The numerous unofficial plasters are various in composition and in specific purpose and efficacy. Plasters in the form of blisters are also largely used. See BLISTER.



PLASTIDS — PLATE-MARKS

Plas'tids, same as chromatophores (q.v.).

**Plata, Rio de la,** *rē'ō dā lä plä'tä*, a great estuary of South America, lying between Uruguay and Argentina, and formed by the junction of the Paraná and the Uruguay rivers (qq.v.). With these rivers it may be considered the second great river system of South America which drains the so-called La Plata states, namely Argentina, Uruguay, Paraguay, southeastern Bolivia, and southern Brazil. But the Plata itself is merely the estuary of this system, and it is impossible to mark the point where it empties into the ocean, as the "river" is 170 miles wide between Cape San Antonio and Cape Santa Maria. The volume of the river is great, in spite of its shallowness, and its current is perceptible 150 miles out to sea. The broadest rivermouth of the world, the Plata measures 25 miles across throughout its course between its source and Buenos Ayres, and is more than 60 at Montevideo, where the only harbor of the whole basin is situated. The entry from the ocean is dangerous, and is guarded by light-houses and light-ships. The course of the La Plata system was explored by Day in 1853 and by Page 1853-6.

**Plataea,** *plä-tē'a*, ancient city of Bœotia in Greece, on the frontier of Attica, beneath Mount Cithæron and south of the Asopus River. The famous temples of Hera and of Athena Areia with one of Phidias' colossal statues and paintings by Polygnotus were situated here. Its inhabitants were probably of Ionian stock. In 519 they made a treaty of alliance with Athens, and at Marathon 1,000 Plataeans shared in the victory. Their city was burned by the Persians in 479 and in September of the same year the Persian army was defeated here by the Plataeans, Athenians and Spartans in a bloody battle, in which Mardonius, leader of the forces, left for the conquest of Greece after Salamis, took the offensive after the armies had been face to face for a fortnight, and was killed with almost his entire army. The Plataeans were highly honored by their allies for their part in this great battle and their independence was guaranteed by all the Greek states. But in the Peloponnesian war Plataea sided with Athens and was nearly betrayed (431) by a body of Thebans who attempted to destroy the city. In 429 the Spartan army of Archidamus attacked the city, from which all the non-combatants save 110 women had been sent to Athens. The 480 who remained (80 Athenians) withstood all assaults, so that the Spartans had to be satisfied with a thorough blockade, in the second year of which the city was taken and its defenders killed, except a gallant party of 212 which had cut its way through the Spartan lines. The city was rebuilt and reoccupied by its people in 387, only to be destroyed again in 372 by the Thebans. It was again restored after the battle of Chæronea.























**Plate and Plated Ware.** Plate is the name by which utensils of silver or gold for domestic purposes are designated. Articles of this character have from the remotest times and among all civilized nations been highly prized, and from their durability, intrinsic value, and the beautiful forms into which they are often wrought, have been esteemed the most precious heirlooms, and been held among the choicest

family treasures through successive generations. The richest treasures of the temple of Solomon were of gold and silver plate, and such constituted the untold wealth taken by the Spanish conquerors of Peru from the ancient incas. Though modern art has scarcely carried the manufacture of plate to higher perfection than that attained by skilful workmen of past centuries, it has succeeded in producing substitutes for it in what is called plated manufacture, equally useful and almost as beautiful as the genuine plate, at prices that place within reach of those of moderate means what constituted the luxuries of the rich. In the United States the silver plate industry is carried on principally at Providence, R. I., and Meriden, Conn.

In the plating process the use of silver is known as plating, and with gold as gilding. Plating by the galvanic process is termed electro-plating. See ELECTRO-METALLURGY.

**Plate-marks, or Hall-marks,** are symbols or marks placed on gold and silver plate for the purpose of showing its degree of purity, the place of manufacture, etc. In most European countries the stamping of plate is a matter of legal regulation. In England, Scotland, and Ireland the marks are five in number — (1) The maker's mark or initials. (2) The assay mark. In the case of gold this is a crown with figures denoting the number of carats fine. For silver it is in England a lion passant, with figures; in Ireland a harp crowned; in Edinburgh a thistle; and in Glasgow a lion rampant. (3) The hall-mark of the district offices, which are in London, York, Exeter, Chester, Newcastle, Birmingham, Sheffield, Edinburgh, Glasgow, and Dublin. (4) The date mark, consisting of a letter, changed every year. (5) The duty mark, the head of the sovereign, indicating that the duty has been paid.

The following table shows specimens of the different alphabets used by the Goldsmiths' Company of London as date-letters from 1478; variety in the shape of the shields being also used as a further distinction:

	1478 to 1498 — Lombardic, caps., double cusps.	1696 to 1716 — Court hand.	
	1498 to 1518 — Black letter, small.	1716 to 1736 — Roman, capitals.	
	1518 to 1538 — Lombardic, capitals.	1736 to 1756 — Roman, small.	
	1538 to 1558 — Roman and other caps.	1756 to 1776 — Black letter, capitals.	
	1558 to 1578 — Black letter, small.	1776 to 1796 — Roman, small.	
	1578 to 1598 — Roman, capitals.	1796 to 1816 — Roman, capitals.	
	1598 to 1618 — Lombardic, capitals, external cusps.	1816 to 1836 — Roman, small.	
	1618 to 1638 — Italian, small.	1836 to 1856 — Black letter, capitals.	
	1638 to 1658 — Court hand.	1856 to 1876 — Black letter, small.	
	1658 to 1678 — Black letter, capitals.	1876 to 1896 — Roman, capitals.	
	1678 to 1696 — Black letter, small.	1896 to 1916 — Roman, small.	

The accompanying figure shows a Birmingham silver plate-mark. (1) the maker's initials; (2) the standard mark; (3) the hall-mark of Birmingham; (4) the duty-mark; (5) the date-letter for the year 1889.





## PLATEAU — PLATINUM

**Plateau.** See TABLE-LAND.

**Plateau, Joseph Antoine Ferdinand,** Belgian physicist: b. Brussels 14 Oct. 1801; d. Ghent 15 Sept. 1883. In 1835 he became professor of experimental physics and astronomy in the University of Ghent, in which capacity he continued to serve until 1871. He became noted for his extensive researches in optics and molecular forces, his experiments being all the more wonderful from the fact that they were mostly done after he had become totally blind, the result of previous labors in the field of subjective vision. He was helped in these experiments by his son and son-in-law, who acted as his visuals. His chief work, and wherein his experiments and researches are described, was '*Statique expérimentale et théorique des liquides soumis aux seules Forces Moléculaires*' (1873). Beside a short but comprehensive article on '*Persistence of Vision*' (1876), he also published a bibliography of works relating to optics.

**Platen-Hallermünd, August, COUNT VON,** German dramatist and poet, distinguished for his opposition to German Romanticism: b. Ausbach, Bavaria, 24 Oct. 1796; d. Syracuse, Sicily, 5 Dec. 1835. He received his education in the military academy at Munich; became a lieutenant in the Bavarian army, and served throughout the campaign against France in 1815; subsequently obtained a furlough and took up the study of philology at Würzburg for two years and from 1819-25 at Erlangen. About this time he was awarded a stipend by the King of Bavaria which enabled him to satisfy his desire to study Oriental languages and literatures by extensive travel. As regards Platen's writings much has been said both in praise and criticism; although in later years he became bitterly opposed to and often satirized Romanticism. Nevertheless his earlier works show to a great extent the effects of Romantic influence, and it is mostly for this contradiction that he is criticized. His first works, published in 1821, were poems written in the Persian form of the "gazel" under the title '*Ghaselen*.' These poems were closely followed by '*Neue Ghaselen*' (1824); '*Der gläserne Pantoffel*' (1824), a poem which more than the others shows the Romantic influence; '*Sonnette aus Venedig*' (1825), as beautiful a collection of sonnets as may be found in the German language; '*Der Schatz des Rhampsinit*' (1824); '*Die verhängnisvolle Gable*' (The Fatal Fork) (1826), a satirical comedy attacking the "fate tragedy"; '*Der Romantische Oedipus*' (1829), directed against Romanticism; an historic drama, '*Die Liga von Cambrai*' (1833); and the legendary epic, '*Die Abbassiden*' (1835). An edition of his collected works was published in two volumes (Stuttgart 1876).

**Plating.** See ELECTRO-PLATING; PLATED-WARE.

**Platiniridium,** a native alloy of platinum and iridium in varying proportions. It is found in small grains and crystals associated with native platinum.

**Plat'inum, or Platina** (Spanish, "like silver"), a metallic element, first brought to the notice of the civilized world by the Spanish traveler Ulloa, who obtained it from the gold-bearing sands of the river Pinto, near Popayan, Colombia, in 1735. Watson extracted the

metal, in 1741, from the silvery sand that was sent him from this source, and gave it the name "platinum." In 1822 platinum was found in Russia, in the alluvial deposits of the Ural district; and it is from the Urals that the greater part of the commercial supply is now obtained, though a portion of it comes from South America and from Borneo.

Platinum almost invariably occurs in nature in the free or uncombined state, usually alloyed with iridium, osmium, iron, and other metals. Many specimens of native platinum are magnetic, and some even exhibit polarity, like the lodestone; those which are polarized being usually (but not invariably) alloyed with an uncommonly high percentage of iron. Several methods are known for separating platinum from the other metals with which it occurs in nature, but for these reference must be made to the more extended treatises on chemistry and metallurgy.

Pure platinum, when in the compact state, is a white, silvery metal, somewhat softer than copper, very malleable and ductile, and capable of receiving a high polish. It has a specific gravity of about 21.5, and is therefore one of the heaviest substances known. Its specific heat is 0.032, and its coefficient of linear expansion (Fahrenheit scale) is about 0.0000049. On account of the close equality of this last constant to the coefficient of expansion of glass, platinum wires are almost universally employed in the manufacture of incandescent electric lamps, for leading the electric current through the glass to the carbon filament within. A conductor having a coefficient of expansion materially different from that of glass could not be successfully used for this purpose, since the differential expansion between the conductor and the surrounding glass, as the lamp becomes alternately heated and cooled in its service, would inevitably result in a leakage where the wire passes through the glass; and the external air, entering the bulb, would destroy the vacuum and hence bring about the destruction of the filament also. On account of the high cost of platinum, many attempts have been made to discover a successful substitute for it, in the manufacture of electric lamps. No demonstrably satisfactory substitute has yet been found; but it is quite likely that one of the alloys of nickel and iron, with which experiments are now being made, will ultimately replace the platinum in this application. The electrical resistance of a platinum wire is from 10 to 12 times as great as that of a silver wire of the same dimensions. Platinum melts at about 3,200° F., and for its fusion the highest temperature of the oxy-hydrogen flame is required. When melted, the metal does not oxidize; but it absorbs oxygen gas, which it gives off again upon rapid cooling, with a curious "spitting" action. At a dull red heat platinum also absorbs hydrogen gas readily; Berliner stating that platinum foil that has been carefully cleaned and freed from gases will absorb no less than 200 times its own volume of hydrogen, and 80 times its own volume of oxygen. These absorbed gases are retained so powerfully that they cannot be entirely removed except by heating the metal strongly in a vacuum. Hydrogen will also pass through platinum foil easily at a red heat, even when the foil is more than one millimetre (that is, 1-25th inch) thick.

Chemically, platinum has the symbol Pt, and



## PLATO

an atomic weight of about 194.8. It is not attacked by oxygen, nor by pure hydrochloric, nitric, or sulphuric acid. For this reason, and also on account of its comparative infusibility, it is greatly used in the laboratory in the form of crucibles and other apparatus; and when alloyed with iridium it is also employed in the construction of standard weights and measures, the alloy with iridium being harder than pure platinum, and hence less liable to injury from wear or from accident. Alkaline substances attack platinum to some extent, their action being most rapid at high temperatures. Chlorine also acts upon it, and for this reason electrodes of platinum are seldom used in the electrolysis of solutions of common salt. Platinum may be successfully used even for this purpose, however, if the metal is quite pure, and the electrodes are kept scrupulously clean.

The most important simple salt of platinum is the tetrachloride,  $\text{PtCl}_4$ . In the preparation of this substance metallic platinum is first dissolved in the mixture of nitric and hydrochloric acids known as "aqua regia," and the solution is evaporated. The crystals which are thus obtained have the composition  $\text{H}_2\text{PtCl}_6 + 6\text{H}_2\text{O}$ , and the substance  $\text{H}_2\text{PtCl}_6$  (which has acid properties) is known as "chloroplatinic acid." Its hydrogen atoms are each replaceable, and the salts are formed by replacing them by bases known as the "chloroplatinates" of those bases. When the crystals that are obtained as described above are allowed to stand over caustic potash for a sufficient time, they lose four molecules of their water of crystallization; and if the residue is then heated in chlorine gas to about  $650^\circ\text{F}$ ., it parts with the elements of hydrochloric acid, and becomes reduced to platinum tetrachloride,  $\text{PtCl}_4$ . The pure tetrachloride is brown in color, and is readily soluble in water. Chloroplatinic acid is very often (though incorrectly) called "platinum tetrachloride," and in certain of their laboratory applications the two can be used almost interchangeably. When ammonium chloride,  $\text{NH}_4\text{Cl}$ , is added to a solution of platinum tetrachloride, ammonium chloroplatinate,  $(\text{NH}_4)_2\text{PtCl}_6$ , is precipitated. Many other compounds of platinum with ammonium are also known, but their chemistry is too complicated for present consideration. Chloroplatinates of the metals of the alkalis, analogous in composition to ammonium chloroplatinate, are easily obtained, and some of them are important in the laboratory. Potassium and sodium, for example, are so similar in their chemical deportment that they can be separated only with much difficulty unless they are at first brought into the form of chloroplatinates. If a solution of the mixed chlorides of sodium and potassium is added to a solution of platinum tetrachloride, the chloroplatinates of sodium and of potassium are formed, their compositions being analogous to that of the chloroplatinate of ammonium, just given. The chloroplatinate of sodium is readily soluble, and remains in solution; while the corresponding salt of potassium is nearly insoluble, and is therefore precipitated. Three oxides of platinum have been prepared by indirect methods, but none of them is of any considerable importance. Platinum does not readily form salts (save in the case of its halogen compounds) by replacing the typical hydrogen atoms of acids; and when it occurs in com-

bination, it is more commonly found in the acid radical of the salt (as in the case of the chloroplatinates) than in its positive radical.

"Platinum black" is merely metallic platinum in a state of minute subdivision. It may be prepared in various ways. According to the one method, ordinary platinum is first melted with twice its own weight of zinc, and the alloy so produced (which is very brittle) is finely pulverized. The zinc is then dissolved away by the action of sulphuric acid, and the residue, after washing with very dilute nitric acid, consists of nearly pure platinum in the desired state of subdivision. Platinum black (which takes its name from its color) absorbs oxygen with great facility, taking up (according to Liebig) as much as 800 times its own volume of that gas. The oxygen so absorbed may be utilized for effecting the oxidation of organic substances, and for this reason platinum black is greatly used in organic chemistry. "Spongy platinum" is pure metallic platinum in a porous or spongy condition, and may be conveniently prepared by igniting the chloroplatinate of ammonium. It is gray in color, and (like platinum black) it possesses the power of absorbing gases to a remarkable extent. A jet of hydrogen gas, when directed against a fragment of spongy platinum, is absorbed so energetically that the heat that is developed is sufficient to ignite the jet.

**Plato** (Gr. *πλάπων*, "broad," a sobriquet given by Ariston, a teacher in athletics, and referring probably to Plato's broad shoulders) was born in Athens in the deme of Collytus, in 427 B.C., of aristocratic parentage, and died there in 347. According to an ancient tradition he was born on the 7th of Thargelion, Apollo's Day, which, in Olympiad 88.1 (accepting the Metonian canon), fell on 29 May, Julian calendar. His original name was Aristocles, the name of his grandfather. His father's name was Ariston, of the line of Codrus, last of the kings of Athens, and his mother was Perictione, of the line of Solon, greatest of the Athenian archons. In many respects Solon was Plato's political exemplar, for Solon was at once philosopher and statesman. Plato distinguished himself in his early youth as an athlete, having wrestled in the Isthmian games at Corinth, and there is a doubtful tradition that he was once victor at Olympia. Before he was 20 he had written dramatic and lyric verse assiduously and with success. The most important event in his earlier life was his meeting with Socrates in 407. This event was decisive for his later career. He had already studied philosophy under the Heraclitean Cratylus, but from 407 to the death of Socrates in 399 he was entirely absorbed in the dialectic of his new master, whose chief disciple and most complete interpreter he became. Immediately after the death of Socrates in prison (Plato, owing to illness, was not present), the disciple went to Megara, where, with his friend Euclid, he studied the Eleatic philosophy. After a brief residence in Megara, it is probable that he returned to Athens, and thereafter made extensive journeys to Egypt, Cyrene in Africa, Italy, and Sicily. In Cyrene he visited the mathematician Theodorus. In Italy he was befriended by the famous ruler, Pythagorean philosopher, and military leader, Archytas of Tarentum. In Sicily he formed an intimate friendship with Dion, brother-in-law of



## PLATOFF

the elder Dionysius. Dionysius, then ruler of Syracuse, was offended by Plato's free criticism of the government, and turned him over to the Lacedæmonian ambassador, Pollio, to be sold as a slave. He was brought to Ægina, where Anniceris (of the Cyrenaic school) ransomed him. After his release, a plot of ground hard by the Academy was bought for the use of Plato's school, which then took the name of the adjoining gymnasium (academy). Plato established his academy in 387 and presided over it until his death in 347. The foundation of the academy thus dates from the exact middle of his life. Two later journeys were made to Sicily, one in 367, on the accession of Dionysius the Younger, and one in 361, both for purposes of political experiment, but without success. Indeed, on the last visit his life was put in jeopardy by the distrust of Dionysius. Thereafter he made no further attempts in practical statescraft, but carried forward continuously his scientific and literary work at the academy, where, in his early teaching, he employed a dialogic method (after the manner of his master, Socrates), and later the more dogmatic lecture. He died in 347 (according to tradition, on his birthday, having thus completed exactly four score years), as Cicero says, *scribens*, "pen in hand" (*De Senectute* v. 13). His tomb near the academy, in the Ceramicus, was still to be seen at the beginning of the Christian era.

*Writings.*—No work of Plato known to antiquity has been lost. On the contrary, the present *corpus* contains more than the genuine list of works. The traditional Platonic canon (that of Thrasyllus in nine tetralogies, accepted entire by Grote) contains 36 works (counting the letters as one), divided into 56 books. The works are written almost entirely (excepting the 'Apology') in dialogue, a form which grew out of the Socratic conversations, which these writings purport to reproduce. They are not systematic treatises, but rather essays, the earlier of which are more peirastic and the later more dogmatic (cf. Pater's 'Plato and Platonism,' pp. 157-159). Their chronology represents the gradual philosophical evolution of Plato's own mind, and not any preconceived pedagogical plan. Regarding the determination of the sequence or dates of the dialogues, no consensus of opinion among Platonic scholars has been reached. The most important dialogues are the 'Symposium' (on Love), the 'Phædo' (on the Immortality of the Soul), the 'Republic' (on the Ideal State), the 'Theætetus' (on the Nature of Knowledge), and the 'Timæus' (on the Nature of the Physical World). Three periods of composition may be differentiated, namely: (1) A Socratic or Ethical period, in which the anti-sophistic dialogues were written. This period may be regarded as extending from 398 to 387, that is, from the beginning of Plato's philosophical writing to the opening of the academy; (2) a Metaphysical and Constructive period, in which Plato builds the Socratic concept into its metaphysical form, develops the theory of ideas, invents his great myths, constructs the ideal state, and reaches the climax of his intellectual and literary genius—a period extending from 387 to 360; (3) a third period, marked by increasing mysticism and decreasing literary and philosophic power, a growing ascendancy of Pythagoreanism and mathematical

symbolism, a less daring civic ideal, a more dogmatic and less versatile manner of utterance, and a greater emergence of religious interest—a period extending from the last Sicilian journey, or about 360, to his death in 347.

I. *The Socratic and Anti-Sophistic Group*, 398-387: (1) 'Apology'; (2) 'Euthyphro'; (3) 'Crito'; (4) 'Lysis'; (5) 'Charmides'; (6) 'Hippias II.'; (7) 'Laches'; (8) 'Protagoras'; (9) 'Meno'; (10) 'Euthydemus'; (11) 'Gorgias'; (12) 'Republic,' Books I. and II.; or, in the pagination of Stephanus, from 327 to 368 A.

II. *The Metaphysical and Constructive Group*, 387-360: (13) 'Cratylus'; (14) 'Symposium'; (15) 'Phædo'; (16) 'Republic,' Book II., 368 A. to Book V. (inclusive), and Books VIII.-X.; (17) 'Phædrus'; (18) 'Theætetus'; (19) 'Parmenides'; (20) 'Republic,' Books VI.-VII., and reconstruction and unification of the entire work, Books I.-X.; (21) 'Sophist'; (22) 'Politicus'; (23) 'Philebus.'

III. *The Physico-mathematical and Politico-religious Group*, 360-347: (24) 'Timæus'; (25) 'Critias'; (26) 'Laws.'

The following are spurious: 'Alcibiades I. and II.,' 'Hipparchus,' 'Clitophon,' 'Theages,' 'Minos,' 'Epinomis,' 'Axiochus,' 'Letters,' 'Hippias I.,' 'Amatores,' 'Definitiones,' 'Ion,' 'Demodocus,' 'Eryxias,' 'De Justo,' 'De Virtute,' 'Timæus Locrus,' 'Menexenus.'

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**Platoff**, plä'tōf, or **Platow**, Matvei Ivanovitch, COUNT, Russian general and hetman of the Cossacks: b. on banks of Don River, Russia, 17 Aug. 1751; d. Tcherkask, Russia, February 1818. He entered young into the military service, was employed against the Turks in Moldavia, and was made a general of cavalry. When the French invaded Russia in 1812 Platoff was again called into service, and though defeated at Grodno, and obliged to retire into the





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## PLATONIC YEAR—PLATONISM

interior, returned during the retreat of the enemy from Moscow, and with 20 regiments of Cossacks harassed them in their flight, and contributed greatly to the advantages gained over them. In 1813 he defeated Lefebvre at Altenburg and after the defeat of the French at Leipsic entered France, and was at Paris with the Emperor Alexander, whom he accompanied to England. At London he was the object of popular admiration, and a magnificent sabre was presented to him. In 1815 he commanded the Cossacks destined for the second invasion of France, and again made his appearance at Paris. After the restoration of peace he retired to Tcherkask.

**Platon'ic Year**, the name given the period of time which the equinoxes take to finish their revolution, at the end of which the stars and constellations have the same place with regard to the equinoxes that they had at first. Tycho Brahe says that this year or period requires 25,816 common years to complete it; Ricciolus computes it at 25,920; and Cassini at 24,800; at the end of which time some imagined that there would be a total and natural renovation of the whole creation.

**Platonism**, the system of philosophy taught by Plato. The tripartite division of philosophy into Dialectic (Metaphysics), Physics and Ethics is not explicitly made by Plato, although these several disciplines are discussed in the various dialogues and the classification is implicitly made.

*Platonic Metaphysics.*—The fundamental discipline in the Platonic philosophy is the Metaphysics, and the central doctrine in this discipline is the doctrine of ideas. The basic elements of the doctrine are derived from preceding philosophies, although they are here reconstructed with creative genius into a new system. The Platonic ontology is an attempt to mediate between the metaphysical antithesis of Heracliteanism (the philosophy of becoming or "flux," with the denial of all Being) and Eleaticism (the philosophy of static Being, with the assertion that all Becoming is illusory). The mediation was effected by means of the Socratic concept. Socrates did not carry his theory of the concept beyond its ethical implications; Plato in applying it to the resolution of the Eleatic and Heraclitean antimonies constructed a theory of reality. The Socratic concept is a general notion or universal idea in contradistinction to a sensation or perception, which is particular. The former is the content of rational thought or scientific knowledge; the latter is the content of sense experience; the former has universal validity and is stable; the latter is individual and variable. Plato correlated the concept, as the universally valid idea, with Being or the permanent; perception or sensation he correlated with the individual, that is, with the transient or Becoming. The one is the world of thought or ideas; the other is the world of perception or phenomena. The one is the world of reality; the other the world of appearance. The doctrine of ideas is thus made to overthrow the Protagorean doctrine of the relativity of knowledge. General notions or ideas, in Plato's next step, are hypostasized, that is, they are erected into self-existent, transcendent entities, spaceless and timeless. The

Platonic idea is an archetypal form or notional entity, in which all particular things participate, in so far as they bear the name of the archetype as a class name. For example, in so far as the names man, justice, wisdom are applied to Socrates, the individual Socrates participates (*μέθεξις*); in these generic notions, or these ideas of justice, etc., are present (*παρουσία*) in him, or he is patterned (*παράδειγμα*) after them. The archetype is the genus; the individual is a particular subsumed under it. The archetype or generic idea is, therefore, the principle of classification of particulars into groups, which groups exhibit the ideal or essential reality of particulars. Intelligible and sensible realities represent the One and the Many, and these logical relationships are interpreted by Plato ontologically. The relation of the universal to the particular is in certain dialogues described as that of archetype or pattern, in others as participation, indwelling, or communion. Further, these ideas are conceived as efficient causes or energies which give life, growth, and significance to the world of phenomena, and they are furthermore final causes in terms of which the world's processes are regarded as purposive. Looked at ontologically the Platonic idea is the essentially real, absolute Being; looked at epistemologically, it is the absolutely knowable, the object of rational thought; looked at ethically and aesthetically, it is the norm. The supreme idea is the Idea of the Good, whose position and function in the world of ideas is analogous to that of the sun in the world of phenomena. The ethical and teleological character of the Platonic metaphysics is given in the supremacy of this concept, which is identical with God. This supreme idea is the rational conception of the total cosmic good, exhibited completely in the character of the Absolute, and imperfectly expressed in the laws of nature and in the government and conduct of men.

*Platonic Physics.*—Nature is a sphere that undergoes constant transformation. It is not a world of Being (*τὸ ὄν*, "being," connotes fixity and stability), for it does not persist and is not invariable; it is not non-being, for it is the object of sense-experience; it is a world midway between Being and non-Being, that is, a world of Becoming, in constant transit from non-being to being. The idea appears in the phenomenal world veiled in matter and confusedly expressed. Matter is the principle of multiplicity and variability and is one of the vaguest notions in Platonism (as it is in all philosophy). In the "Timæus" (48 B *seq.*) Plato appears to identify it with space,—the receptacle of ideas out of which (or more strictly, into which) the Demiurge fashioned or configured the extended and visible world. The world is not eternal, but is created. Space or matter is eternal, but time comes into being with the world's creation. The efficiency of the ideas in reference to nature is personified in the mythical Demiurge. He is the cosmic energy of the ideal world of reason and goodness, and the created world is therefore reasonable and good. A world-soul is created by the Demiurge, that is, the world is made a living organic whole, self-moving, its motions mathematically determinate, developing in itself and in individuals consciousness, and teleologically imaging the ideal world. The



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goodness of the supreme idea is the ultimate cause of the world.

*Platonic Psychology.*—In the Platonic dualism of ideal and phenomenal, the individual soul occupies a mediate position, that is, it is so constituted as to be related to the ideas on the one hand and to the sensible world on the other. By reason the soul apprehends and is cognate with the first; by sensation it apprehends and is cognate with the second. Reason is the function of the immaterial soul, while sensation is bound up with the material body, in which the soul lives as in a prison. The soul is older than the body and existed prior to its union with the body. The doctrine of preexistence is joined to the doctrine of the immortality of the soul. The three so-called parts or faculties of the soul are reason (*νοῦς*), the spirited element (*θυμοειδές*), and the appetitive element (*ἐπιθυμητικόν*). The seat and organ of the first is the head (the Acropolis of the body, 'Tim.' 79 A); of the second the thorax, particularly the heart; of the third, the organs below the diaphragm. According to the 'Phædrus' these three parts form a unitary soul and are immortal; according to the 'Timæus' they are separable and only the reason is immortal, while the inferior parts perish with the body. The Platonic arguments for the immortality of the soul are (see 'Phædrus,' 'Phædo,' 'Republic'): 1. The soul is a self-moving principle; its motion, consequently its life, is therefore perpetual. 2. The peculiar disease or evil of the soul is vice; if the disease peculiar to a thing does not destroy it, it is indestructible. Vice does not destroy (it corrupts) the soul, therefore it is indestructible. 3. The cyclical argument, namely, the cosmic law of the passage of opposites over into each other, for example, night, day; heat, cold; winter, summer; sleeping, waking; decaying seed, living plant; so death, life. 4. The doctrine of reminiscence shows the learning of mathematical and philosophical truths is only the application of ideas, principles, or axioms already in the mind, and this implies a preexistent state. 5. The soul, as an immaterial entity, is essentially related to the immaterial, invisible ideas, and these are eternal. 6. The idea of life is inseparable from the idea of soul (the Greek word *ψυχή* means "principle of life" as well as "soul"). 7. The soul is indiscerptible. That which is indiscerptible cannot be disintegrated. 8. The superior dignity and worth of the soul argue for its survival of the body. 9. The instinctive aspiration toward and longing for a future life, shows that the doctrine of immortality is founded in the soul's nature. 10. The world as a moral, just world demands a future existence for the rectification of the inequalities in this life.

*Platonic Ethics and Politics.*—Plato founds his theory of virtue on a psychological basis. The parts of the soul are regarded as having distinct and separate functions; the right performance of these several functions produces an organic well-being or moral health. The virtue peculiar to reason is wisdom; to the spirited element, courage; and to the appetitive element, moderation. A fourth cardinal virtue is justice, which is the harmonious condition of the entire soul resulting from the performance of its own function by each "part" and its non-interference with the functions of

other parts. Piety, sometimes enumerated as a fifth virtue, is that aspect of justice which consists in the performance of what is due to the gods. It is the function of reason to furnish true principles of conduct to the individual; of the spirited element, to be courageous, ready and eager in the execution of the principles of reason,—principles which become commands for the lower faculties; and of the appetitive element to desire only that which reason prescribes as moderate. Thus in referring the content of virtue to reason, Plato puts in terms of his psychology the doctrine of Socrates that virtue is knowledge. The Socratic-Platonic conception of virtue is very similar to our "acting on principle." It is the "principle" that gives moral value to conduct, and the reference of morality to knowledge (Socrates) or to reason (Plato) has essentially this meaning. The *Summum Bonum*, as described in the late dialogues, is to become, as far as man can, like God (*ὁμολωσιστῶ θεῷ*), the Absolute Good. The state, in Plato's description, is the individual "writ large." Corresponding with the three elements of the soul he distinguishes three civic classes: the legislators, the warriors, and the tradesmen (including all the lower classes). The state, therefore, is wise, courageous, temperate, and just (in a way analogous to the individual citizen) in that degree in which these several classes perform their functions duly. Plato conceives the aim of the state, as of the individual, to be moral perfection, not power. His ideal government is an intellectual aristocracy, in which only the best endowed and intellectually best trained citizens shall be elevated to the office of legislators. Men scientifically trained, after submitting to a long propædæutic in the actual business of government in its lower branches, shall gradually come to the exercise of the highest civic functions. The preliminary education of this class (which is entirely under state control) is of the utmost importance and is described, both in its spiritual and physical branches, with great detail. Among the most striking features of the ideal state is its communistic character, a communism that extends not only to property, but to wives and children. The communism does not, however, apply to the citizens as a whole, but only to the two upper classes, whose lives are spent in the service of culture and the government. Plato insisted that the highest good of the individual is secured in the highest good of the state, and so the former is apparently merged in the latter. Finally, the Platonic communism is not aimed so much at securing equality of property, as at the exemption of the highest citizens from the distractions of the sense-world and at securing complete devotion to the pursuit of philosophic truth.

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**Platoon'**, a French military term formerly used to designate a body of troops, usually half a company, who fired together. It is still used in the expression *platoon exercise*, which includes the maneuvers connected with the handling and using of the rifle.

**Platt, Charles Adams**, American architect, landscape architect and painter: b. New York 1 Oct. 1861. His art education was acquired in New York and Paris, in which latter city he studied under Boulanger. In 1894 he gained the Webb prize of the Society of American Artists for his painting 'Clouds'; and in 1900 his 'Snow' was awarded a bronze medal at the Paris Exposition. He is the author of 'Italian Gardens' (1892).

**Platt, Orville Hitchcock**, American legislator: b. Washington, Conn., 19 July 1827; d. there, 21 April 1905. He studied law, was admitted to the bar in 1849 and established a law practice at Meriden, Conn. In 1857 he was a clerk in the State senate, served as a member of the body in 1861-2, was elected to the Connecticut house of representatives in 1864 and 1869, serving as speaker during the last year, and from 1879 until his death was a member of the United States Senate. As member of the Committee on Relations with Cuba he introduced the amendment which placed Cuba under the military protection of the United States.

**Platt, Thomas Collier**, American politician: b. Owego, Tioga County, 15 July 1833. He entered Yale in 1849, but ill health obliged him to give up his college course at the close of his second year. He then entered business as a merchant in Owego, and became president of the Tioga National Bank when it was organized in 1865. He also had large lumber interests in Michigan. He later (1879) became secretary and manager of the United States Express Company, and in 1880 its president. His first political position was that of clerk of Tioga County, 1859-61, and here he supported the political interests of Roscoe Conkling; gradually gaining control of the Republican organization of the district, he was elected to Congress in 1872 and 1874. In January 1881 he was elected to the United States Senate, and in May of that year resigned with his colleague, Roscoe Conkling, because of President Garfield's disregard of "senatorial courtesy" in appointing the collector of the port of New York without consulting them. They both sought re-election by the New York legislature, but Platt withdrew from the contest before it was decided. He had in 1880 been appointed a member of the board of quarantine commissioners of New York city, and from 1884 to 1888 was president of the board. He took no openly active part in politics until 1884, when he was delegate to the National Convention. From that time, however,

he slowly and unobtrusively gained control of the Republican party of New York State, until he became its acknowledged leader. In 1896 he was elected United States Senator, and re-elected in 1902 for a term of six years. He has attended every Republican National Convention from 1874 to 1900; in 1896 was influential in obtaining an unqualified declaration for the gold standard; and in 1900 gained the nomination of Roosevelt for Vice-President. His power in his own State is due largely to his knowledge of every detail of the political situation, and to his skill in dealing with men personally. James G. Blaine said of him "He has strong common sense and a quick judgment of men."

**Plattdeutsch**, plät'doich, **Niederdeutsch**, or **Low-German**, the language of the lowlands of northern Germany, spoken from the borders of Holland to those of Russian Poland; its southern limit follows a line drawn from Aachen through Bonn, Cassel, Quedlinburg, Dessau, Wittenberg, Meseritz, and Thorn; its northern boundary reaches the Danish frontier. It belongs to the same linguistic group as the Dutch, the Flemish and the Friesian, and it is nearer to English than is the High-German. Low-German, before the time of the Reformation, was the language of literature as well as of common life within the geographical limits mentioned; the Bible was translated into Plattdeutsch before any version into High-German was made; but Luther's Bible having been composed in High-German and circulated as no book ever before — one bookseller in Wittenberg sold in 40 years 100,000 copies, and before 1559 it was reprinted in 38 editions — the High-German dialect was recognized thenceforth as the superior literary medium. The Plattdeutsch accordingly went into decline, the issues from the press in that dialect growing gradually fewer till, in the end of the 17th century, its literary use had practically ceased. But in recent times there has been a revival of Plattdeutsch literature, and the several Low-German dialects have received a good deal of attention from linguistic scholars. The oldest extant literary monument of the Low-German language is the *Heliand* (healer or savior), a history of the life of Christ composed in alliterative verse; it was written about the year 830 by a Saxon cleric or monk.

**Platte**, plät, a river which rises in the Rocky Mountains, formed by the junction of two streams called the North and South Forks of the Platte. The North Platte is formed by the union of several streams in the North Park, Colorado, and the South Platte takes its rise in the South Park. They flow east, and unite in Lincoln County, Neb., about 400 miles from their source, while the united stream, also flowing mostly east, crosses Nebraska, and enters the Missouri on the border of Iowa, 15 miles below Omaha, after a course of about 1,600 miles. The principal affluents are the Elkhorn and the Loup Fork. The river is from one to three miles broad, but is so shallow that it is not navigable. The South Platte in its upper course is extensively used for irrigation and as a source of water-power.

**Platte Country, The**, in American history, a name applied prior to 1854, given to the territory stretching west from Missouri to the Rocky Mountains, and which now comprises the States



## PLATTENSEE — PLATTSMOUTH

of Kansas and Nebraska. A bill was introduced into Congress in 1854 by Douglas, of Illinois, for the organization of the territory, the slavery question to be determined by the inhabitants, in direct violation of the Missouri Compromise.

**Plattensee**, plät'těn-zā. See BALATON.

**Platter, Thomas**, Swiss scholar and humanist educator: b. Grenchen, a hamlet in the mountains of Valais, near Visp, in 1499; d. Bâle 1582. In the early days of his boyhood he was a goat-herder in the mountains surrounding his home, but later his mother sent him to the local priest to obtain enough learning to enter the priesthood. He soon, however, outgrew the narrow limits of the education obtainable from this source, and became a wandering scholar. He, in company with a cousin, wandered throughout Germany, leading the wretched life of bacchants, but this life became distasteful to him, and, after having trouble with his companion, separated from him, and entered the school at Schlestadt under Jean Sapidus to study Latin. Some time later he went to Zürich to study under Myconius, and while there learned the trade of rope-making, which enabled him to continue his studies of Greek and Hebrew. In 1541 he became professor of Greek in the gymnasium at Bâle, and continued in that capacity until 1578. Platter's most important work was his autobiography, written at the request of his son Felix (1536-1614). The document is important in that it gives an interesting history of education in the 16th century, and shows the life of the students and scholars of that time, besides telling of his own travels. The biography was published in the original in 1840, and later the biographies of the father and son were edited together by Heman (Gütersloh 1882).

**Platteville**, plät'vīl, Wis., city in Grant County; on the Chicago & N. and the Chicago, Milwaukee & St. P. R.R.'s; about 130 miles in direct line west by south of Milwaukee. It was settled in 1827. It is in a fertile agricultural region; and in the vicinity are lead mines. The chief manufacturing establishments are a brewery, creamery, wagon factory, cigar factory, and machine shop. It is the seat of a State normal school. The city owns and operates the waterworks. Pop. (1890) 2,740; (1900) 3,340.

**Plattner, Karl Friedrich**, German chemist and metallurgist: b. Kleinwaltersdorf, near Freiberg, Saxony, 2 Jan. 1800; d. Freiberg 22 Jan. 1858. Very little is known of his early life until 1842, when he became professor of metallurgy at Freiberg, a post he held there until 1857. During this time he experimented with marked success, but he became noted mostly through his application of the blow-pipe to the quantitative assay of metals. He published 'Probirkunst mit dem Löthrohr' (1835); etc.

**Plattsburg**, pläts'bèrg, N. Y., village, port of entry, county-seat of Clinton County; on Lake Champlain, at the mouth of the Saranac River, and on the Delaware & H. and the Chateaugay R.R.'s. It has steamer connection with Burlington, Vt., and all the lake ports. It is about 160 miles north of Albany. It was settled in 1784 by a colony from Long Island and Poughkeepsie in charge of Zephaniah Platt, in whose honor the place was named. It was in-

corporated as a town the next year. It was the scene or near the scene of some of the important engagements of the Revolutionary War and the War of 1812. The first naval battle between American and British forces took place 11 Oct. 1776, off Valcour Island, a short distance from Plattsburg. Benedict Arnold was in command of the American forces and Sir Guy Carleton of the British. This battle was won by the British. Plattsburg was headquarters for the American forces on the northeastern frontier, in the War of 1812. On 11 Sept. 1814 another engagement took place on Cumberland Bay, an inlet of Lake Champlain (q.v.), while at the same time the British made a land attack. Commodore McDonough (q.v.), commander of the American forces, won the naval victory, and Gen. Macomb was equally successful in defeating the British forces on land. The steady growth of the village was checked by fire on two occasions, in 1849 and 1867, when many of the business houses were destroyed.

Adjoining the village on the south is a U. S. military reservation of 679 acres. In 1838 a U. S. military post was established here, and barracks erected sufficient to accommodate a regiment of infantry. South of the "Plattsburg Barracks" and on Lake Champlain is Cliff Haven, the home of the Catholic Summer School of America (q.v.). Plattsburg and the region around are favorite summer resorts. The lake on the east and the Adirondacks on the west furnish a variety of beautiful scenery and greatly modify the temperature during the summer months. It is the commercial and industrial centre for nearly all of Clinton County. The chief manufacturing establishments are lumber mills, sewing-machine works, foundries, machine shops, flour mills, woolen goods factory, and wood pulp mills. It has the Vilas Home for Aged Women, a government building, court-house, several fine church and school buildings. It is the seat of the Plattsburg State Normal and Training School and of D'Youville Academy. It has a high school, public elementary schools, a village public library and four other libraries. Pop. village (1890) 7,010; (1900) 8,434; town (1890) 9,500; (1900) 11,612.

**Platts'mouth**, Neb., city, county-seat of Cass County; on the Missouri River, at the mouth of the Platte River, and on the Chicago, B. & Q. and the Missouri P. R.R.'s; about 50 miles northeast of Lincoln, the capital of the State. It is in a productive agricultural section, and has considerable manufacturing interests. The chief industrial establishments are the C. B. & Q. railroad shops, clay product works, cigar factories, and machine shops. The export trade is chiefly in grain, vegetables, and live-stock. The public school system is excellent, consisting of a high school which cost \$25,000, supplemented by 8 graded public schools; there are 11 church edifices; a court-house erected at a cost of \$80,000; and a large opera-house. There are three banks—one national and two state—with a combined capital of \$150,000. The city is lighted by gas and electric light; has improved waterworks and a sewerage system. There are three daily and three weekly papers published. The government is vested in a mayor, who holds office two years, and a council. Pop. (1900) 4,964.



## PLATYHELMINTHES — PLAUTUS

**Platyhelminthes**, plăt''î-hěl-mîn'thēz, a phylum of the *Metazoa*, commonly known as the flatworms, characterized by a bilaterally symmetrical body, somewhat flattened dorsoventrally and usually elongated. The mass of the body is made up of parenchymatous tissue and a true body-cavity is wanting; the excretory system is of the protonephridial type, and the highly complicated reproductive organs, which with rare exceptions are hermaphroditic, produce so-called compound eggs. The branch includes three generally recognized classes, namely, *Trematoda*, or flukes; *Cestoda*, or tapeworms, and *Turbellaria*, or free-living flatworms; while many authors list here also the *Temnocephala*, *Nemertinea*, *Rhombosoa*, and *Orthonectida*, some ranking them as classes and others as appendices of different grade.

Although these classes manifest noteworthy differences at first sight, yet the points of agreement are so fundamental as to constitute this a well-defined phylum. In the ciliated epidermis the *Turbellaria* stand near the original ancestral form, which no doubt possessed also a dermal musculature that gradually parted with its primitive connections and came to be arranged for the most part in layers. The simplicity of development in the muscular system is evidenced clearly by the absence of skeletal structures and the uniform unspecialized type of the muscular layers. While more or less closely related to the *Cœlenterata*, yet the rich development of the mesodermal tissue as a solid parenchyma in which various reproductive and excretory organs have been differentiated, gives the body a size and solidity which apparently ally it more closely to higher types. The complete absence of a body cavity is a noteworthy feature, as also is the excretory system, which consists of stellate, so-called, "flame-cells" terminating minute capillary tubes that empty singly or in groups, by connection with long lateral canals and at times also with an excretory reservoir. An alimentary canal is present in all save the highly degenerate *Cestoda*, where the last vestige of such an organ has disappeared in the extreme adaptation to the parasitic habit. It is important to note that the canal, whether a simple sac or compound and highly dendritic in the extreme case, has yet but a single opening which serves at once for the ingestion of food-material and the egestion of waste. The mouth occurs regularly on the ventral surface, primarily between the centre and anterior end. The nervous system has achieved a great advance over conditions prevalent in *Cœlenterata* in that there have been formed important nerve centres in the anterior region, while from these longitudinal trunks traverse the body and are connected by generous anastomoses. One can distinguish ventral, lateral, and dorsal pairs of nerves passing posteriorly, as well as others shorter and extending toward the anterior tip. Sense-organs are poorly developed, although optical, auditory, and tactile structures are present in some forms.

The reproductive system is hermaphroditic and the rare exceptions represent clearly a derived condition. The universal complexity of the organs is noteworthy and most marked in the female system. Here one finds the rare occurrence of separate germ and yolk glands. Self-fertilization, although unusual and often guarded against, does occur in some cases and

is an evident response to the isolation of parasitic existence.

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**Platypus**, a genus of monotremes, called *ornithoryncus*, peculiar to New Holland, seemingly a link between the aquatic bird and the mammalia. It is about 12 inches in length, covered with a thick, soft fur, dark brown above, and whitish beneath. The muzzle is elongated, enlarged, flattened; the teeth are situated in the back part of the mouth, two on each side; the feet are webbed, and the hind legs are armed with spurs which secrete a poisonous fluid; the tail is flat and obtuse; there is no external ear and the eyes are very small. The echidna or spinous ant-eater is a genus resembling the platypus, but not amphibious. See DUCKBILL.

**Plautus**, the third of the Roman dramatists in chronological order and the first in literary and linguistic importance. His full name was Titus Maccius Plautus; it was formerly supposed to be M. Accius Plautus and is so given in editions before 1850. He was born in Sarsina, a small Umbrian town, about 254 B.C., probably of free parents, but in humble station. Of the events of his life only three are known definitely: the 'Stichus' was written by him for the plebeian games in 200 B.C.; the 'Pseudolus' was given at the dedication of the temple of the Magna Mater in 191; he died in 184. There is a brief notice of his literary activity in Gellius, iii. 3, 14, in which it is stated that after coming to Rome he was engaged in some work connected with the stage, that he used the money thus earned in trading by sea, and having lost it, he returned to Rome in such straits that he was obliged to support himself by grinding at a mill; that while so occupied he wrote three plays and began his career as a dramatist. This account is said to be taken from Varro, but it contains some evident inconsistencies, and it is not improbable that it is a grammarian's construction, based upon supposed personal references in the plays and put together after the analogy of the literary Lives written by Greek grammarians. The uncertainties which attend the attempt to reconstruct the earlier Roman history are especially great in matters of literary history, which were not of sufficient importance to be officially recorded.

Of the writings of Plautus, 20 plays have come down to us, with considerable fragments of a 21st. But it is probable that these constitute only a part of his work. During the century of dramatic activity in Rome (c. 250–150 B.C.), there was no established theatre in the city, nor were there frequent presentations of plays. Dramas were written for performance at certain regular games, twice or three times in a year, and at occasional funeral games. Having been accepted and presented on a single occasion, the plays passed out of the hands of the poet and remained in the possession of the actors. When the century of dramatic production came to an end with the death of Terence (159 B.C.), the plays of the older writers were again put upon the stage, often with some modifications, especially in the prologues, and not infrequently plays by inferior writers were brought out under the name of a more famous poet. The genuine plays of Plautus thus became confused with



## PLAY

others which passed under his name, so that later traditions varied, some assigning to him as many as 130 plays, others as few as 21. There was during his lifetime no reading public, but in the half-century after 150 the plays came into circulation for reading, and efforts were made by critics to distinguish the genuine from the spurious. This culminated in the fixing by Varro of a canon of 21 plays, which were regarded by all critics as Plautine, and which are beyond reasonable doubt the plays that we now possess. The last play, the 'Vidularia,' was lost with the last leaves of a MS., and has been preserved only in fragments. The text also, thus transmitted through the actors' copies and revised and modernized by the grammarians, contains many interpolations and is more corrupt than the text of any other Latin writer. Of the 20 plays, the best known are 'The Captivi,' 'Trinummus,' 'Menaechmi,' and 'Aulularia,' partly because they are most suitable for class-room reading; the 'Bacchides,' 'Pseudolus,' 'Rudens,' and 'Miles Gloriosus' are superior to them in style and humor. About half of the plays are corrupt in text, or fragmentary or of inferior merit.

The comedies of Plautus are based upon Greek plays of the New Comedy (c. 321-250 B.C.), and in a few cases Greek poets—Menander, Philemon, Diphilus—are named. His plays therefore illustrate that fusion of Greek form with Roman spirit which is generally characteristic of Latin literature. The plots, with their fundamental element of trickery, are wholly Greek, as are the characters and situations, at least in outline, and the subject-matter of the plays is the social and family life of a Greek city. The actors wore Greek dress and bore Greek names, and it is not unlikely that the stage traditions were brought from the Greek cities of southern Italy. The form of the dramas was Greek, though modified in one important respect by the introduction of a large element of music and dancing, by reason of which the plays bore a closer resemblance to a comic opera without a chorus than to a spoken drama. But Plautus was himself a man of Italian temperament, sharing fully in the rebound of animal spirits which followed the self-denying and anxious years of struggle with Hannibal; he was a shrewd observer of life in its humorous aspects, and a master of the art of revealing character through dialogue. By virtue of these qualities, and in spite of the restrictions imposed by a form foreign to him and to his audience, he was able to make the Greek plots and characters the vehicle for the expression of a genuine and original humor, to fill in the Greek outlines with the rich Italian coloring. In some plays, for example, in the 'Captivi,' the fusion is not complete and a certain degree of incongruity may be detected; in others, as in the 'Bacchides,' the hearty and almost riotous humor blends the two elements into a harmonious whole. That he truly expressed the spirit of his race is evident from his popularity during his lifetime, and from the long-continued presentation of his plays upon the Roman stage. His comedy has not been without influence also upon modern literature; Molière founded his 'L'Avare' upon the 'Aulularia,' and Shakespeare's 'Comedy of Errors' is an adaptation of the 'Menaechmi.'

The Latin employed in the plays is the col-

loquial speech of a period prior to the formation of a distinct literary style, and, as the best surviving illustration of the unregulated spoken Latin, it offers to modern philologists rich material for the study of the processes of linguistic growth and change. All work in Latin lexicography, syntax, and style must begin with the usage of Plautus. His writings are of considerable importance also to Romance philologists, since many words and usages which do not occur in classical Latin may be traced back from the Romance languages to the early colloquial Latin.

*Bibliography.*—The best complete edition is the Teubner text by Goetz and Schoell, a condensation of the great critical edition begun by Ritschl in 1848 and completed by his three pupils, Goetz, Schoell, and Loewe, in 1894. There are good commentaries on single plays by Brix and Lorenz, and in English by Tyrrell and Sonnenschein. In Sellar's 'Roman Poets of the Republic' may be found an excellent essay upon the literary qualities of Plautus. No complete English translation has appeared since Thornton's (2d ed., 5 vols., 1769).

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**Play.** Various phenomena connected with the play of man and of animals have recently attracted the attention of both biologists and psychologists. These two lines of inquiry may be summed up in the two questions: (1) What is the function of play in the life of the organism? and (2) what are the essential psychological characteristics of play as distinguished from those of ordinary mental life?

In answer to the first question, three theories have been advanced, each of which seems to contain an element of truth. (1) There is the "surplus-energy" theory of Spencer, according to which play is the natural outlet of the surplus energy that has accumulated in a vigorous organism. (2) The "practice" theory worked out most fully by Groos, according to which play has a positive function in the life of the animal as affording practice and preparation for the serious activities of life. (3) The "recuperative" theory that regards the play-activities as fulfilling their proper function in affording an opportunity for rest or recuperation on the part of the other activities.

From the psychological side it has sometimes been held that "shamming" or semblance (often resulting in real self-illusion) is an essential of all play; but this mark does not seem to be present in all cases. The real differentia of play is perhaps found in the fact that the end of play is always the pleasure of the activity itself, while work has always some end beyond the activity. Consult: Spencer, 'Principles of Psychology'; Groos, 'The Play of Man,' and 'The Play of Animals.' J. E. CREIGHTON,

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**Play Censorship.** A censor of plays, especially in Europe, is a person whose permission is necessary for the production of stage performances. A relic of the censorship of the press survives in Great Britain in the licensing of plays. By an Act of 1843, no plays may be acted for hire till they have been submitted to the Lord Chamberlain, who may refuse to license them in whole or in parts; the official who reads



## PLAY OF COLORS—PLEASONTON

them for this purpose being the "examiner of stage plays." A penalty of \$150 attaches to the offense of acting an unlicensed or prohibited play; and the theatre in which it is represented forfeits its license. In the United States there is no general censor, but local authorities have power to forbid the representation of plays which they consider to be injurious to morality.

**Play of Colors**, in mineralogy, is the rapid display of different colors on revolving a mineral. It is this property which adds so much to the beauty of the diamond (q.v.) and other gems. The play of colors in many gems is due to their high refractive and dispersive power. The magnificent play of colors of the precious opal was attributed by Brewster to microscopic cavities, but Behrends has proved that it is due to thin, curved lamellæ of the mineral, the refractive power of which may vary by 0.1 from that of the mass. These lamellæ are assumed to have been originally in parallel position, but they were bent and broken in the solidification of the mineral.

**Pla'ya**, mud deposits left by the drying up of temporary lakes in arid regions. They present a hard, barren surface, which shrinks and cracks under the sun's heat and in some instances becomes coated with efflorescent salts, resembling drifting snow. The Great Basin in the United States contains playa deposits of hundreds of feet in thickness. They are laid down by the desiccation during the dry season of large shallow lakes, known as sinks, holding in suspension a fine yellow silt, which form in the wet season and have no outlet. The deposits increase in depth by being thus intermittently covered by the silt-bearing water. Locally they are known by various names, such as mud-flats, salt-flats, alkali-flats, etc. The Black Rock Desert in Utah is an example.

**Play'fair**, plūf'fer, **John**, Scottish physicist: b. Benvie, Forfarshire, Scotland, 10 March 1748; d. Edinburgh, 19 July 1819. He was graduated from the University of Saint Andrews in 1765, entered the ministry in 1770 and held various livings, in the meantime devoting much time to mathematics; in 1785 he was appointed assistant professor of mathematics at the University of Edinburgh, and in 1805 accepted the chair of natural philosophy there. He was secretary of the physical class in the Edinburgh Royal Society in 1789, subsequently general secretary, and in 1807 was elected a member of the Royal Society. In 1815-16 he made a tour of France, Italy, and Switzerland engaged in geological and mineralogical researches. He was a frequent contributor to the Edinburgh 'Review,' and his articles which are of great scientific value are collected in the 4th volume of the complete edition of his works edited by James G. Playfair (1822). He edited Euclid's 'Elements' (1795), and besides memoirs for the 'Transactions' of the Royal Society of Edinburgh, wrote: 'Outlines of Natural Philosophy' (2 vols. 1812-16); 'Illustrations of the Huttonian Theory of the Earth'; etc.

**Playfair, Lyon**, **BARON**, English scientist and politician: b. Chanar, India, 21 May 1818; d. London 29 May 1898. Educated at Saint Andrews, he also studied chemistry in Glasgow, and began, but did not complete, the medical course at Edinburgh. After a brief period as a clerk in Calcutta he became laboratory assistant

to Graham in University College, London, and in 1840 was graduated at Giessen, where he studied chemistry under Liebig. In 1843 he became professor of chemistry in the Royal Institution at Manchester, and in 1858 professor of chemistry at Edinburgh, a post which he held till 1869. His political career began in 1868 with his election to the House of Commons as member of the Universities of Edinburgh and Saint Andrews, which he represented till 1885, when he was elected for South Leeds. He became postmaster-general under Gladstone in 1873, and in 1880-3 was chairman and deputy-speaker of the House. In 1892 he was raised to the peerage as Baron Playfair of Saint Andrews. He published 'Science in its Relation to Labor' (1853); 'Primary and Technical Education' (1870); 'Science in Relation to the Public Weal'; and other works.

**Playfair, William Smoult**, English physician: b. 1836; d. Saint Andrews, Scotland, 13 Aug. 1903. He was educated at Saint Andrews and Edinburgh, was assistant-surgeon in the Bengal army in 1857 and professor of surgery at the Medical College, Calcutta, in 1859-60. He published: 'A Treatise on the Science and Practice of Midwifery'; 'Handbook of Obstetric Operations'; 'A System of Gynecology' with Clifford Allbutt; etc.

**Playing Cards.** See CARDS.

**Plea and Pleading.** A plea is a special answer to a bill of equity, making a charge or demand, and requests a judgment of the court in the first instance on the ground that the plaintiff is debarred from an answer required by the bill,—such, for example, as a plea to the jurisdiction of the court.

Pleading is a logical legal statement of facts constituting the plaintiff's cause of action, or the grounds of a defense. It is the formal manner of alleging, as far as may be sufficient, that which either party to a suit expects to prove. The object of pleading is to make the matter in dispute between the parties plain and intelligible.

**Pleiades**, in astronomy, a collection of stars visible in the evenings of autumn and winter, familiarly known as the "seven stars." Only six can be seen by an ordinary eye. They form a collection by themselves, having a common proper motion in the sky. The brightest, Alcyone, of the third magnitude, was supposed by Mädler to be the central star of the universe; but this notion is now considered groundless.

**Pleasanton**, plēz'ōn-tōn, **Alfred**, American military officer: b. Washington, D. C., 7 June 1824; d. there 17 Feb. 1897. He was graduated from West Point in 1844; served on the frontier and in the Mexican War; in 1862 was commissioned major of the 2d Cavalry, served in the Peninsular campaign, was promoted brigadier-general of volunteers and in the Maryland campaign commanded a division of cavalry. At Chancellorsville he performed important service by staying the farther advance of the Confederates. In 1863 he was promoted major-general of volunteers and placed in command of the cavalry corps of the Army of the Potomac, with which he led at Gettysburg, where for gallantry in action he was brevetted colonel in the regular army. Transferred to the West in 1864, he defeated General Price at Marais des-Cygnés and



## PLEBEIANS — PLEISTOCENE EPOCH

forced the retreat of the Confederate forces from Missouri. He retired from the volunteer service in 1866 and until 1871 was internal revenue collector and commissioner. During his military career he participated in 105 battles and at one time was tendered the command of the Army of the Potomac. In 1871 he became president of the Terre Haute & Cincinnati railroad and in 1888 was placed on the retired list of the United States army.

**Plebeians**, ple-bē'anz (*Plebs*), an order of the Roman people, corresponding to the English Commons. The time at which the Plebeians were recognized as a distinct order in the state is not known; they were at first excluded from almost every right of citizenship. They differed from the *Cientes* in not being obliged to choose a patron, were allowed to hold land, but had no share in the *ager publicus*; they were obliged to serve in the army, but were excluded from all political privileges. The government of the state belonged exclusively to the Patricians, with whom the Plebeians could not intermarry. This was their condition under the kings. The subsequent domestic history of Rome is merely a record of struggles of the Plebeians to assert their claim to the place in the commonwealth. When Tullus Hostilius conquered Alba, he admitted the chief of its citizens to the Patrician class, while the rest were enrolled as Plebeians. The same course was followed in other conquests, so that the number of the Plebeians was constantly swelling, while they were of the same blood, and possessed of the same courage, determination, and other moral qualities as the dominant class.

The Plebeians, like the Patricians, were divided into *gentes*, but they were excluded from the three Patrician tribes, and from the *curiæ*, which formed the governing class. Tarquinius Priscus seems to have made an attempt to introduce the Plebeians to the privileges of citizenship, but was not successful. Servius Tullius organized the Plebeians in tribes, of which he constituted four for the city and 26 for the surrounding subject territories. Each tribe had a tribune. They had their own social and religious privileges, and were allowed to meet in *comitia tributa* convoked by the tribunes. A semblance of political power was at the same time conferred on them by Servius Tullius. He divided the whole body of citizens into five classes according to the amount of their property, upon which division was founded the *comitia centuriata* or great national assembly, to which the greater part of the legislative and judicial power of the *comitia curiata* was transferred. The citizens, in this assembly, voted by centuries, but as the equestrian order and the first class of citizens had the majority of the whole number of centuries, and voted first, it was only in the case of differences among them that it was necessary to consult the lower classes. Some of the noble Plebeian families were also admitted into the equestrian order. To follow the entire course of concessions which followed this beginning would demand an examination of the most complicated details of Roman history. The establishment of tribunes (494 B.C.), the law of the 12 tables (451-450 B.C.), the Lex Canuleia (445 B.C.), which permitted intermarriage; the admission to the consulate (366 B.C.), with the successive admission in 351 B.C. to the censorship, 336 B.C. to the prætorship, and 300 B.C. to

the offices of pontifex and augur, were the leading steps in a succession of victories which culminated (286 B.C.) in the Lex Hortensia, which gave the plebiscita of the people the force of law. From this time the privileges of the two classes may be said to have been equal; the word *populus* now began to be used to designate the whole people, and *plebs* was employed sometimes to designate the assembly of the *comitia centuriata*, or popularly to distinguish the general mass of the common people.

**Pleb'iscite**, a form of voting introduced into France under the Napoleonic régime, and named after the Roman *plebiscita*.

**Plectog'nathi**, a group of teleostean fishes, having the body invested in a box-like arrangement of plates covered with a tough integument. The filefishes, trunkfishes, globe-fishes and the like are examples. See FISH; ICHTHYOLOGY.

**Plectospon'dyli**, an order of soft-rayed fishes represented by the suckers (*Catastomidae*), carps, etc. See ICHTHYOLOGY.

**Plec'trum**, a small instrument made of ivory, horn, quill, or metal, with which (having it in his right hand) the player on a lyra or cithara sets the strings in vibration. Plectra are used by performers on the mandolin and zither.

**Pledge**, or **Pawn**, a species of bailment, being the deposit or placing of goods as security for the payment of money borrowed, or the fulfilment of an obligation or promise. It is distinguished, in English law, from a mortgage of chattels by the circumstance that the legal property in the chattel mortgaged is in the mortgagee, whereas the legal ownership of goods pawned remains in the pawner, though according to the definition of a pawn and pledge the pawnee not only has the right of possession, but must be in possession. If the money is not paid at the time stipulated the pawn may be sold by the pawnee, who may retain enough of the proceeds to pay the debt intended to be secured. See PAWNBROKERS.

**Pleiades**, plī'a-dēz, the daughters of Atlas by Pleione, daughter of Oceanus. According to one version of their story they committed suicide out of grief for the death of their sisters, the Hyades; but another version makes the fate of their father (see ATLAS) the impelling cause. According to a third version, they were companions of Artemis, and being pursued by Orion (q.v.), were saved from him by the gods and translated to the sky. The versions agree in declaring that the Pleiades were transformed into stars, where they are all visible save one, Sterope, who hides herself for shame that she alone of the seven married a mortal; her sisters are Electra, Maia, Taygete, Alcyone, Celæno and Merope.

**Pleistocene** (plīs'tō-sēn) **Epoch**, or **Quaternary Period**, in geology, includes the time that elapsed between the close of the Tertiary and the dawn of the historical or recent period. Measured in years, it is the shortest of the epochs, but geologically it is one of the most interesting. It includes the great Ice Age during which glaciers advanced and retreated across vast areas in North America and northwestern Europe. It is also the epoch, during which, so far as can be determined by the available evi-



## PLEOCHROISM — PLETHO

dence, man first appeared on the earth. For these two reasons it has been the more discussed. Being so recent it left much evidence of changes of land and water areas of climate that has not been wiped out; but the very abundance of the evidence increases the task of deciphering and summarizing it, since for remote epochs only the great changes are known through the evidence of the rocks.

It is fairly certain that at the close of the Tertiary great areas in northern North America and Europe were more elevated than now. North America and Asia were perhaps united across Bering Strait; similarly the British Islands were part of a European continent that stretched out from Norway toward Iceland and north of Russia and Siberia over areas now covered by the Arctic Ocean. Regarding the equatorial land areas less is known, but possibly North and South America were united and it is possible that the Desert of Sahara was in part at least covered by an arm of the ocean. Of the distribution of land and water in the Antarctic regions the evidence found is not conclusive, though it is probable that the Antarctic continent was of greater extent than now, with a land bridge from Australia to South America. How much higher the land areas toward the north in Europe and North America were is uncertain, but it is probable that the regions about Hudson Bay and northern Sweden and Norway were at the least several thousand feet higher. The climate of these areas at the time was generally drier and cooler than it had been during the late Tertiary. During the early Pleistocene river valleys were deeply carved and the topography was strongly accentuated. Gradually the climate in the northern hemisphere became colder, and possibly moister. What produced this change is one of the most baffling problems in geology. In the course of years perennial snow stood on the higher ground and gradually accumulating formed vast ice sheets or glaciers which slowly advanced from these higher regions over the regions southward, and in the case of such mountains as the Alps, to northward. Thus began the great Ice Age which lasted thousands of years. The ice sheets advanced, retreated and advanced again. Some of the retreats must have been of long duration. In fact the evidence from rock decay and the formation of soils leads some geologists to believe that the time that has elapsed since the final retreat and disappearance of the great continental glaciers is not as long as that of some of the interglacial intervals. The probable number and succession of the glacial advances and retreats and the work done by the ice in modifying the topography of the glaciated regions are discussed elsewhere (see GLACIAL PERIOD). At the end of the Ice Age the regions in the North that had been the centre of glaciation were much lower than at its beginning and the climate was moister. A subsequent elevation and a drier climate make the conditions governing life what they are to-day. Outside the glaciated areas the changes of level and climate have left less trace.

The advances and retreats of the ice necessarily meant great changes in climate. During the advances Arctic types of plants and animals were forced southward, during the retreats other types migrated northward, the Arctic types retreating or finding refuge on mountain ranges. One result of these migrations was the extinc-

tion of types that could not migrate readily and in particular of the great mammals. Man when he appeared waged war upon the large land animals that had withstood climatic changes. Thus it is that with the dawn of the historical period the fauna of Europe and America was impoverished as compared with periods immediately preceding, and the huge pachyderms, which, through Tertiary time, had been so striking a feature of the animal population of what are now the temperate regions of the world, disappeared, leaving only their gigantic remains to tell modern man the kind of monsters that have been the contemporaries of his prehistoric progenitors.

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**Pleochroism.** See PHYSICAL CRYSTALLOGRAPHY.

**Ple'siosau'rus**, a genus of extinct reptiles of the order *Sauropterygia*. Several species have been described from very complete remains in European Lias rocks, first discovered in 1822 and studied by Cuvier and his followers. In these reptiles the head is small, the neck very long, the tail of moderate length. The typical species are *P. dolichodirus*, *P. macrocephalus*, and *P. conybeari*; the first was about 10 feet long; the others considerably larger. It may reasonably be inferred that these reptiles were aquatic and inhabited the estuaries of rivers and shallow waters, occasionally swimming out to sea. Their gait on land would necessarily be awkward and difficult. The elongated neck would serve to enable them to descry their prey from among or over the tops of the reeds and vegetation amid which they might lie concealed in the banks of rivers or in estuaries, while this same length of neck would adapt them for readily seizing their prey, which consisted probably in greater part of fishes. Consult for particulars of structure Woodward, 'Vertebrate Paleontology' (1898).

**Plessis**, plě-sē, **Joseph Octave**, Canadian Roman Catholic bishop: b. near Montreal, P. Q., 1763; d. Quebec, Canada, 4 Dec. 1825. He was educated at the Petit Séminaire, Quebec, taught belles-lettres and rhetoric at the College of Montreal, was ordained in the priesthood in 1786, and soon afterward became secretary to Bishop Hubert. In 1792 he was appointed curé of Quebec, and later became coadjutor to Bishop Denault, despite the opposition of the governor of the province, who feared the influence of Plessis with the French Canadians, and in 1806 succeeded Bishop Denault in the see of Quebec. An effort made to introduce an exclusively Protestant system of instruction, and an attempt to prevent his taking the oath of allegiance as bishop resulted in the recall of Gov. Craig. Sir George Provost was appointed in his stead, and the demands of the bishop were conceded. During the War of 1812 the bishop loyally supported the English, and thereby gained the favor of the government, he was then recognized in his office of bishop, granted a seat in the legislative council, and was pensioned. In 1818 he was nominated archbishop of Quebec. Consult 'Life' by Ferland (1864).

**Pleth'o**, surname of Georgios Gemistos, Byzantine scholar and philosopher of the 14th



## PLETHORA — PLEURISY

and 15th centuries: b. Constantinople. For many years he was the head of a philosophical school at Misithra in the Peloponnesus. He went with the Emperor John VIII. Palæologus, to the council at Ferrara, and remained until 1441 in Italy, where he gave great impetus to Greek studies, and was the means of establishing the Platonic Academy of Cosmo de' Medici. His treatise in praise of Platonism inaugurated the long quarrel between the disciples of the two great masters of antiquity, which produced a profound study of their systems. Pletho, however, mingled with the Platonic philosophy the notions of the later Alexandrian school and of the spurious writings attributed to Zoroaster and Hermes. Consult: Schultze, 'Pletho, und seine Bestrebungen' (1874).

**Pleth'ora**, or **Hyperæmia**, a condition of overfulness of the blood-vascular system, a condition in which there is obvious excess of blood in the body. It can hardly be called a disease. That is to say, the quantity of blood may be in excess of the normal, but its quality may be unaltered. On the other hand, there is a condition of plethora, called by pathologists hydræmic plethora, in which there is not only excess in the total volume of blood, but the excess is due to retention of water, so that the blood is more watery than usual. But the term plethora as ordinarily used signifies simply excess of blood.

Amputation is a frequent cause of plethora, as the digestive powers do not immediately accommodate themselves to the reduced wants of the system, and too much food is liable to be taken and too much blood formed. Plethora has two leading causes—the introduction into the vascular system of too much nutriment, and the deficient activity of tissue-change in the various organs, whereby the nutritive matter is insufficiently removed from the blood. A tendency to plethora thus generally develops at an advanced age, when the activity of tissue-processes has been considerably diminished. Plethora is often confounded with obesity, from which it is quite distinct. Plethoric persons, however, are usually unduly stout, much of the excess of nutritive material being deposited as fat under the skin. Plethora produces a diminution of activity and a greater tendency to sleep than belongs with health; these symptoms increase as it becomes aggravated, and culminate in lassitude and vertigo, turgid countenance, suffused eyes, palpitations of the heart, and similar phenomena. The treatment of plethora is entirely negative, and is suggested by the causes of the disease. Abstinence and exercise are its two most important elements, and their combination depends upon the circumstances of the individual case. Generally abstinence from malt liquors, wines, or spirits is recommended.

**Pleu'ra**, the serous membrane lining the cavity of the thorax or chest, and which also covers the lungs. Each lung is invested by a separate pleura or portion of this membrane; the structure being spoken of rather as double pleuræ than as a single membrane. Like all serous membranes, each pleura is a completely closed or shut sac, and does not communicate with its companion membrane; and it further resembles the other serous membranes in that one side or part of the sac lines the containing cavity, while the other part or fold is reflected

over the contained organs. In the thorax, therefore, each pleura is found to consist of a portion lining the walls of the chest, this fold being named the *pleura costalis* or parietal layer of the pleura. The other fold, reflected upon the lung's surface, is named in contradistinction the *pleura pulmonalis*, or the visceral layer. These two folds enclose a space known as the pleural cavity, which in health contains serous fluid in just sufficient quantity to lubricate the surfaces of the pleuræ as they glide over one another in the movements of respiration. In front the two pleural sacs touch one another at a single point only, about the middle of the sternum, and they therefore enclose a space between them known as the mediastinum, which is again divided into anterior, middle, posterior portions. In the mediastinal space the heart and other organs of the chest, excepting the lungs, are situated. The pleura lines the ribs laterally, and a portion of the sternum or breast-bone in front. From the breast-bone it passes backward over the pericardium. The pleura of the right side is wider, shorter, and extends higher in the neck than that of the left side. The outer aspect of the membrane adheres to the lung-surface, and also to the pulmonary vessels as these leave the pericardium. It is also attached to the diaphragm below; elsewhere it is but loosely connected to the contiguous surfaces. It is supplied with blood-vessels from the internal mammary, intercostal, phrenic, and other arterial trunks; its veins corresponding in nature to the arteries. Its nervous supply is derived from the phrenic and sympathetic nerves, while the absorbent or lymphatic vessels are also numerous.

The diseases to which the pleuræ are subject, are chiefly pleurisy or inflammation of the membrane; pneumothorax, with or without effusion of fluid into the pleural cavity (hydrothorax); and empyema. Hæmothorax, or blood in the pleural cavity, generally results from accidental wounding of the intercostal arteries. Inflammation of the pleura of itself may terminate in hydrothorax or empyema, the inflammatory products in this, as in other cases, appearing in the form of serous fluid or pus respectively.

**Pleu'risy**, an inflammatory disease of the pleura (q.v.). It is either dry or accompanied by effusion. Dry or fibrinous pleurisy is characterized by an inflamed area, usually of small extent, covered with a layer of plastic lymph and somewhat roughened. Its invasion is accompanied with sharp pain and a dry cough, and friction-sounds are heard on placing the ear to the chest. Adjacent portions of the membrane may adhere together, forming adhesions which become permanent and limit the movements of the lung. Pleurisy is usually due to cold, unless secondary to another disease, such as pneumonia, tuberculosis, or cancer. Frequently an arrest of the inflammatory process occurs, and the fibrinous layer disappears from the surface of the pleura by absorption. If not, there may be an effusion of serum into the space between the two layers of the pleura. The amount of effusion may be so great as to cause serious displacement of the lung or heart. If small in amount the fluid is often reabsorbed; but otherwise it must be removed by tapping. The fluid at first is pale and yellowish, or stained



## PLEURISY-ROOT—PLIMSOLL

with blood-pigment. Later it becomes turbid, and if it becomes infected by bacteria carried into the pleura by the lymphatics, or entering through a penetrating wound or during the progress of malignant disease or tubercle, it is converted into purulent matter. The condition is then termed empyema, or chronic purulent pleurisy, and is grave. The pus may penetrate the wall of the pleural cavity and the lung-tissue and burst into a bronchial tube and be coughed up. Or it may perforate the diaphragm, enter the peritoneal cavity, and cause a purulent peritonitis. Few cases recover without surgical procedures which consist of opening the suppurating cavity and providing drainage.

In all pleurisy breathing is apt to be shallow and difficult, and general weakness, loss of appetite, headache, and rapid pulse are noted. When pus appears in a pleural cavity there is an irregular temperature, a succession of chills, and recurrent sweats. Upon the entrance of fluid into the pleura, the friction-sounds disappear, and a dulness and later a flatness is ascertained by percussion over the position of the effusion. Wet or sero-fibrinous pleurisy may continue for months, and the compressed lung may never expand again to its former volume, but may become "carnified." Tuberculous pleurisy occurs as a result of tuberculosis of the lung, in a vast number of cases, as a primary disease. As a secondary implication, dry pleurisy always occurs when the tubercular process reaches the surface of the lung. Hemorrhagic pleurisy, or pleurisy with a bloody effusion, occurs frequently in cases of cancer, Bright's disease, and certain fevers, as well as in tuberculosis.

According to the situation of the lesion, pleurisy is termed diaphragmatic or interlobular. When limited by adhesions which form pockets, it is termed encysted. In the treatment of pleurisy little medicine is used. A cathartic is desirable at the outset. Adhesive-plaster straps are employed, fastened around the chest, or half of it, to secure immobilization of the affected side. An ice-bag gives relief from pain and limits the inflammation. Counter irritation may be secured with iodine or mustard, but blisters and cups are now seldom employed. Vapor baths, to cause diaphoresis, and diuretics are rarely required. Salicylates are useful in some cases. Aspiration of the fluid is secured by means of a hollow needle to which a suction-pump is attached, a method invented and introduced by Wyman of Cambridge and Bowditch of Boston. The needle is inserted generally in the axillary line and the operation is practically without risk. The fluid is withdrawn slowly, and even as much as a quart may be removed with safety. Often after a small fraction of an effusion is removed the remainder will be absorbed spontaneously. In cases of empyema a free incision is usually made and open drainage secured. Sometimes it is necessary to reset a part of one or two ribs. After recovery from empyema the chest is usually sunken and flattened.

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**Pleurisy-root**, a perennial herb of the genus *Asclepias* (q.v.).

**Pleuronec'tidæ**. See FLATFISH.

**Pleu''ropneumo'nia**, a disease peculiar to cattle. It is highly contagious, and exceedingly fatal, though a certain proportion of animals recover. It first manifests itself in a morbid condition of the general system; but its seat is in the lungs and the pleura, where it causes an abundant inflammatory exudation of thick plastic matter. The lungs become rapidly filled with this, and the animal suffers from cough and difficulty in breathing. Many die in the course of a few days. See CATTLE-PLAGUE; RINDER-PEST.

**Plev'na**, or **Plev'en**, Bulgaria, the chief town of the district; about four miles east of the Vid, a tributary of the Danube. Plevna commands a number of important roads, hence is a place of some strategical importance. It is noted for the gallant resistance of its Turkish garrison under Osman Pasha to the Russians during the Russo-Turkish war of 1877-8. Osman intrenched himself here in the early part of September, and the Russian attempts with superior forces to take the place by storm were failures. When food and ammunition had run short he made a bold effort to cut his way through his enemies, but was compelled to capitulate with 40,000 men (10 Dec. 1877). Pop. (1901) 20,302.

**Plexim'eter**. See PERCUSSION.

**Pleyel**, plī'ël, **Ignaz**, Austrian composer: b. Ruppertsthal, near Vienna, Austria, 1 June 1757; d. Paris, France, 14 Nov. 1831. He studied composition under Haydn, and in 1786 made a tour through Italy and France, where he was everywhere received with the greatest favor. In 1787 he was appointed chapel-master to Strasbourg cathedral; but in consequence of the Revolution he was obliged to flee. He proceeded to London; became again connected with Haydn, and gave a series of concerts in 1791-2. He soon after went back to France, and at a later period founded a musical business and piano factory which became one of the most important in Europe. In 1801 he commenced editing the 'Bibliothèque Musicale,' in which he inserted the best works of the Italian, German, and French composers. His own works, chiefly instrumental pieces, are light, pleasing, and expressive. The earliest of them are the best. One of the most popular is the well-known hymn tune which bears his name.

**Pli'ca**, **Plica Polonica**, or **Trichoma**, a condition formerly regarded as a disease, indicated by a matting of the hair of the head or body, in which the hair becomes agglutinated by a nauseous exudation from the roots, the bulbs become enlarged, and the hair swells and becomes soft. Plica is said to have appeared in Poland and adjacent districts about the end of the 13th century, and is now gradually wearing out. The condition is usually kept up by neglect, being deemed a safeguard against some internal disease, and no means being taken to remove it. The treatment of plica is for the most part empirical, and beyond cleanliness and attention to diet there appears to be nothing in regard to it determined with certainty.

**Plimsoll**, plīm'söl, **Samuel** ("THE SAILORS' FRIEND"), English reformer: b. Bristol 10 Feb. 1824; d. Folkestone, Kent, 3 June 1898. Through his occupation as a coal dealer he be-



## PLINLIMMON — PLIOCENE EPOCH

came interested in the condition of sailors, and the dangers to which they were exposed by unscrupulous overloading of heavily insured vessels induced him to enter Parliament in 1868 as member for Derby. In 1873 he published 'Our Seamen,' which succeeded in its purpose of arousing public attention, and in 1876 the Merchant Shipping Act, embodying many of his demands, was passed. Among its provisions was the load line known as "Plimsoll's line," which has since been marked on all English ships. He also wrote 'Cattle Ships' (1890), with reference to securing reform in that direction.

**Plinlimmon**, plīn-līm'mōn, or **Plynlimon**, Wales, a mountain-mass on the boundary between the counties of Montgomery and Cardigan, 10 miles west of Llamidloes. It has three summits, attaining a maximum altitude of 2,468 feet. The Severn and the Wye rivers rise on its slopes.

**Plinth**, in architecture, the lower square member of the base of a column or pedestal. In a wall the term plinth is applied to two or three rows of bricks which project from the face.

**Plin'y** (GAIUS PLINIUS SECUNDUS), commonly called Pliny the Elder, Roman author: b. Novum Comum 23 A.D.; d. Stabiae 79 A.D. He came to Rome at an early age where he availed himself of the best teachers. He served in Germany under Domitius Corbulo and Pomponius Secundus, and obtained the command of a troop of cavalry. During the intervals of his military duties he composed the treatise 'De Juculatione Equestri,' and began a 'History of the Germanic War,' which he subsequently completed in 20 books. Apparently he fought in the Jewish war and was made procurator of Syria. It is known that he was also appointed procurator of the emperor in Spain. His nephew, Pliny the Younger (q.v.), has left an account of his life at this period, which was one of constant study. He made extracts from all the books he read, or had read to him, and at his death left his nephew 160 volumes of these notes. His 'Natural History,' compiled from materials accumulated in this way, was published about 77. This is his only extant work. He perished in the eruption of Mount Vesuvius which overwhelmed Pompeii and Herculaneum in 79. The 'Historia Naturalis' is divided into 37 books, and is, according to his own account, a compilation from upward of 2,000 volumes. It embraces the domain of natural history in the widest sense, including astronomy, geography, and meteorology. It even goes beyond what natural history in any sense would include—treating of the fine arts, and human institutions and inventions. The first edition was published at Venice in 1469. The edition of Hardouin 1685 is the first critical edition. The edition of Panckouke (1829-33), with a French translation, and notes by eminent modern naturalists and scientific men, including Cuvier, is of great value. The best editions of the text are those of Sillig (1851-8) and Detlefsen (1866-73). Pliny was translated into English by Philemon Holland (1601, two vols. folio). There is a translation (1855) in Bohn's Classic Library by Bostock and Riley.

**Pliny** (GAIUS PLINIUS CÆCILIVS SECUNDUS),

called Pliny the Younger, Roman author: b. Novum Comum 62 A.D.; d. about 113. He was a nephew of Pliny the Elder, by whom he was adopted and carefully educated. He studied at Rome under Quintilian and Nicetes Sacerdos, in 76 wrote a work in Greek—"What it was I know not; it was called a tragedy"—and in 81 made his first appearance as an advocate by pleading a case before the centumviri. After service in Syria as tribune of the third legion, he entered public life, becoming successively quæstor Cæsaris (emperor's quæstor; 87), tribune of the plebs (91), and prætor (93). He was then forced by the conditions of Domitian's government to withdraw from his office; and the discovery among Domitian's papers of a charge of treason against him makes it evident that his life was saved by the tyrant's assassination (96). In September 100 he became consul (with Cornutus Tertullus). Trajan, with clear appreciation of Pliny's administrative talents, made him augur (104 or 105), and later curator of the channel and banks of the Tiber and of the municipal drainage system. He was sent out in 111 as governor with special powers of the province of Bithynia. His official correspondence with the emperor ends in 113; and he then disappears from view. His miscellaneous letters are the best extant contemporary authority for an important period of Roman history. Those to and from Trajan afford the chief documentary evidence for the study of Roman provincial government; and they contain, also, the earliest information *ab extra* of the manners of the primitive Christians and their official treatment by the Roman administration. Through the extent and variety of his own works, supplemented by inscriptions discovered at Novum Comum, Pliny is perhaps more fully and accurately known than any ancient writer save Cicero. His letters, however, unlike those of Cicero, were evidently written and arranged for publication. The order is largely chronological, although, to give an impression of carelessness, slight deviations appear within the individual books. The diction is clear and smooth; and if, as Simcox thinks, his "boundless self-complacency found here a safe opportunity for expansion," there is also manifest throughout a certain tone of culture and distinction which quite reconciles to any such quality. Of Pliny's verses nothing remains, and of his published speeches only a fulsome panegyric on Trajan whose florid style probably represents his oratorical attempts to imitate Demosthenes. The best edition is that of Keil (1873), who established the text and was aided by Mommsen. There are also many other excellent editions in whole or in part. There is an English version of the letters by Lewis (1880). Consult also Church and Brodribb, 'Pliny's Letters' (1872) in Collins' 'Ancient Classics for English Readers.'

**Pliocene Epoch**, according to the European geologists the most recent of the divisions of the Tertiary Period, roughly equivalent in the nomenclature of the United States Geological Survey to Neocene Period. Lyell distinguished it by the fact that the larger part of the fossil shells found in its beds are of recent or living species. In the United States its characteristic beds are known as the Sumter series. In the Carolinas occur beds of loam, clay, or sand, lying



in hollows of the older Tertiary deposits and containing 40 to 60 per cent of living marine shells, which are referred to the Pliocene Epoch. The most remarkable remains of this epoch are found in the Upper Missouri region. They include a large number of mammals now extinct, as for instance three species of camel, a species of rhinoceros, a mastodon, an elephant, four or five species of the horse family, a wolf, larger than any living species, a fox, a tiger as large as that of Bengal, and other carnivora. Formations of this period are scattered through the Atlantic and Gulf coast regions. In England the Chillesford beds, the Norwich Crag, Red Crag, and White Crag belong to this epoch, and in Continental Europe extensive marine strata in Italy and Sicily. In Italy the flora of this epoch has been shown to be very rich, including the pine, oak, evergreen oak, plum, etc.

**Pliohip'pus.** See HORSE, EVOLUTION OF.

**Pliosau'rus**, a genus of Sauropterygian reptiles allied with the Plesiosaurus, and distinguished chiefly by its greater size and by the larger head borne on a short neck. These latter reptiles occur as fossils in the middle and upper Oolites only. Some attained a length of upward of 40 feet, for example, *Pliosaurus brachydirus*. Their habits were probably similar to those of the *Plesiosaurus* (q.v.).

**Plock**, plötsk, or **Plotzk**, Russian Poland, (1) town, capital of the government of Plock; on the right bank of the Vistula, 60 miles northwest of Warsaw. It has no less than 25 squares, of which one in the old town is very regularly built. It has a handsome cathedral, a considerable trade, and several large fairs. Pop. 27,372. (2) The government of Plock has an area of 4,200 square miles of a level and moderately fertile territory. Pop. (1901) 563,825.

**Plock'horst, Bernhard**, German painter: b. Brunswick 2 March 1825. He was originally a lithographer, but making the acquaintance of Piloty in Leipsic, he followed that artist to Munich, and they attended the Academy together. In 1853 he went to Paris and entered as pupil the studio of Couture. He subsequently traveled for purposes of study through Belgium, Holland, and Italy, and settled at Berlin as a portrait painter of considerable popularity. At this time (1866) he executed a large canvas, 'Mary and John Returning from the Grave of Christ.' This work revealed so decided a genius for religious painting that he henceforth devoted himself almost entirely to this department of art. From 1866 to 1869 he was art professor in the Archducal Art School at Weimar, and in the latter year returned to Berlin and exhibited what is considered his greatest work, 'Fight of the Archangel Michael with Satan for the Body of Moses,' now in the Museum at Cologne. This was followed by the altar-piece for the Cathedral at Marienwerder, 'The Resurrection of Christ.' Among his other religious paintings are 'The Parting of Christ from His Mother'; 'Christ on the Way to Emmaus'; 'Christ Appears to Mary Magdalene'; 'The Finding of the Infant Moses'; 'The Guardian Angel'; 'Suffer Little Children to Come Unto Me'; etc. His principal portraits are those of the Emperor Wilhelm I. and of the Empress Augusta.

**Plombières**, plän-bê-är, France, a health-resort in the department of Vosges, 14 miles south of Epinal. It became fashionable during the Second Empire through the favor of Napoleon III., though the virtues of its waters were known ever since the times of the Romans. There are nearly 30 springs, ranging in temperature from 66° to 150° F.; their waters are in great repute against skin diseases, gout, rheumatism, dyspepsia, female complaints, etc. A handsome casino was opened in 1876, and there are picturesque walks and a park in the valley in which the village stands. Permanent population (1901) 1,830.

**Plotinus**, plō-tī'nūs, the most famous of Neo-Platonists: b. Lycopolis, Egypt, about 204 A.D.; d. Minturnæ, Campania, 270. In his intercourse with his pupils and acquaintances he avoided all reference to the antecedent circumstances of his life, his age, nativity, or parentage. It is conjectured that he was of Roman descent, probably a freedman. It was in his 28th year that the desire to study philosophy awoke in him. He then fell into great despondency, and was brought by a friend to Ammonius Saccas, a Christian, who had written some works on Christian theology, but returned to the Hellenic faith. He remained with him some ten years. In 242 he joined the expedition of the Emperor Gordian to the East, in order to learn the philosophy of the Persians and Indians. After the death of Gordian he went to Rome where he subsequently lived and taught. About 254 his friends induced him to put his doctrines in writing. The works of Plotinus were highly valued by Longinus, although that philosopher was in no sense a Plotinist, and are distinguished by energy and enthusiasm. He was in fact a preacher. His teaching secured him great respect and popularity among those who did not receive Christianity. Parents left their children to his care, and his house was full of orphans of both sexes entrusted to his guardianship. Although neglectful of his own temporal interests, he showed no want of shrewdness in looking after the estates of his wards. Plotinus enjoyed the favor of the Emperor Gallienus, from whom he obtained the privilege of rebuilding at the expense of the government two destroyed towns in the Campania, with a view to their being governed according to the laws of Plato. Plotinus was one of the great masters of philosophy. The value of his system depends less upon the intrinsic truth it contains than upon its historical importance, and its adaptation to a certain class of human sympathies. The historical value of the system, great both in its antecedents and consequents, is due partly to the circumstances out of which it arose, and partly to the genius and originality of its founder. It had its source at the junction of two independent streams of thought; mysticism and dialectics, which, already fortuitously united, received a new direction from the individual energy of the mind of Plotinus. He was well acquainted with the older Greek philosophy, the Ionian and the Eleatic schools, etc., and according to the eclectic tendencies of his day believed there was a fundamental unity in these various systems. It was to Plato, however, that he looked as his great authority. He believed himself a strict follower of Plato; uses Plato's term, the Good, for his highest generalization; but



## PLOVER — PLOW

with Plotinus it is an abstraction from which every determinate quality has been eliminated and would rather be described in modern philosophical language as the Absolute. Consult Kirchner, 'Die Philosophie des Plotin' (1854).

**Plov'er**, the general name employed to designate most birds of the limicoline family *Charadriidæ*, of which the true plovers are sometimes held to constitute the subfamily *Charadriinæ*, and to that extent are separated from the turnstones and surf-birds (qq.v.). The plovers have a short or moderate bill, never exceeding the head, soft basally, but horny, somewhat enlarged and usually slightly hooked at the end. The legs are comparatively short, and, with only a few exceptions, have no hallux, and the three remaining toes are not much lengthened. The body is full and plump, the neck short and thick, and the head large. The long pointed wings reach to the tip of the short, 12-quilled tail. Plovers are small or moderately sized birds, remarkable for their extensive migrations and found along the seashore or in plains and fields. They are strictly ground birds and with few exceptions lay four speckled pyriform eggs in a slight depression in the ground. About 75 species are known from all parts of the world, some of the exotic ones exhibiting remarkable modifications. Within the limits of North America there occur three genera and 13 species, all closely related. The most distinct of these is the lapwing (*Vanellus vanellus*), known by its crested head and long overlapping wings, a rare straggler from Europe which scarcely belongs to our fauna. To the genus *Charadrius* belong the black-bellied or bull plover (*C. squatarola*) and the golden plovers (*C. dominicus et al.*). The former is nearly a foot long, and in the breeding plumage has the under parts largely black, but in the autumnal plumage, as usually seen in the United States, the black is limited chiefly to the axillary region. This plover may be distinguished at once from any closely related American species by the presence of a distinct hind toe. It breeds in the far north sparingly as far south as Minnesota, and undertakes the most stupendous migrations, reaching South America on our side, and South Africa, Australia and Tasmania on the other. It migrates in flocks both coastwise and in the interior; and is equally common in this country and Europe where it is called the gray plover. The American golden plover (*C. dominicus*), also known to gunners as the field plover and bull-head plover, is only slightly smaller than the last, from which it is easily distinguished by the absence of a hind toe and the paler finely mottled plumage, the upper parts of which have much golden-yellow in summer. This species breeds in Arctic America and winters as far south as Patagonia, passing through the United States as a transient in the spring and again from August to November. At the latter season their numbers are augmented by the young of the year, and they migrate in great flocks or waves which often linger for several weeks in neighborhoods where food is abundant. Consult: Elliot, 'North American Shore Birds' (New York 1895); Sandys and Van Dyke, 'Upland Game Birds' (New York 1902); Murphy, 'American Game Bird Shooting' (New York 1882); besides the standard works on ornithology.

**Plow**. An implement, drawn by horses, oxen, or other means, used for breaking up or loosening the soil, preparatory to planting or sowing. The plow was the primary implement of civilization. The cultivation of the soil, which began with the invention of the plow, made it possible for men to live in permanent, populous communities, and civilization found a foothold wherever the pastoral tribes of the Stone Age learned the lesson of industry by following the plow. According to an Egyptian legend, "Osiris taught the way and manner of tillage and good management of the fruits of the earth." It was undoubtedly in the valley of the Nile, or the Euphrates, that the plow was invented, for in these valleys are found the oldest ruins of agricultural settlements.

The first plow was roughly fashioned from a forked tree. One branch served as the beam, while the other branch was cut off and pointed, and the tail was trimmed to form a handle. Plows of this crude type are pictured on Egyptian monuments. After bronze tools came into use, it was possible to make a more finished and efficient plow of dressed timbers, and many variations are found in the forms of wooden plows that were used 2,000 to 4,000 years ago. In the prevailing type, a block of wood, with the front end pointed or wedge-shaped, served as the bottom, to which the beam and a single handle were attached. In Latin America, and in many other parts of the world, wooden plows of this form, with iron points and one handle, are in use to this day. The extension of agriculture and civilization in Europe awaited the introduction of iron for plow points, which occurred shortly before the Christian era.

The ancient plow merely stirred or loosened the soil. Modern plows cut a furrow and turn it over so as to cover the sod and weeds, and leave fresh soil on the surface as the seed bed of the crop that is to be planted or sown. English and American patent records show the evolution, in the past two centuries, of the modern form of plow. The Colonial plow, which was used in the United States until the beginning of the 19th century, reflects English ideas in plow-making. The point was of wrought iron, sometimes tipped or edged with steel. The moldboard and all the other parts were of wood, but in some cases the moldboard was covered with sheet iron.

In 1797 Charles Newbold, of New Jersey, patented a cast-iron plow in which the share and moldboard were cast in one piece, but this plow did not prove successful, as the cast-iron point would soon wear off, and farmers could not afford the cost of renewal of so large and expensive a casting. The most practical improvement of this period was made by Richard B. Chenaworth, of Baltimore, one of the first manufacturers of farm implements in the United States, who patented, in 1813, a cast-iron plow in which the share, moldboard, and landside were cast in separate pieces. Jethro Wood, of New York, who took out patents in 1813 and 1819 on improvements in cast-iron plows, has been given credit for important work in the introduction of improved plows, although the main feature of his patent of 1819 was not a practical invention. He never engaged in manufacturing, and was unsuccessful in obtaining any income from royalties or licenses under his



## PLOWDEN — PLUM

patents, but he gave his entire life to the work of advocating the use of cast-iron plows.

To James Oliver, of South Bend, Ind., is due the credit for the invention of the chilled plow, America's most important contribution to the art of plow-making. He began the manufacture of plows at South Bend, Ind., in 1855. A shrewd business man, as well as a practical inventor, he saw at once the need of the farmers for a durable plow which would scour in difficult soil, and he undertook to supply this want by the invention of the chilled plow. When iron is cast in a chill, that is, in a mold one side of which is a metal vessel filled with water, the sudden cooling of the molten iron in contact with the chill gives the casting a surface as hard as the hardest steel. Many inventors had spent fortunes in the effort to utilize this fact in plow-making, but two great difficulties had baffled all their efforts. The chilled metal was not strong enough to stand the hard usage that a plow receives in the field, and it was impossible to prevent flaws and blow holes in the broad face of a moldboard. After many years of effort, in which he risked all his capital, Mr. Oliver mastered the problem. His first success was obtained in chilling the wing or outer end of the moldboard, where the friction with the soil is greatest. This increased the efficiency and durability of the plow to such an extent that Mr. Oliver redoubled his efforts to make a full chilled moldboard, and he ultimately succeeded in this purpose by the use of three inventions. The first of these inventions consisted in the use of a chill filled with hot water. The heat dried out the moisture of the sand in the mold, and this obviated the flaws and blow-holes that were caused by steam, which had been generated when the molten metal was poured into the mold. The next invention was the ventilation of the chill by means of checkered grooves on its face, which permitted the air and hot gases from the metal to escape from the mold. These two inventions produced a chilled casting which was free from flaws, but moldboards cast in this manner were not strong enough to stand ordinary usage in the field. This last difficulty was overcome by the invention of an annealing process which tempered and strengthened the moldboard without detracting from its wearing and scouring qualities and made the chilled plow a complete success.

In every detail of its construction, the chilled plow shows the hand of a master inventor. A few of the notable improvements that have been patented by James Oliver are as follows: The cast share, with chilled point and cutting edge, made by a simple process which enables it to be sold at a very low price, so that the expense of renewing shares is small; the share with an upward, coulter-like extension, which fits against the front edge of the moldboard and gives a new vertical cutting edge to the plow when the share is renewed; the curved malleable standard, which brings the beam over the line of resistance of the plow; the simple adjustment of the beam, which makes the plow balance perfectly with two or three horses; the malleable gauge wheel, which regulates the depth of the furrow; and other devices to simplify and improve the work of the plow.

Chilled iron has proved itself the ideal material for the wearing parts of a plow. It is harder than any steel that it is practicable to

use in a plow, and wears more than twice as long. The plow limits, by its efficiency, the area which man can cultivate. Ten millions of American farmers cultivate more land than 100,000,000 agricultural families in Asia, where wooden plows are used to prepare the soil. Even Asia, however, is learning the lesson of the chilled plow, in common with all agricultural countries, and the large export trade which has grown up, in addition to the domestic demand, has made the Oliver Chilled Plow Works the largest plow-making establishment in the world.

R. L. ARDREY.

**Plow'den, Edmund**, English jurist: b. Plowden, Shropshire, 1518; d. 6 Feb. 1585. He was educated at Cambridge and Oxford, admitted to practise physic and surgery in 1552 and later studied law. He was returned to Parliament for Wallingford, Berkshire, in 1553, and in 1554 as member for both Reading, Berkshire, and Wootton-Bassett, Wiltshire; in 1554-5 he withdrew his company with 39 members who were dissatisfied with the proceedings of Parliament. Proceedings were brought against them for contempt, Plowden defended his own case, and the matter was dropped. He was returned to Parliament for Wootton-Bassett in 1555. After the accession of Elizabeth he received no further political recognition, his steadfast adherence to the Roman Catholic faith barring his path, though he was admittedly the greatest lawyer of his day. No proceedings were taken against him, though he often appeared in court as counsel for those of his faith, Bishop Bonner being one of his clients. His works are highly valued as a clear and authoritative record of the law proceedings of his time. 'Les Commentaires' (1571) fully sustains his reputation as a great jurist, and he also wrote: 'Les Quæres del Monsieur Plowden' (trans. 1662). Consult: Granger, 'Biographical History of England' (1824), Wallace, 'The Reporters' (1882).

**Plücker**, plük'ër, **Julius**, German mathematician and physicist: b. Elberfeld 16 July 1801; d. Bonn 22 May 1868. He became a lecturer at Bonn in 1825, professor of mathematics there in 1829, and after holding a chair at Halle in 1834-6 was again at Bonn until his death. His contributions to mathematics were of much importance. He invented what is known as line (or linear) geometry, the theory of systems of rays, complexes, and congruences, his uncompleted work on which was finished by Klein, his assistant, as 'Neue Geometrie des Raumes' (1868-9). In his 'Theorie der algebraischen Curven' (1839) he develops the "six equations," known by his name, concerning the singularities of algebraic curves. From 1847 he devoted much attention to physics. He made study of the magnetic properties of gases and liquids, spectroscopy, and electrical phenomena of light in rarified air. He originated the Geissler tubes, and discovered the fluorescence of cathode-rays. His 'Analytisch-geometrische Entwicklungen' (1828-31) contains accounts of his labor in this field. Consult: Dronke, 'Julius Plücker' (1871); Clebsch, 'Zum Gedächtniss an J. Plücker' (1872).

**Plum**, the popular name for several species of the genus *Prunus*, extensively cultivated in mild climates for their fruits. They are widely distributed in the North Temperate zone, especially in America. They have alternate, simple,



## PLUM

leaves; white flowers mostly in cymes and generally appearing with the leaves; and drupaceous, one-seeded bloom-covered fruits. They are closely related to apricots, cherries and peaches.

The most important species is the European plum (*Prunus domestica*), a native of the Caucasus region, and thought to have been derived from the blackthorn (*P. spinosa*). It has given rise to four distinct groups: *Prunes*, firm, thick-fleshed sweet varieties of various colors (blues are best known), adapted for drying without the removal of the stone (see PRUNE); *Damsons*, little, firm-fleshed plums of diverse colors and usually clustered, frequent in fence corners; *Green gages*, small green, globular plums generally of high flavor; *Large*, yellow, blue, red, and purple varieties. The domestics are the leading plums from New England southward to Pennsylvania, westward to Lake Michigan, and upon the Pacific coast. Some of the hardier Russian varieties are being tried in the colder regions of the West and North.

Next in importance are the Japanese varieties of *Prunus triflora*, first introduced into America in 1870. This species is presumably a native of China. The fruits are generally rounder than those of the *domestica* varieties, and are more noted for their light reds and yellows. Their chief merits are: added variety to the list, especially of early maturing kinds, firm-fleshed fruits which ship well, and vigorous, productive trees freer from the attacks of curculio and black knot (see below) than the *domesticas*. They will succeed farther south than the *domesticas*, and in many instances farther north.

Several American species are also rapidly gaining in popularity in the United States and Canada. *Prunus americana* and *P. angustifolia* are the leading species, the former especially in the North and West, but also extending to the Gulf States; the latter popular from Pennsylvania southward. These are of still more recent introduction into cultivation than the Japanese varieties, and are valuable acquisitions where the two preceding groups fail. The wild goose plum (*P. hortulana*, of some botanists) is evidently a inongrel or hybrid group derived from the two previous species.

The following species are also cultivated: Myrobalan or cherry plum (*P. cerasifera*), presumably a Caucasian species, used largely by nurserymen for budding plums upon; apricot or Simon plum (*P. simonii*), an introduction from China popular in California since 1880, but little grown in the East; beach plum (*P. maritima*), common upon the coast from Nova Scotia to Virginia, but little cultivated except as an ornamental shrub; Pacific Coast plum (*P. subcordata*), indigenous in Oregon and California, and somewhat cultivated; and the sand plum (*P. angustifolia*, var. *watsoni*), a shrubby species common in Kansas and Nebraska, but little cultivated.

Plums are propagated from seed only when new varieties are desired; varieties true to name are all propagated by budding or, to a very limited extent, by grafting. The process is the same as for the peach (q.v.). If *domestica* varieties are to be grown upon light soil they are generally whip-grafted on peach stocks, the peach being adapted to such soils. Similarly, peaches to be grown upon heavy soil are often grafted upon plum stocks.

The various groups succeed upon a wide range of soil; the *domesticas* are generally well adapted to heavy soils; the Japanese to medium and even light; and the American kinds often to very light. There are, however, varieties in each group adapted to other soils than suit the majority. The land is deeply plowed and thoroughly harrowed before planting. The trees are set about 20 feet apart in squares or hexagons (see PEACH), or in rectangles from 8 to 12 feet asunder in rows 18 to 20 feet apart. In the last case cultivation is given only one way when the trees commence to touch. Usually less than half a dozen main limbs, preferably close to the ground, are allowed as the framework of the tree and after the first year or two little pruning beyond the removal of interfering, injured or dead branches is given. The trees are usually planted when two years old from the bud, extra vigorous growers sometimes when one year old. Varieties of the Japanese and American groups should not be planted in blocks of only one kind, since they are often self-sterile and fail to set fruit; two or more kinds should be alternated in the orchard. (See PEAR.) Cultivation is practically the same as for apples and pears. In the Western States, however, a mulch of straw, marsh hay, etc., is often substituted for cultivation. The fertilizers usually employed are rich in potash and phosphoric acid. Cover crops of legumes should supply sufficient nitrogen, or a biennial dressing of stable manure may be used as a supplement. Occasional dressings of lime are often beneficial. Few fruits respond better to liberal feeding than the plum. The conservation of plant food which follows thinning the fruit, to stand at least two inches apart, is also of great benefit to both tree, annual productivity, size of fruit, and in the prevention of fruit rot. (See PEACH.) When fully grown and colored but before becoming soft the fruits are gathered and generally marketed, in the East, in eight-pound Climax grape baskets. The plums shipped to eastern markets from California (mostly of the prune and Japanese types) are packed in boxes and sent by refrigerator express freight.

Some of the principal diseases of the plum are also common to the cherry or the peach, or both. Plum-pockets (*Exoascus pruni*) is a specific plum malady. Shortly after the blossoms fall the little plums swell rapidly to an inch long or more and become bladdery. As the disease progresses the light green color changes to deep brown or black, the walls thicken, the stone fails to develop, and the fruit falls. Affected foliage and green twigs also become distorted. Spraying before the buds open and again after the flowers fall is recommended as a check. (See FUNGICIDE.) Black, or plum-knot (*Plowrightia morbosa*) is common to both plums and cherries. Swellings appear upon the twigs and branches, burst and reveal a golden brown or yellow interior with velvety appearance due to the rapidly forming summer spores. As the season advances the surfaces change to black with a more or less pimply appearance. In the spring a second crop of spores (winter spores) is liberated. Under favorable conditions spores from either crop may spread the affection through crevices in the bark, etc. The knots are perennial, gradually extending the infested area. Cutting and burning as soon as discovered; painting the wounds with kerosene or Bordeaux mixture, thorough spraying



## PLUM BLOSSOM — PLUMAGE

with standard Bordeaux mixture before the buds open and with diluted mixture afterward are all recommended and should all be practised. One alone is insufficient. Badly infested trees and trees of wild cherries, plums, etc., should be burned promptly. Leaf blight or shot-hole fungus is produced by two species of fungi, *Septoria cerasina* and *Cylindro-sporium padi*. Small purplish spots upon the leaves gradually turn brown and drop out leaving shot-like holes. If badly infested the leaves turn yellow and fall, sometimes defoliating the trees. Spraying with diluted Bordeaux mixture at intervals of two weeks from the time the leaves expand until midsummer is considered a specific. This disease is often found on cherries. Systematic annual spraying will hold all these diseases in check.

Comparatively few insects feed upon the plum. Some caterpillars and other leaf-chewing insects sometimes appear in devastating numbers, but they can usually be controlled with Paris green (lime should be added to prevent injuring the foliage); plant lice are sometimes troublesome, but whale-oil soap, kerosene emulsion, etc., are effective. (See INSECTICIDE.) But the most serious enemy is the plum curculio (*Conotrachelus nenuphar*), which in many sections has completely destroyed the crop. The adults, small gray-black snout beetles less than a quarter of an inch long, appear in spring and until the fruit has formed feed upon the foliage. Then the females chew little crescent-shaped cavities in the young plums, and lay their eggs in holes bored beside the crescent or in the crescent itself. The white, footless larvæ burrow to the region of the stone where they live for about three weeks. The fruits fail to develop and fall, and the larvæ burrow into the ground where they pupate for about four weeks, emerging as adults which hibernate. They have only one brood. Before the trees blossom arsenites may be used; but jarring the adults into sheets in the early morning while they are torpid and dropping them into kerosene is most practised. Special machines like inverted umbrellas on wheels are in use in large plum orchards. The plum gouger (*Coccotorus scutellaris*) is a troublesome pest in the Mississippi River basin. Its habits are much like those of the curculio. It does not, however, make a crescent-like mark, and its larvæ feed in the stone instead of around it.

Consult: Waugh, 'Plums and Plum Culture' (New York 1901). This work contains a bibliography. The following Agricultural Experiment Stations have published bulletins upon plums: Vermont, Nos. 53, 67, and 75, with references for 1896-1901; Wisconsin, Nos. 63 and 87; Cornell University, Nos. 38, 62, 106, 131, 139, and 175. Saunders, 'Insects Injurious to Fruits' (Philadelphia 1889); Smith, 'Manual of Economic Entomology' (Philadelphia 1896).

M. G. KAINS,  
*Crop Expert.*

**Plum Blossom, Order of the.** See ORDERS, ROYAL.

**Plum Curculio.** See PLUM.

**Plum, Date.** See PERSIMMON.

**Plumage.** Feather are preeminently the distinguishing characteristic of birds: all birds have them, while no other animal possesses them. As elsewhere described (see ORNITHOLOGY)

feathers fill two important functions, the retention of animal heat in the body and the support of the bird in flight; and since they cover practically the whole bird, all the striking features of color and ornament so highly developed in this group, pertain to the feathers.

The typical feather consists of a nearly transparent, cylindrical portion (calamus), which merges above into an opaque usually squared shaft (rhachis), which bears on either side the webs or vanes, soft flexible surfaces which upon slight tension split up into their component parts (barbs). These are slender lamellæ which branch off from the rhachis and in turn give rise to branches (barbules). The anterior barbules of one barb overlie the posterior barbules of the next barb, and the numerous cilia (barbicels) which they bear, many of which are hook-shaped at the tip, interlock with the thickened upper edge of the posterior barbules, binding the barbs together and forming the air-tight web which is so essential to flight. At the point where the rhachis joins the calamus is a pit known as the umbilicus, and here is frequently found a sort of secondary feather known as the aftershaft; it is usually much smaller than the main shaft and more downy in character, but sometimes, as in the emu, is of the same dimensions and appearance.

Feathers are entirely products of the skin, being similar in this respect to hair, claws, etc., but are peculiar in the fact that they do not grow continuously, but are periodically shed and replaced by other feathers. The first feathers appear as small papillæ on the skin of the embryo. Each papilla is produced by a group of cells known as the Malpighian cells, which increase and divide, part of them growing down and forming the lining of the feather-follicle, the others forming the feather itself, and surrounding the central mass or pulp, which is well supplied with blood-vessels and furnishes the requisite nourishment to the growing feather. The Malpighian cells which produce the feather form three layers—a thin exterior one, the sheath which covers the young feather in what is familiarly called the "pin feather" stage, and later scales off as the feather expands; a middle layer, which forms the feather itself; and a very thin innermost layer, which covers the pulp and which persists inside of the calamus as a series of pithy caps left by the retreating pulp. This pulp is withdrawn to the base of the follicle when the feather is completely grown, and becomes active again when the feather is shed, or at the time of the periodical molting (q.v.).

According to structure, feathers may be divided into (1) pennaceous or those with well developed vanes; (2) plumulaceous or down-feathers; (3) semiplumes; (4) filoplumes or hair-like feathers, familiar to anyone who prepares fowls for the table, and who destroys these feathers by singeing. This classification is by no means absolute, as many feathers combine the characters of the above forms in various ways.

Feathers may be again divided into contour feathers, that is, those which appear on the surface, and down feathers, or those which are usually entirely concealed by the contour feathers. The former are usually pennaceous in structure, but in the various ornamental plumes, barbicels and even barbules may be wanting or



## PLUMB-LINE — PLUMBAGO

reduced in number, producing a fluffy feather. The down feathers have no barbicels and usually no rhachis, but consist of long fluffy barbs, all of which grow out from the end of a very short calamus. Powder-downs are down feathers which are constantly disintegrating into a fine powder, and are found in the plumage of various birds, notably parrots, tinamous, herons and the species of *Podargus*.

With regard to age, feathers are divisible into two groups: (1) neossophtiles, or feathers of the young birds at the time of hatching; and (2) teleoptiles, or feathers of later life. The neossophtiles are always downy in structure, and after a varying period they are superseded by the teleoptiles. The short calamus of the neossophtile never becomes closed up, and is split longitudinally as it is forced out by the teleoptile, and for some time its slender downy barbs are borne on the tip of the new feather. When one generation of teleoptiles succeeds another the old feathers usually drop out, but in the emus and cassowaries they remain attached to the tips of the new feathers, just as do the neossophtiles. Neossophtiles are best developed in the birds which run about within a short time after hatching, such as the gallinaceous birds, ducks, sandpipers, etc. In these species the body is thickly and completely covered with down. In the hawks and owls the covering is nearly as thick, but in the latter the neossophtiles grow out for a considerable time after hatching, sometimes completely altering the appearance of the bird. In the snowy owl, for instance, the newly hatched young with the tips of the neossophtiles showing, is pure white, while older ones, in which these feathers are full grown, appear dull gray, owing to the difference in color of the terminal and basal portions of the feathers.

In passerine birds the neossophtiles are not very abundant, while in several groups — notably the woodpeckers where the young are reared in hollowed trees, and the kingfishers which burrow in sand banks — the neossophtiles have been entirely suppressed, so that the first coat of feathers on these birds consists of teleoptiles. This is apparently due to the protection afforded by the nest to the young, which renders the early downy covering quite unnecessary. In the mound-builders a still more remarkable condition prevails. Here the neossophtiles are developed but are shed before the bird is hatched and it actually leaves the egg clad in the teleoptiles.

It is obvious that the early plumage condition of birds is directly dependent upon their nesting habits, and this must be clearly borne in mind when it is considered in connection with classification. Thus many apparently striking characters will be seen at once to have been very recently acquired.

Following the nestling stage, birds acquire one coat of feathers after another, the frequency of the change depending upon the number of molts. The first teleoptile or "juvenal" plumage is generally quite different from that of the adult, and is worn for only a few months after the bird leaves the nest, when it is superseded by the plumage of the first winter, in which the characters of the adult generally appear. This may be retained for a whole year, or it may give way to a nuptial plumage in the early spring, the latter being always the case in birds

which are strikingly different in color in summer and winter. It is now demonstrated that feathers cannot change their pigment after they are once developed, and consequently all striking changes are due to molt. There are some partial exceptions to this, in the case of birds which undergo marked wear or abrasion, such as the snow-bunting. In this species the feathers of the back are black basally, those of the head white, but both are broadly tipped with brown, and as they lie in place brown is the prevailing tint. In early spring the tips become brittle and fall away, leaving the black-and-white basal portions in strong contrast. In the crossbill, as shown by Dr. Dwight, the barbs are red and the barbules gray, and in spring the latter fall off, resulting in a material brightening of the plumage.

The relation of the juvenal plumage to that of the adult bird is a matter of much interest, owing to the fact that it usually shows some ancestral characters, and often gives us a clue to the relationship of the species: for example, the young of our robin is spotted like the ancestral thrushes, while the adult has departed widely from this type in its plain rufous breast and slaty back.

In a large number of species the plumages of the male and female differ materially; the latter is always the more primitive, and the male generally assumes a dress similar to it for the winter, returning to his brilliant livery on the approach of the nuptial season. Darwin's theory of sexual selection, which was formerly held to account for the brilliant plumage and wonderful ornamental feathers of male birds is in the light of modern investigations not so satisfactory, but no acceptable theory has yet been presented. Protective coloration in plumages has received a good deal of attention from Wallace and others, and doubtless the theory in some cases has been unduly elaborated. While protective coloration plays a most important part in the evolution of plumage it is quite as likely that pale desert forms are as much the result of the direct effect of the sun as purely protective development. The protective plumages of the ptarmigan both in winter and summer, and the curious protective dress acquired by certain ducks in summer when rendered temporarily flightless by their peculiar method of molting, deserve mention in this connection. See PTERYLOGRAPHY.

WITMER STONE,

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**Plumb-line.** See PLUMMET.

**Plumba'go**, a genus of herbs or sub-shrubs of the order *Plumbaginaceæ*. The species, of which about a dozen are known, are natives of warm climates, especially western Asia and the Mediterranean region. They have variously formed, usually alternate, entire leaves; and white, pink, or blue tubular flowers, arranged in terminal spikes or racemes. The best known species are *P. capensis* and *P. rosea*, which are popular as greenhouse and garden plants. They are easily propagated by cuttings, and will thrive in any good potting or garden soil. In cold temperate climates cuttings rooted in the early autumn, grown in the greenhouse during the winter, and transplanted to the garden in the spring, will blossom through the summer and autumn and may then be used as winter plants



## PLUMBAGO — PLUMBERS' AND STEAM FITTERS' SUPPLIES

or kept in a cellar. In southern California and other mild climates the plants often climb 15 feet or more if not molested, but in green-houses they are usually straggling shrubs.

**Plumbago, or Graphite,** also called Black Lead, a form of native carbon containing from about 50 to nearly 100 per cent of that element. It crystallizes in hexagonal plates, has a steel-gray or iron-black color, metallic lustre, is slippery to the touch and very soft, so that it can be cut with a knife, and produces a black, shining streak. It has a specific gravity of from 1.9 to 2.3. It is usually mixed with iron and frequently contains a small quantity of impurities. The mineral is mined in considerable quantities in its crystalline form at Hague, N. Y., and in Chester County, Pa. It is also found in Alabama, Wyoming, North Carolina, Wisconsin, and as amorphous graphite in Rhode Island and Michigan. In its purest state it is obtained in Ceylon and in the district of Semipalatinsk in Siberia. It is also produced in Austria-Hungary, Italy, Bavaria, Japan, Mexico, and Canada. It is largely used for pencils, as a lubricator, in crucibles, paint, stove blacking, and as a conductor of electricity over non-conducting surfaces such as gutta-percha.

Artificial graphite is manufactured in large quantities at Niagara Falls. The production of the mineral in the United States has steadily risen. In 1902 it amounted to 4,176,824 pounds of the crystalline variety, valued at \$153,147, and 4,739 tons of the amorphous kind, valued at \$55,964.

### Plumbers' and Steam Fitters' Supplies.

The word "plumbing," derived from the Latin *plumbum* (lead), as originally used, meant to seal or repair with this metal, but the term as now used, in its broadest sense, means the pipes, connections, fixtures, etc., used for the purpose of supplying water, gas or heat from outside places to the interior of a building, or of carrying these throughout the building; and also for the purpose of drainage. All the ancient nations employed lead pipes to some extent; water was universally conveyed through them when the pressure was too great for earthenware pipes; and the Romans used them in their aqueducts in crossing ravines or valleys where the construction of bridgework was difficult or impossible.

The improvement in plumbing fixtures was remarkably slow, and has taken place within the last 65 years. The trade of plumbing was practically unknown prior to that time, but upon the completion of the Croton Aqueduct in 1842, more substantial and durable pipes and fittings became necessary, a condition which ultimately led to the establishment of manufactories of plumbers' supplies. At first these concerns were engaged almost exclusively in the manufacture of lead pipe, sheet lead, or iron pipe, which were the principal articles used by the plumber, but to-day lead has been largely replaced by other metals, and we find that the plumber and the gas, steam, and water fitter use lead, copper, brass, and various styles of plated pipe, and that the use of vitrified clay or sewer pipe has been almost entirely abandoned, except for connecting the house and street sewerage systems. The grade of work done by the plumber has

made a very material advance, the work being done by licensed plumbers only, and in many cases under the direct supervision of expert inspectors employed by the city. In nearly all large cities plumbing is governed by rules and regulations, carried into effect by the department of the city government appointed for that purpose, and it is the duty of such departments to enforce the regulations which define the class of work to be done, the sizes of the various kinds of pipes to be used, the class of fixtures, etc. Such work usually comes under the supervision of the building, or the sewerage and water supply departments. The service pipe, which connects the system of supply pipes in a building with the main in the street, is generally laid by the water department.

For many years the entire plumbing system of the ordinary dwelling consisted of a sink with hot and cold water faucets over it, and connected with the water-back and boiler attachments of the range. This was followed by the installation of the bath-tub—an unsightly affair, consisting of a wooden box lined with lead. This was in time replaced by the cast-iron tub, then the copper-lined tub, both of which were superseded by the modern porcelain bath-tub, now brought to the acme of perfection. At the present time the various appliances in the plumbing trade known as fixtures are almost innumerable. Faucets, cocks, and valves are provided for each place where water is drawn; laundry tubs, provided with hot and cold water pipes, are installed in the kitchen; marble, cast-iron, or steel wash bowls are placed in the bath-rooms or sleeping-rooms of a dwelling; and shower and foot-baths are provided when desired.

The main feature of the plumbing in a modern dwelling lies in the water-closet and the system of pipes which carry off fouled water. In this division of plumbing more care and ingenuity have to be exercised by the plumber than in any other line of the trade, for it is with this division more than any other that the question of general public health is concerned. Sewage is a constant menace to health and it is the carrying off of refuse upon which the manufacturers have turned their inventive faculties. Though water-closets have been in use as long as have bath-tubs, no special attention was paid to their improvement in construction till 1775, when the first patent was taken out in England by a watchmaker, named Alexander Cummings. This was of the siphon-trap style, and in 1778 was followed by a closet with a valve which worked on a hinge at the bottom of the bowl, the invention of Joseph Bramah. In 1792 another patent was granted for a valve closet supplied with a tank, the hopper of which was flushed by pressure on the seat. From that time the inventions were many and various, until at the present time we have valve closets, pan closets, plunger closets, hopper closets, cistern closets, siphon closets, and latrines. The old-fashioned pan closet, used almost universally many years ago, was one of the most unsanitary of all the plumbing fixtures in use, and because of its filth and stench has been generally discarded. It consisted of a metal pan which worked on hinges, and when let down emptied the contents into the discharge pipes. Then came the valve and plunger closets, which were



## PLUME-MOTH — PLUMIER

later superseded by the siphon closets. The valve closet takes its water from the main service pipe, whereas the cistern closet receives its supply of water in the tank from the main, and it is then discharged in the bowl by pulling a hanging chain attached to a lever, which raises the valve in the cistern.

Water-closets are now most generally constructed of glazed earthenware, some are made of the finest bone china, and others again are made of cast-iron for sake of economy. In cheap flats, however, the old-styled closed plumbing has given way to the most modern sanitary appliances, and open work is generally to be found even in the poorest, because of its cleanliness, healthfulness, and ease of access to repair.

Having described the various appliances which are to a certain degree familiar to all, the next part of the general sanitary system to be considered is the arrangement of pipes and appliances which connect the basins, sinks, and water-closets with the general sewer. Ventilation is one of the most important subjects which the sanitary plumber must understand. How to prevent gases arising from sewers—for where there are sewers there is sure to be sewer-gas,—and how to prevent the air in a room from becoming foul, have been constant sources of trouble to the modern sanitary plumber, and that he has solved these problems has probably resulted in more benefit and insured the public against more harm from diseases attendant upon these evils than any other one thing. It is an indisputable fact that the wise and exact observance of these sanitary laws has been a potent factor in materially reducing the death rate in our larger cities.

In this system of pipes the most important object is to prevent the air within them from gaining access to the building. This is most generally done by means of a trap or depression in the pipe, or by making the internal pipes gas-tight. The inverted siphon, sealed by water lying in the bend, is probably the best form of trap. Fresh air should have free access to the pipes, the air of the sewer should be shut off from that of the pipes within the house, and fouled water should be immediately and completely removed from the vicinity of the building. The ventilation largely affects the methods of connecting the main drain with the soil-pipes. The most general and easiest method of ventilating the soil-pipe is to extend the drain pipe to a point above the roof, and through this the current of air, which comes in at the manholes in the street and passes along the street sewers, flows upward and out. The method is most effective where the street sewers are constructed on the "separate" system, but where the street sewers are built on the "combined" plan, it is preferable to have a trap on the house sewer in connection with the fresh air inlet, because of the fact that the foul-air currents are thus diverted from the interior pipes and a current of fresh air is forced upward through the soil and ventilating pipe.

Waste pipes should be of lead, though sometimes cast or wrought-iron is preferable and the soil, waste, and ventilating pipes should be exposed as much as possible for purposes of inspection or repair. The main house drain, and the soil pipe should be of heavy cast-iron with

lead-calked joints, and all iron pipes and fittings should be coated with coal-pitch varnish, both inside and outside. If plumbing work be carried out on the ideas set forth, with proper traps, light, ventilation, simplicity, accessibility, good workmanship and a high grade of material throughout, the public health will properly be insured against the ravages of disease so common before the improved appliances came into vogue.

Another distinct division of the plumbing trade is the carrying of steam in pipes throughout a building. Prior to 1840 and even as late as the Civil War, the growth of steam heating had not assumed any great proportions. English inventors had made many attempts at steam heating by means of small pipes connected with boilers, on the theory that this would create a high temperature. But this soon gave way to the low pressure system because of the fact that there was little or no wear upon the apparatus, and the generation of the low pressure saved fuel. Joseph Nason, of New York, and J. J. Walworth, of Boston, were largely instrumental in the earlier development of the industry. Boilers were first used, but these were quickly followed by radiators constructed of wrought-iron tubes, both vertical and horizontal. In 1865 the manufacturers began to make heating boilers and radiators from cast-iron, and the manufacture of steam and hot-water furnaces has become an industry of great importance. The development of the modern office building has in a large measure added to the success of this branch of the trade, for it is in these that this system of heating is carried to its greatest degree of perfection. The boilers used in these buildings are of wrought-iron or steel, because the running of elevators, electric lights and pumps, necessitates that a high pressure be maintained on the boiler.

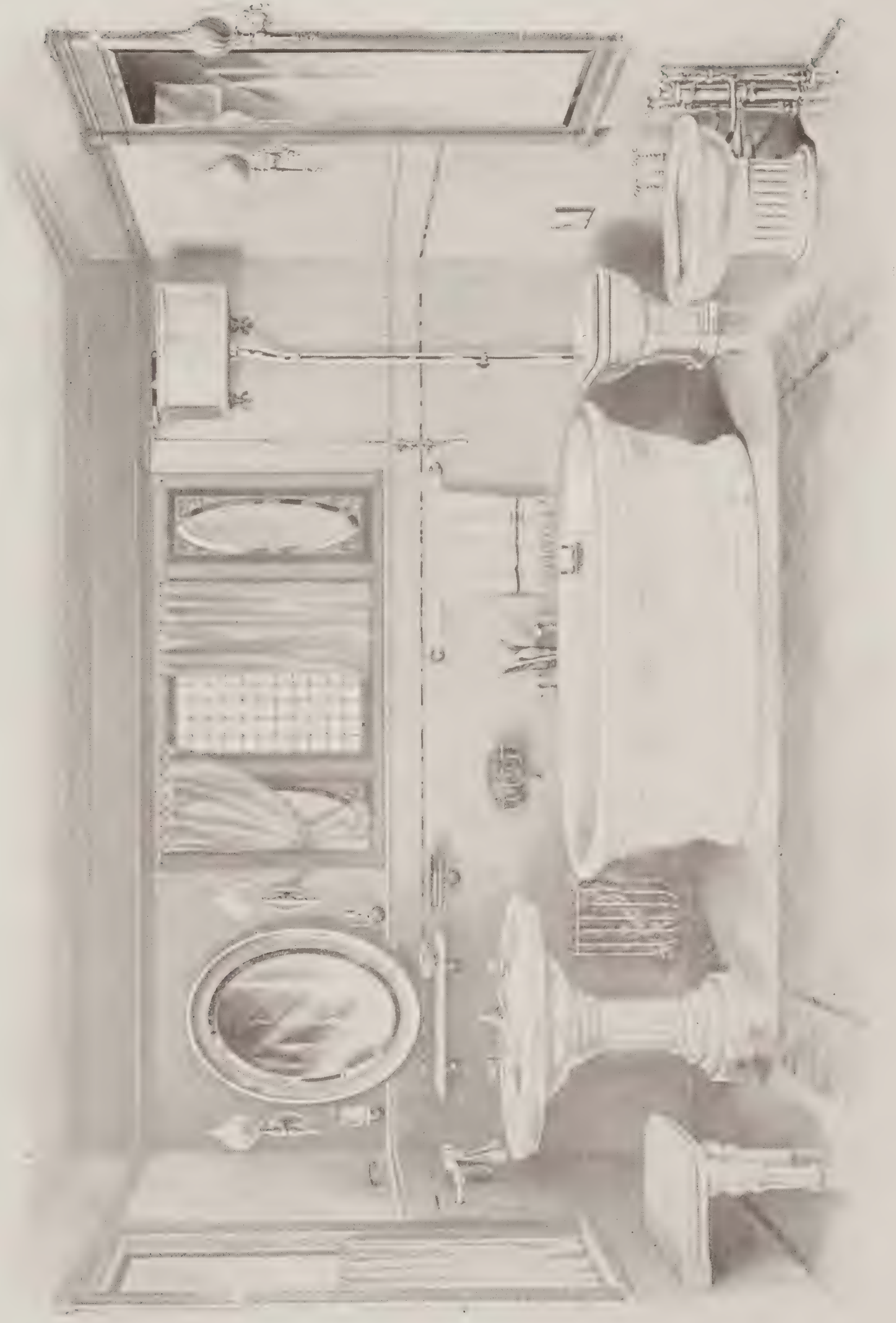
The statistics for this industry prior to the Civil War are meagre, but in 1840 the amount of business did not exceed \$200,000 on an invested capital of \$75,000. In 1860 the number of plumbing and gas fitting, and plumbers' supply factories was 170; capital invested, \$676,400; employees, 1,098; wages, \$415,590; cost of materials used, \$786,733; value of product, \$1,698,920. In 1890 the number of establishments had increased to 5,449; capital, \$39,013,354; value of product, \$92,866,389. In 1900 there were 12,050 establishments, with \$60,709,792 capital, and products valued at \$146,623,752. See **BOILER**; **BATH**; **DRAINAGE**; **SANITARY ENGINEERING**; **SANITARY SCIENCE AND PUBLIC HEALTH**; **VALVES**; **WATER, ITS RELATION TO DISEASE**; ETC.

**Plume-moth**, or **Featherwing**, one of the small moths of the family *Pterophoridae*, allied to the clothes-moths, which are readily distinguished from all others by the fact that their wings are deeply cleft, so as to resemble five feathers on each side of the body.

**Plumed Knight**, **The**, a name applied to James G. Blaine (q.v.). It was first used in a speech made by Colonel Robert G. Ingersoll, when nominating Mr. Blaine for the presidency in 1876.

**Plumier**, **Charles**, shärl plü-mē-ä, French botanist: b. Marseilles, France, 1646; d. Santa Maria, near Cadiz, Spain, 1704. He studied under Joseph de Tournefort and in 1689 went





Courtesy J. L. Mott Iron Works

A MODERN BATHROOM.







to the West Indies, engaged in botanical researches under the government and on his return published 'Description des Plantes de l'Amérique' (1693). Subsequently in 1693 and 1695 he made voyages to America at the request of the king, and he was about to sail on a fourth voyage when he died. His 'Traité des Fougères de l'Amériques' (1705) is still an authority; among his other works are many valuable manuscripts in the library of Paris and in the Jardin des Plantes, and 'Nova Plantarum Americanarum Genera' (1703). Consult Haller, 'Bibliotheca Botanica.'

**Plum'met**, or **Plumb-line**, a leaden or other weight let down at the end of a cord to regulate any work in a line perpendicular to the horizon, or to sound the depth of anything. Masons, carpenters, etc., use a plumb-line fastened on a narrow board or plate of brass or iron to judge whether walls or other objects be perfectly perpendicular, or *plumb* as the artificers call it. Near a range of high mountains the plumb-line, as can be shown by special arrangements, is not perfectly true, but inclines toward the mountains; and officers in charge of the United States Coast and Geodetic Survey among the Hawaiian Islands, have observed that the deviation of a plumb-line from the vertical is greater in the case of mountains, in an island than in continental mountains, and greater in the neighborhood of extinct volcanoes than in that of active volcanoes. In given localities the plumb-line also varies according to the ebb and flow of the tide.

**Plumptre**, plūmp'tr, **Edward Hayes**, English theologian and scholar: b. London 6 Aug. 1821; d. Tunbridge Wells 1 Feb. 1891. He was educated at Oxford, and was successively chaplain at King's College, London (1847), professor of pastoral theology there (1853), and professor of exegesis there in 1864. He was also appointed prebendary of St. Paul's, London (1863), rector of Pluckley, Kent (1869), and vicar of Bickley, Kent, in 1873. In 1869-74 he was one of the revisers of the Old Testament and was appointed Dean of Wells in 1881, a position which he held until his death. Among his published works are: 'Lazarus and other Poems' (1864); 'Master and Scholar,' verse (1866); 'Christ and Christendom' (1867); an excellent verse translation of Sophocles (1865), and a similar one of Æschylus (1868); 'Biblical Studies' (1870); 'The Law of Progress in Theology' (1876); 'St. Paul in Asia' (1877); 'Movements in Religious Thought: Romanism, Protestantism, Agnosticism' (1879); 'Theology and Life' (1884); 'Things New and Old,' verse (1884); 'The Spirits in Prison' (1884); a verse translation of the *Commedia* and *Canzoniere* of Dante (1886-7); 'Wells Cathedral and its Deans' (1888); 'Life of Bishop Thomas Ken' (1888).

**Plun'ket**, **William Conyngham**, 1st BARON PLUNKET, British statesman: b. Enniskillen, Ireland, 1 July 1764; d. Old Connaught, Wicklow, Ireland, 4 Jan. 1854. He was graduated from Dublin University in 1784, admitted to the bar in 1787 and in 1797 became king's counsel. In 1789-1800 he sat for Charlemont in the Irish Parliament and acquitted himself with much credit until the extinction of that body. He was appointed solicitor-general in 1803 and appeared for the prosecution at the trial of Robert Emmet; in 1805 he was appointed attor-

ney-general for Ireland and in 1807 and 1812-22 sat in the British House of Commons, where as a Protestant he made a resolute fight for Catholic emancipation. In 1822 he was raised to the peerage, was attorney-general of Ireland 1822-7, chief-justice in 1827-30 and lord-chancellor from 1830-41, when he retired from public life. Consult: David Plunket, 'Life, Letters, and Speeches of William Conyngham Plunket' (1867).

**Pluralism**. This term is used in current philosophical discussion to denote the view that regards the world as composed of a number or plurality of beings of distinct and independent nature. It is thus opposed to Monism (q.v.), which asserts that there is only one ultimate form of reality (as for example, with Spinoza, who regards all finite things as modes or manifestations of one substance, or with the idealism of the present day which interprets all forms of existence as parts of an Absolute Experience). In some sense both Monism and Pluralism must be true; that is, in some sense the world is one, a single universe, and in some sense it is composed of many various parts. The ultimate problem of philosophy is to define the sense in which each of these propositions is true, to reconcile the point of view of the one with that of the many.

The practical motive in the opposition between Monism and Pluralism lies chiefly in the necessary implications of these theories regarding the place and importance of the human individual in the world. Pluralism is a protest against a Monism that would merge the many individuals in a one all-embracing absolute system, and thus leave no place for their independent life and power of free initiative. Against the "block world" of Monism, the Pluralists insist on the separateness and uniqueness of the personal life of the human individual, which cannot be reduced to a mere part or element in a larger whole. On the other hand, the Monists point out that through over-emphasizing the independence and separateness of individuals, the Pluralists are unable to reach any intelligible conception of a system or universe of things, or to discover any common standard of truth or of conduct.

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**Plush**, a textile fabric having a cut nap the same as velvet or fustian.

**Plutarch**, ploo'tärk (Gr. Πλούταρχος), Greek writer: b. Chæronea, Bœotia, about 46 A.D.; d. there about 125. He studied philosophy under Ammonius, a peripatetic philosopher of Attica, in 66 A.D., which is the only indication of his age. He several times visited Rome, where, during the reign of Vespasian he remained for some little time, giving lectures in philosophy and collecting materials for his 'Lives.' He spent his later years at Chæronea, where he had a priesthood and was also an archon and building-inspector. His 'Parallel Lives of Illustrious Greeks and Romans' is the work to which he owes his fame. The lives are written in pairs, one Greek and one Roman, followed by a comparison of the two, which in some instances is wanting. A few of the 'Lives' themselves are lost. In these 'Lives' Plutarch is said to have quoted 250 authors, the works of many of whom are lost. The work is chiefly intended for the illustration of character, and as he makes use of incidents for this purpose without regard to their



relative value, is only partially serviceable for historical purposes. In the arrangement of his incidents he does not always follow a chronological order. Their excellence consists mainly in their fidelity in biographical portraiture. They traverse all of the classical antiquity, are the prime authority, and the only one, for numberless factors, and contribute more, perhaps, along certain lines to the knowledge of the ancient world than does any other one work. A knowledge of them was long considered indispensable to culture. A Latin collection, consisting of translations made by different persons of the separate lives, was printed in Rome in two volumes folio in 1470. The first edition of the text was printed in Florence in 1517. An edition by Bryan, with Latin translation (completed after his death by Du Soul), was published in 1729. There are editions by Coraes (1809-15), Sintenis (1839-46), and Dübner (1846-7). Among translations there is the fine French translation by Amyot (1559), and there is of this the worthy English version by Sir Thomas North (1579), characterized as "Shakespeare's storehouse of learned history," since to it the great dramatist was indebted for his outlook on classical history and some of his finest characters and plots, as also one by Evelyn, Garth, Creech, and others, with a life by Dryden (1638-86); and one by John and William Langhorne (1770, with several subsequent improved editions). The translation called Dryden's was corrected and revised by A. H. Clough, and published in 1859. George Long has translated and annotated some of the 'Lives.' Plutarch's other works, about 60 in number, are generally classed as 'Moralia,' though some of them are narrative. Philemon Holland executed an English translation of the 'Morals' (1603), and there is also a translation revised by W. W. Goodwin (1874-8). An edition of all the works of Plutarch, by J. C. Hutten, appeared at Tübingen (1791-1805). There is also a Paris edition with Latin translation (1862-77). The best text of the 'Moralia' is that of Bernardakis (1888-97). The name Plutarch is sometimes given to a collection of lives of distinguished men. Consult also Volkmann, 'Leben, Schriften, und Philosophie des Plutarch' (1869).

**Plu'teus.** See LARVA.

**Pluto**, ploo'tō, in Greek mythology, the giver of wealth, or Hades, the god of the lower world. The former name gradually superseded the latter, which was more commonly used by the poets. He was the third son of Cronus and Rhea, a brother of Zeus (Jupiter) and Poseidon (Neptune), and to him, on the partition of the world, fell the kingdom of the shades. But there was another view of his character. He became a benevolent being, who held in his hand the keys of the earth, and blessed the year with fruits; for from the depths of the earth proceed the grains and the plenty which attends them. He fought with his brothers against the Titans, and received from the Cyclopes, whom he had released, the helmet that makes its wearer invisible, which he lent to Hermes in the war of the giants, and to Perseus in his expedition against the Gorgons, and which afterward came into the possession of Meriones. He judges every open and secret deed, and to him are subordinate the three judges Æacus, Minos, and

Rhadamanthus. The cypress, the box, the narcissus, and the plant adiantum (maiden-hair) were sacred to him: oxen and goats were sacrificed to him in the shades of night, and his priests were crowned with cypress. He is represented in gloomy majesty, his forehead shaded by his hair, and with a thick beard. His head is sometimes covered with a veil. He frequently also wears his helmet, or a crown of ebony, or a wreath of adiantum or narcissus. In his hand he holds a two-forked sceptre, a staff or a key; by his side is Cerberus. He is either seated on a throne of ebony or in a chariot. Since he did not heed sacrifice or prayer, he was worshipped only on rare occasions. The Romans identified him partly with Orcus, partly with Dis. See PERSEPHONE.

**Pluton'ic Rocks**, those igneous rocks which were formed at great depths beneath the surface of the earth, under pressure. They have usually a distinctly crystalline structure due to their having cooled slowly, and are contrasted with volcanic rocks which, while also of igneous origin, have been poured out at or near the surface of the earth and have solidified there. The granites are the chief of the plutonic rocks.

**Plutus**, ploo'tūs, Greek god of wealth, son of Iasion and Demeter. He was blinded by Zeus in order that he might not confer riches on the good alone. In Greek statuary he is represented as a boy with a cornucopia symbolically indicating that through agriculture comes wealth. His residence is beneath the ground and this has sometimes confused his identity with that of Pluto. He comes to mortals weak and lame, but departs from them with winged feet.

**Pluviose**, plü-vē-ōz, in French chronology, the name adopted, in October 1793, by the French Convention for the fifth month of the republican year. It commenced on 20 January and was the second winter month.

**Plymley**, plīm'lī, **Peter**, pseudonym of Sydney Smith (q.v.). In 1807-08 he published 'Letters on the Subject of the Catholics to my Brother Abraham by Peter Plymley,' which enjoyed a wide circulation and greatly furthered the cause of Catholic emancipation.

**Plymouth**, plīm'ūth, England, an important seaport and commercial town of Devonshire, on Plymouth Sound, between the estuaries of the Plym and Tamar, 36 miles southwest of Exeter. Devonport on the west, Stonehouse in the middle, and Plymouth proper on the east, constitute the aggregate known as "The Three Towns." Devonport has on the west the Hamoaze or lower part of the Tamar estuary, and is divided from Stonehouse and Plymouth proper by an inlet crossed by several bridges. (See **STONEHOUSE** and **DEVONPORT**.) Plymouth extends from Stonehouse on the west to the Plym or Catwater on the east. The site is uneven, consisting of a central hollow and two considerable eminences, one on the north, and the other, called the Hoe, on the south, laid out as a promenade and recreation ground, from which a magnificent view is obtained. On the Hoe has been re-erected (Smeaton's) old Eddystone lighthouse, and there are also here a statue of Sir Francis Drake, and a memorial of the Armada. At the east end of the Hoe, on a bold headland, stands the citadel erected in the time of Charles II. The older parts of the town consist of nar-





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PLYMOUTH ROCK.







## PLYMOUTH

row and irregular streets, devoid of architectural beauty, and often steep and winding. But in the newer parts and suburbs many handsome terraces and villas have been erected. The public buildings include the guildhall, a handsome Gothic building; the Royal Hotel and theatre, in the Grecian style; the post-office; the custom-house, the exchange, the Athenæum, the Mechanics' Institute, the Plymouth and Cottonian public library, containing 10,000 volumes, and a collection of original drawings, prints, paintings, and artistic articles, the grammar and other endowed schools, the Public Dispensary, Female Penitentiary, Eye Infirmary, South Devon and East Cornwall Hospital, etc. The laboratory and headquarters of the Marine Biological Association are located here. Among ecclesiastical buildings are the two parish churches, Saint Andrew's church, a fine Gothic building of the 15th century containing some fine monuments, and Charles' church, of the 17th century, with an elegant spire; Sherwell Congregational chapel, and the Roman Catholic cathedral.

The manufactures include soap, sail-cloth, brushes, Roman cement, earthenware, rope and twine, etc., and there are also ship-building yards, foundries, two sugar refineries, breweries, starch-works, and flax, saw, and flour mills, together with limestone quarries. The fisheries, chiefly of whiting, hake, and mackerel, are very productive. The trade also, both coasting and foreign, is very important. Steamers ply regularly to North America, the Cape, Australia, New Zealand, the West Indies, etc. The parts of the port chiefly appropriated for mercantile shipping are Sutton Pool and Mill Bay, particularly the latter, where there are extensive wet-docks, and the largest vessels lie in safety along its fine pier and pontoon even at low water.

Plymouth owes its celebrity chiefly to its importance as a great royal naval station, for which the spaciousness of its sound renders it admirably suited. Originally, however, the sound, about three miles wide at its mouth, being open to the southwest winds, left vessels at anchor exposed to the greatest danger. With the view of protecting the anchorage from the heavy swell of the sea, the stupendous Plymouth breakwater was undertaken, and finally completed at an expense of about \$10,000,000. On the west end of the breakwater a lighthouse, 68 feet above the platform, and visible at the distance of eight miles, except in foggy weather, has been erected, but the entrance into the sound is guided by the still more celebrated Eddystone lighthouse, which stands on a large cluster of rocks in the channel opposite to it. To defend the port an iron-cased fort was built near the breakwater, and Saint Nicholas, or Drake's Island, within the breakwater, has been furnished with strong fortifications, mounted with heavy guns. Various other forts and batteries also defend the place. The chief naval establishments are in Devonport and Stonehouse, the former having the royal dock-yard for building and repairing ships, the steam-yard for machinery and boilers, etc.; while Stonehouse has the victualing yard, naval hospital, marine barracks, etc. The Hamoaze is a favorite anchorage for men-of-war.

Plymouth, originally a fishing village, bore in very early times the name of Tamarworth, which, after the Conquest, was changed to that

of Sutton, or South Town. It had become a considerable town under its present name in 1438, when a charter, confirming its old and granting many new privileges, was conferred upon it by Henry VI. From Elizabeth it obtained a new charter through the solicitation of Sir Francis Drake, and on the threatened invasion of the Armada the British fleet had its rendezvous here. Bonaparte arrived here in the Bellerophon in 1815. Pop. (1901) 107,509. Consult the histories of the town by Worth (1871) and Williams (1898).

**Plymouth, Mass.,** town, county-seat of Plymouth County; on Plymouth Harbor, a part of Massachusetts Bay, and on the New York, N. H. & H. R.R.; 35 miles southeast of Boston. It was here that the Pilgrims landed from the Mayflower in December 1620, and established the first permanent colony in New England. The Plymouth Rock on which they first landed is carefully preserved, and is now covered by a granite canopy. Other places of interest in the town are Pilgrim Hall, where books, pictures and other valuable relics of the early days of the town are kept, and Cole's Hill and Burial Hill, where many of the first settlers are buried. Plymouth also has the national monument to the Pilgrims, dedicated in August 1889. Its central figure is a granite statue of Faith, with the four figures of Morality, Law, Education, and Freedom at the base; the height of the monument is 81 feet. The town has a variety of manufactures; they include duck, cordage, woolen goods, tacks, wire, nails and electrical supplies. The harbor, though large and well protected, is shallow; there is some coasting trade, and the fisheries are of considerable importance. On account of its beautiful situation and historic interest Plymouth is also a popular summer and tourist resort. The waterworks are owned and operated by the town. Pop. (1890) 7,314; (1900) 9,592. Consult: Banvard, 'Plymouth and the Pilgrims'; Davis, 'History of the Town of Plymouth' (1885); Bradford, 'History of Plymouth Plantation' (1898). See MASSACHUSETTS.

**Plymouth, N. H.,** town, one of the county-seats of Grafton County; on the Pemigewasset and Baker rivers, and on the Boston & Maine railroad; 40 miles north-northwest of Concord. It is in a region noted for fine scenery, and is a popular summer resort. It has a number of manufactures, including gloves, shoes, boxes, lumber, etc. It contains the county courthouse where Daniel Webster pleaded his first case; and has a public high school, and a public library. It is also the seat of the State Normal School, and of the Holderness School for Boys (Episcopal). Pop. (1890) 1,852; (1900) 1,972.

**Plymouth, N. C.,** town, county-seat of Washington County; on the Roanoke River, a few miles from where it enters Albemarle Sound, and on the Atlantic Coast Line Railroad, 105 miles east of Raleigh. It fell into the hands of Federal troops in 1862, was taken by the Confederates in April 1864 with the aid of the Albemarle (q.v.), and was reoccupied by the Federals in October. It is the trade centre of an agricultural region and ships lumber, cotton, rice and vegetables. It is the seat of a State Normal School. Pop. (1890) 1,212; (1900) 1,011.



## PLYMOUTH

**Plymouth (N. C.), Engagements at.** When Gen. Burnside had occupied Roanoke Island and Newbern in February and March 1862, the Union gunboats became active in patrolling the waters of North Carolina and seizing the coast and river towns. Plymouth was occupied in June by Lieut. C. W. Flusser, United States Navy, and was held by him until relieved 15 June by a company of the 9th New York infantry; 10 Dec. 1862 the town was held by about 300 men under command of Capt. Ewer, 3d Massachusetts infantry. Early that morning Ewer was attacked by Lieut.-Col. John C. Lamb, with the 17th North Carolina, a few cavalry, and some artillery, in all about 600 men. Ewer's pickets were quickly driven in, and his men took refuge in the custom-house. Lamb's artillery opened fire; the town was fired in several places; and the gunboat Southfield, lying abreast of the place, received a shot in her boiler, which disabled her, and she drifted down the stream. The gunboat Commodore Perry coming up, Lamb retired after being in the town about an hour and reducing most of it to ashes. From 10 to 13 March 1863 the 17th North Carolina hovered about the place and made demonstrations upon it, but the regiment retired when the gunboats came up from Albemarle Sound. The gunboats had been relied upon to hold the place, but it was now strongly fortified on the land side and garrisoned, and early in April 1864 was held by Gen. H. W. Wessells, with four regiments of infantry, detachments of cavalry and artillery, in all about 3,000 men. As before, the principal reliance for the defense of the place was the navy.

In the spring of 1864 the Confederate authorities at Richmond determined that an attempt should be made to recapture Plymouth, and Gen. R. F. Hoke was put in command of a division for that purpose, and was to be assisted by Capt. J. W. Cooke of the navy, with the Albemarle then nearly completed. The Albemarle was an iron-clad vessel, similar to the Merrimac, carrying two heavy guns, and was built at Edwards Ferry, on the Roanoke, 30 miles below Weldon. She was built in a cornfield, and all the old iron in that section of the country was collected to make her armor. Hoke's division proceeded to the vicinity of Plymouth, drove in Wessell's pickets 17 April, surrounded the place on the land side from the river above to the river below, opened with artillery, made assaults on parts of the line on the 18th, which, with the aid of the gunboats, were repulsed, and prepared to storm the works as soon as the Albemarle could clear the river front of the Union vessels protecting the place with their guns. On the 18th the Albemarle left Hamilton, passed down the Roanoke and, favored by unusually high water, ran over obstructions placed in the river, ran past heavy shore-batteries, and at 3 A.M. on the 19th discovered the Union gunboats Miami and Southfield lashed together about half a mile below the town. Capt. C. W. Flusser was in command of the two vessels and had lashed them together with long spars, with chains festooned between them, it being his intention to get the Albemarle between the two vessels, which would have placed the Confederate vessel at a great disadvantage. Cooke avoided this by running the Albemarle close to the southern shore, and

then, suddenly turning toward the middle of the river, dashed obliquely into the side of the Southfield, the long knife-like prow of the Albemarle penetrating 10 feet, making a large opening into the side of the Southfield and carrying her to the bottom within a few minutes, with a part of her crew. The Albemarle's prow had become entangled with the Southfield. The Miami, close alongside, opened with her heavy guns, and a shell fired by Flusser struck the Albemarle, rebounded and exploded, killing Flusser instantly. Lieut. French took command, and attempted to board the Albemarle, but was repelled, and the Miami withdrew from the contest and ran down into Albemarle Sound. Next morning the Albemarle opened fire upon the forts and works near the river, and Hoke, moving around to that side, attacked the works. After being several times repulsed, he carried them, Wessells surrendering his entire command. In killed, wounded, and captured the Union loss was 2,834 men. The Confederate loss is not fully known, but Ransom's brigade alone suffered a loss of about 500 killed and wounded.

Soon after the capture of Plymouth Gen. Hoke was ordered to the army in Virginia, but the place was held by the Confederates in some force, aided by the Albemarle. On 5 May 1864 the Albemarle, with two other vessels, ran down the river into Albemarle Sound and engaged a Union fleet of seven vessels, inflicting much damage, and returned to Plymouth. There was no Union ironclad that could cross Hatteras Bar and enter the North Carolina sounds, no other vessels could cope with the Albemarle, and it was reserved for Lieut. W. B. Cushing (q.v.) to execute a plan for her destruction. On the night of 27 Oct. 1864 he entered Roanoke River with two steam launches, each carrying a 12-pound howitzer and a torpedo. The launches carried 20 men, well armed with revolvers, cutlasses, and hand-grenades. Passing near the pickets on the shore, Cushing approached the Albemarle at 3 A.M. and was hailed and fired upon with musketry from the shore and the vessel. Discovering that there was a circle of logs around the ship and about 10 feet from it, he turned back, and when about 100 yards away again turned, at full headway struck the logs and slid over them, and, in face of a crashing fire of canister and musketry, exploded a torpedo under the vessel and tore a large hole in her, "big enough to drive a wagon in," her commander says, and she soon settled to the bottom. Cushing with his men took to the water, he and one or two others escaping, while two were drowned and 11 captured.

On the 29th October Commodore Macomb, with his fleet, went up Roanoke River, and, arriving at the wreck of the Southfield, exchanged shots with the Confederate batteries, but finding that the channel of the river had been effectually obstructed, he returned, next day went by way of Middle River into the Roanoke, and on the morning of the 31st engaged the batteries on shore, which were supported by musketry from rifle-pits and houses. After an hour's contest, in which 10 vessels were engaged, a Confederate magazine was blown up; the works were abandoned, and the Union forces took possession of the town. Consult: 'Official Records,' Vol. XXIII.; 'Naval War Records,' Vols. IX. and X.; the Century



## PLYMOUTH — PNEUMATIC TOOLS

Company's 'Battles and Leaders of the Civil War,' Vol. IV.; Soley, 'The Blockade and the Cruisers.'

E. A. CARMAN.

**Plymouth, Pa.**, borough, Luzerne County, on the Susquehanna River, and on the Delaware, Lackawanna & Western railroad; four miles west of Wilkesbarre. It was first settled in 1768, and during the trouble between Pennsylvania and Connecticut in regard to boundaries (1799) was claimed by both States. In the last decade of the 19th century, its growth was particularly rapid. It is in the great anthracite coal region of Pennsylvania, and its chief industries are the mining and exporting of coal; it also manufactures drills and other mining machinery, and hosiery. It contains a borough and a township high school and a parish school. Pop. (1890) 9,344; (1900) 13,649.

**Plymouth Brethren**, a religious sect which had its rise in the British Isles about 1827, when the Rev. John N. Darby, a minister of the Episcopalian Church of Ireland, associated himself with a group of dissenters in Dublin and formed a religious society of Brethren on a platform of Evangelical Calvinism. Similar local societies existed in various towns of Ireland and England, and Darby, while visiting the society at Plymouth, won over to his views a large number of persons, among them two or three clergymen of considerable distinction, one of them the Rev. Benjamin Wills Newton, another the Rev. James L. Harris, and the third the noted Biblical scholar the Rev. Dr. Samuel Prideaux Tregelles. Plymouth now became the principal centre of the movement, and hence the popular title of the sect, Plymouth Brethren: the official title is "Brethren" or "Christians." A weekly newspaper was edited by Mr. Harris, and the sect made rapid progress, congregations being formed in every considerable town in England. In 1838 Mr. Darby went on an evangelizing mission to Switzerland and spent seven years in that country, chiefly in French Switzerland, where his success in gaining disciples and forming congregations was extraordinary among the Methodists and other dissenters: in Germany, too, in German Switzerland, in Italy and in France his opinions were received with no small favor: but French Switzerland, and in particular Geneva, Lausanne and Vevay, was his stronghold. When he returned to Plymouth in 1845 he sought to depose Mr. Wills Newton from the headship of the community there, charging him with a disposition to introduce priestly rule: but most of the Brethren upheld Mr. Newton, and Darby thereupon formed a separate assembly. At Bristol in 1848 there was a similar division, but this time into three sects, those siding with Darby, those siding with Newton, and those siding with neither. Of these divisions there were subdivisions later. Four divisions of Plymouth Brethren had in the United States churches and membership as follows, in the year 1900: Div. I. churches 109, communicants 2,289; Div. II. churches 88, communicants 2,419; Div. III. churches 86, communicants 1,235; Div. IV. churches 31, communicants 718. The Plymouth Brethren hold that an official ministry is an unchristian institution; among them all the male members are on an equal footing, and have the right to exhort in the meeting; after the opening exercises—a hymn or prayer—there is usually a pause to wait for volunteer addresses. See RELIGIOUS SECTS.

**Plymouth Colony, The.** See MASSACHUSETTS, *History*; MAYFLOWER, THE.

**Plymouth Company, The**, in American history, a company formed in the 17th century, of Plymouth and Bristol merchants, and also called the North Virginia Company. It was incorporated in 1606, and obtained a charter from James I., with grant of land between Long Island and Passamaquoddy Bay. This company was the rival of the London Company. In May 1607, two ships were despatched to America bearing a company of colonists commanded by George Popham. An abortive attempt at permanent settlement was made on the Kennebec River, but Popham died and the remaining colonists returned home. The company still continued to exist till its reorganization in 1620 as the New England Company, or Council for New England.

**Plymouth Rock.** See MAYFLOWER, THE; PLYMOUTH, Mass.

**Plymouth Rock**, a fowl. See POULTRY.

**Plymouth Sound.** See PLYMOUTH, England.

**Plympton**, plimp'ton, **Almira George**, American author: b. Boston, Mass. She was educated in the private schools of Boston and has gained a reputation as an author of juvenile books. Among them are: 'A Willing Transgressor'; 'Penelope Prig'; 'Rags and Velvet Gowns'; 'Gerald and Geraldine'; 'In the Shadow of the Black Pine.'

**Plympton, George Washington**, American engineer and educator: b. Waltham, Mass., 18 Nov. 1827. He was graduated from the Rensselaer Institute of Technology, Troy, N. Y., in 1847 and was professor of engineering and architecture at the University of Cleveland in 1852, professor of mathematics at the New York State Normal College, Albany, in 1853-6, and in 1857-63 occupied the chair of physics and engineering of the State Normal School, Trenton, N. J. He has been professor of physics and engineering at Cooper Union, New York, since 1869 and director of the night school since 1879. He has also been professor of physics and engineering at the Brooklyn Polytechnic Institute since 1863, professor of chemistry and toxicology at the Long Island College Hospital 1864-86, editor of Van Nostrand's 'Engineering Magazine' in 1870-86, and has published: 'The Starfinder' (1878); 'How to Become an Engineer' (1892); etc.

**Plynlim'on.** See PLINLIMMON.

**Pneumat'ic Despatch.** See PNEUMATIC TUBES.

**Pneumatic Gun.** See ORDNANCE.

**Pneumatic Tire.** See BICYCLE; AUTOMOBILES.

**Pneumatic Tools** are a class of portable mechanical appliances operated by compressed air. The motor is self-contained, and they are generally worked by the hand. They are of two types—percussion and rotary. In the former the work is accomplished by rapidly repeated blows, and in the latter by a boring action. They are used for a great variety of mechanical operations permitting the actions of percussion and rotation, such as drilling, ramming, hammering, riveting, caulking, boring, screwing, expanding boiler tubes, and carving. A good representative of the percussion tools is the pneu-



## PNEUMATIC TUBES

matic hammer. It consists of a cylinder in which a piston works with a reciprocating (back and forth) action, actuated by compressed air admitted to and exhausted from the cylinder by suitably arranged openings.

A loose-fitting tool (such as a rivet-set, in case the appliance is employed as a riveter) is inserted in the front end of the cylinder to which the compressed air is conveyed by flexible hose connections, and through the handle at the rear. To operate, the device is held by the handle and the tool is pressed firmly against the work. The operator then admits the air-pressure into the cylinder by pressing on the throttle lever, and starts the reciprocating hammer which strikes the tool or rivet-set at each forward stroke. The action is similar to that of driving a chisel with a mallet or hammer, with the exception that the successive strokes are delivered with great rapidity, at a rate of speed as high as 20,000 blows per minute, and sound like a continuous buzz, the efficiency of the appliance being due to the frequency of the strokes rather than to the power of each individual stroke. Pneumatic percussion tools, in general, are made small enough to be operated by the hand, and they are adapted for various uses by simply replacing the tool piece at the front end of the cylinder by tools specially shaped to fit the particular kind of work. The arrangements for actuating and controlling the piston vary greatly in the different makes, but all of them belong to either the valve or the valveless form.

In the valve-hammers, a reciprocating valve acts in combination with the piston and regulates the admission and exhaust of the compressed air. They deliver a long stroke at a speed ranging from 1,500 to 3,500 blows a minute with great power, and are suitable for heavy riveting, chipping, and caulking purposes. In the valveless hammers, the striking piston acts as a valve and controls the admission of the air-pressure to the alternate ends of the cylinder. They deliver a short stroke at a very high rate of speed, generally over 15,000 blows a minute, and are suitable for stone carving, beading flues, light caulking, and other purposes requiring a light chipping action. Owing to their simpler construction, they last longer than the valve hammers, and are more economical in air consumption relative to the number of blows delivered. For clipping purposes, the speed is greatly reduced, and the piston is constructed to act on a hinged link so as to impart a pincer-like action to the clipping jaws. As riveters, they range from the portable sizes to heavy stationary machines. Any ordinary pneumatic hammer may be employed in riveting but such work is better accomplished, generally, by the regular U-shaped riveter designed for that purpose. (See METAL-WORKING MACHINERY.) In riveters the compressed air is used at a pressure of 125 pounds to the square inch, while in the other forms the intensity is somewhat less, generally about 90 pounds to the square inch. Rotary pneumatic tools are commonly known as portable pneumatic drills. In wood-working, they are used for boring and drilling; in metal-working, they are employed in the operations of tapping, reaming, screwing nuts on bolts, boring cylinders, expanding tubes, turning crank-pins, cleaning castings, grinding steam-pipe joints, etc. They are made in a large number of sizes rang-

ing from the light forms used for boring small holes, up to the large machines requiring a two or three-horsepower motive energy. Originally, they consisted of a small rotary engine with an attached feeding mechanism. Subsequently, to avoid the consequent waste of power, small reciprocating engines were designed, bringing them to the present form, in which they are used with marked economy for all purposes where heretofore the hand brace was employed. They are made in two forms—with single-acting or with double-acting oscillating cylinders, and work with an air-pressure ranging from 70 to 85 pounds to the square inch. In the former, the motor consists of two pairs of single-acting cylinders coupled to the opposite ends of a crank-shaft, the pinions of which gear with the spur-wheels on the tool-shaft. The whole mechanism is enclosed in a cylindrical metallic case. In the latter, two double-acting oscillating cylinders are geared to a crank-shaft carrying a single pinion which gears with a spur-wheel on the tool shaft. Another form—the Boyer piston drill—consists of a motor in the form of an oscillating engine composed of three single-acting cylinders carried in a rotary frame. The pistons being attached to a fixed shaft, the frame is caused to rotate by suitable gears, and imparts its motion to the tool-shaft. The compressed air connections are flexible hose similar to those used in the percussion tools. Other forms of pneumatic tools of special application are the hoist, jack, stay-bolt cutter, mud-ring riveter, "bull-dozer" press, paint sprayers, sheep shearers, and sand blasts. Their names define the purposes for which they are used. The hoist has largely replaced the ordinary hoisting chain; the jack is a modification of the hoist, and is used by being placed under the piece to be lifted. Pneumatic tools are of recent origin, and have been principally developed in the machine-shops of the United States, especially in connection with the repair departments of the railroads, but they are now being rapidly introduced in European and other countries also.

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**Pneumatic Tubes.** Pneumatic tubes are employed to despatch letters, parcels, telegrams, etc., to a distance, by the energy of compressed air. Their application was originally suggested by Denis Papin, in 1667, when he read a paper before the Royal Society of London, describing a plan by which the air in a tube was exhausted in such a way that the piston working in the tube would be drawn in the direction of the suction, pulling with it an attached carrier. His idea was taken up and developed by several inventors, with more or less success, up to 1854, when the Electric and International Telegraph Company, of London, built in that city the first pneumatic despatch system which was actually operated for commercial purposes. It consisted of a lead tube 220 yards in length and  $1\frac{1}{2}$  inches in diameter, in which the carriers were propelled in one direction only. Subsequently, the diameter of the tubes was increased to  $2\frac{1}{4}$  inches, which were arranged to send the carriers in two directions—outward from, and inward to, the central station. At the present time the English Postal Department alone operates over 60 miles of tubes, 40 miles of which are situated in the London district. In the English system,



## PNEUMATICS — PNEUMOGASTRIC NERVE

the tubes radiate from the central station to the branch stations located at various points, the larger stations being equipped with two tubes — one for outward and one for inward traffic, while the smaller stations carry on the work through a single tube. The out-going carriers are propelled by pressure and the incoming carriers are drawn in by the suction of a vacuum. The standard pressure used is about 10 pounds to the square inch, and a vacuum of about 6 pounds to the square inch, giving about the same speed in both directions. The tubes consist of lead pipes  $1\frac{1}{2}$  to  $2\frac{1}{4}$  inches in diameter, for interior use, such as the delivery of telegrams and parcels of small size, such as cash-carriers in stores, from one room to another in the same building; while the underground or street tubes are larger, ranging from  $2\frac{1}{4}$  to 3 inches in diameter. The  $2\frac{1}{4}$ -inch pipes weigh about 8 pounds per linear foot, and are made in lengths of 28 feet. When installed, they are enclosed in a cast-iron pipe 3 inches in diameter, made in sections of 9 feet. The air-pumps are driven by steam-engines, or by electric motors; those in the London district are worked by four 50 H. P. steam-engines. All of the carriers have gutta-percha bodies covered with felt, and are provided with buffers or pistons of felt attached to the front ends, which fit tightly in the tubes. The ends of the carriers are closed by elastic bands to prevent the messages from falling out, but they can be stretched sufficiently to allow the insertion of the message forms. The despatching and receiving apparatus originally consisted of very complicated double-sluice valve, but it has been superseded by the D-box, a contrivance much simpler in form, which allows communication at will with either the pressure or vacuum mains, so that it is available for both sending and receiving. The carriers run at a speed of about 25 miles an hour.

In Germany, the Siemens system is employed. Its first extensive use was made in Berlin, in 1865, when 5,670 feet of wrought-iron tubing,  $2\frac{1}{2}$  inches in diameter, were laid and connected the telegraph station with the Exchange. In this system, the tube forms a complete circuit, into one end of which the air is introduced under pressure while it is exhausted at the other end, thus maintaining a constant circulation, and also enabling the inserting and despatching of the carriers without temporarily shutting off the air current. The carriers were stopped at intermediate stations by placing a wire screen across the tube. The sending and receiving apparatus was constructed of two short pieces of tubing attached to a rocking frame so that either of them could be swung into the main circuit by the hand, whenever desired. One of them was open at both ends, and was used in sending; the other was provided with a wire screen at one end, and when swung into the line of the main tube, allowed the air to pass through but stopped the carrier. At the present time, Berlin has in operation about 30 miles of tubes serving about 40 stations. As in the first experimental line, the tubes are laid in circuits, each of which serves a certain number of stations, but the air instead of being kept in constant circulation is stored up in large tanks, and turned into the tubes whenever it is required to despatch a carrier. Paris and Vienna have systems similar to that of Berlin. The

carriers are run in trains despatched at 15 minute intervals, with a maximum speed of 23 miles an hour. They stop at all of the stations on the circuit so that the carriers belonging to each station can be taken off, and those for the succeeding stations put in.

In the United States, the first attempt to establish a pneumatic despatch system was made by Beach, about 1872, who undertook the construction of a tunnel 6 feet in diameter, under Broadway, New York city. His system was called the "atmospheric railway" (q.v.) and contemplated the running of a car capable of seating 10 persons, through the tube, by the propelling energy of air pressure generated by a revolving fan. The project was abandoned after the completion of a small section of the tunnel. In 1904 the systems installed by the United States Post-office Department were as follows: The Philadelphia lines connecting the city post-office with the Bourse, a distance of 2,974 feet, and its extensions to the terminal stations of the Pennsylvania, and the Philadelphia & Reading railroads, a total distance of about  $1\frac{1}{2}$  miles; and the New York city lines, connecting New York city post-office with that of Brooklyn, and with the Grand Central Station and the intermediate postal sub-stations, a total distance of about 10 miles. The installation is on the plan of the Batcheller system, very similar to that employed by the English. Compressed air at pressures ranging from 5 to 10 pounds per square inch is forced through wrought-iron tubes ranging from 6 to 8 inches in diameter. They are laid in double lines so as to allow traffic in opposite directions, and are provided with automatic sending and receiving apparatus at all stations. In addition to the lines operated by the government, they are extensively used by private concerns in a great many cities, of which, the systems operated by the Western Union Telegraph Company in New York city and Chicago are the most important.

*Bibliography.*—More detailed information may be obtained from the following named publications: 'Pneumatic Tube Service' (published by the Postmaster-General, Washington); Batcheller, 'The Pneumatic Despatch System'; Kemp, 'Year Book' (London, 1902); and various publications on the subject by the British Postal Service.

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**Pneumatics**, a former name for the science that discusses the properties of gaseous fluids. It is a branch of hydrodynamics (q.v.). See GAS; SOUND; WIND; WAVE.

**Pneumogastric Nerve**, the vagus, or tenth cranial nerve (see CRANIAL NERVES), the lung-stomach nerve. It is formed by the junction of from 10 to 15 filaments which arise in the medulla oblongata. They form a flattened band which passes out through the skull with other nerves and pursues its course down the neck behind the carotids, being in the same sheath. Below the clavicle the right and left pneumogastrics go in different directions. The right pneumogastric enters the chest-cavity in front of the subclavian artery, gains the back part of the root of the right lung, breaks up into a coarse series of branches, being joined by the sympathetic, and forms the posterior pulmonary



## PNEUMONIA—PO RIVER

plexus. From this two cords of nerve-tissue continue downward on the right side of the œsophagus. An œsophageal plexus is formed about this tube, into which fibres from both sides enter. The fibres then converge to form a single trunk; this passes through the diaphragm and spreads out on the posterior surface of the stomach. The left pneumogastric passes into the thorax between the left common carotid and left subclavian arteries. It forms a plexus for the left lung corresponding with the right side. Its terminal branch passes in front of the œsophagus, and is finally distributed to the front portion of the stomach. The nerve contains both sensory and motor fibres and its function is complex. It is concerned in the functions of the lower part of the œsophagus. It is the important nerve of respiration; is the great cardiac regulator; and is the chief motor nerve of the stomach.

Diseases of the pneumogastric are comparatively rare, but by reason of its wide distribution, and because many of its fibres are distributed to a great number of structures, partial affections are not uncommon. The pharyngeal branches are occasionally involved in diphtheria and in nuclear disease. The pharynx becomes immovable and anæsthetic. Food may lodge in the gullet or enter the windpipe, causing coughing and strangling. Sometimes fluids regurgitate through the nose. In the larynx paralysis of the fibres may produce a confusing series of symptoms, with cough, diminution or loss of voice, hoarseness, impairment of respiration, pain, etc. The specialist is alone able to determine which branches are involved. Affections of the pulmonary branches affect the nutrition of the lung, pneumonia usually resulting from destruction of the vagus. Protracted hiccup is an affection of the vagus, as is also bronchial asthma. Unusual rapidity of the heart action (tachycardia) is due to temporary loss of control of the vagus on the heart. Cardiac palpitation is due to much the same agency; it is frequently associated with impaired stomach functions and is very frequent in hysterical and neurasthenic affections. An abnormally slow pulse (bradycardia) is usually due to an excess of stimulation of the vagus. Angina pectoris (q.v.) is a severe and usually fatal affection implicating the pneumogastric nerve. The involvement of the gastric branches may result either in loss of motion or sensation or excess of each. Sobbing and vomiting are largely induced by excessive irritability of the vagus. Gastralgia is also associated with disorder in this nerve. Loss of function may result in serious impairment of motion and secretion, although the sympathetic nervous system makes an important part of the nervous supply of the stomach. See HEART; STOMACH.

**Pneumo'nia.** See LUNG, DISEASES OF.

**Pnom-Penh**, pnôm-pěh', Indo-China, capital city of Cambodia, 140 miles northwest of Saigon, on the confluence of the Me-Kong and the Ton-le-Sap, lying partly in the plain and partly on a slight elevation, from which it gets its name, signifying in the vernacular "hill of abundance." It is the commercial centre of Cambodia, being situated near the Buon Phlau or Quatre Bras, the meeting place of Cambodia's four water ways. A palace of the king, and almost royal dwellings of the Buddhist priests, as well as the home of the French resi-

dent, are on the hill; the low ground near the river is occupied by native huts. The main commerce of the city is carried on by the Chinese. Pop. (est.) 50,000.

**Pnyx**, nîks, in ancient Greece, a place in Athens where the people assembled to make decrees, pass laws, etc.

**Po**, pō (ancient PADUS, or ERIDANUS), the largest river of Italy, in respect both of its length and its volume of water. It rises on the confines of France and Piedmont in Mount Viso, one of the Cottian Alps, and flows rapidly eastward through Piedmont in the character of a mountain torrent, till, after having been augmented by several other mountain streams, it reaches Lombriasco. Here it begins to move more slowly and after passing Turin, becomes somewhat sluggish. It again flows eastward to the Adriatic Sea. It is about 400 miles long. In its lower course its banks are protected by levees and dikes, as the surface of the river is higher than the surrounding country. A number of rivers, chiefly from the Alps, flow into the Po. Its principal affluents are, on the left, the Clusone, Sangone, Dora-Riparia, Stura, Dora-Baltea, Sesia, Agogna, Terdoppio, Ticino or Tessin, Olona, Lambro, Adda, Oglio, and Mincio; on the right, the Vraita, Tanaro, Scrivia, Trebbia, Nura, Taro, Parma, Enza, Secchia, and Panaro. After receiving the Adda its average breadth is about 650 yards. Below Piacenza, which it passes on the right about lon. 9° 40' E., it is confined by artificial embankments, which are said to have originated with the ancient Etruscans, and notwithstanding the immense sums which have been expended upon them, and the engineering skill which has been exerted in order to render them perfectly secure, the most disastrous inundations have repeatedly taken place. The embankments themselves have added to the danger. The deposits made by the river are perpetually tending to raise the level of the water. This makes it necessary to make a corresponding increase in the height of the embankment, and the effect of these combined operations has been to lift the river so high above its natural bed that it is actually on a level with the tops of the houses in the city of Ferrara. The Po is well supplied with fish, including, among others, the shad, salmon, and sturgeon. The deposits brought from the mountains are increasing the extent of the delta, which advances into the Adriatic at the rate of 200 feet each year.

**Po River, Engagement on.** After two days' terrific fighting in the Wilderness (q.v.), with a loss of over 17,000 men, Gen. Grant concluded to continue the movement by the left, and on the evening of 7 May he put his army in motion for Spottsylvania Court House. The Second corps, under Gen. Hancock, the last to move, reached Todds' Tavern about 9 A.M. of the 8th, and intrenched, being on the right of the army. A reconnoissance to Po River, two miles distant, developed Confederate cavalry on the opposite bank. On the 9th Hancock moved up to the right of Warren's Fifth corps, and took position and intrenched on high ground overlooking the Po and the Shady Grove road. The left of Gen. Lee's line rested on a bend of the Po, and as reports indicated that he was moving in the direction of Fredericksburg, Hancock was ordered to examine the stream with a view to



## POA — POCAHONTAS

crossing it and making a reconnoissance along the Shady Grove road on Lee's left, crossing the river again by the Shady Grove or Block House bridge, or below it, in order to turn and attack Lee's left. The stream, some 50 yards wide, was crossed by Barlow's, Gibbon's, and Birney's divisions late in the afternoon, Birney meeting a stubborn resistance from cavalry and a battery. After crossing, three pontoon bridges were laid, and the troops were pushed toward the Block House bridge, Barlow in advance, but night coming on compelled a halt until morning, with Barlow's skirmishers close to the bridge. The orders for the 10th were that, while the rest of the army felt the Confederate position in front, Hancock was to ascertain the position and force of the enemy in his front and the location of his left flank, and to hold his corps ready to advance. At daybreak Hancock made a close examination of the Block House bridge with the design of carrying it by assault, but the Confederates (Mahone's division) had been sent to that point during the night, and had intrenched, commanding the bridge and its approaches. Therefore Brooke's brigade of Barlow's division went down the river to find a crossing, and Gen. Birney sent two regiments out on the Andrews Tavern road to cover Brooke's movement. About half a mile below the bridge Brooke threw across a regiment which, after going a short distance, discovered a Confederate line of strong earthworks occupied by artillery and infantry. At this time, about 1 P.M., Hancock received a despatch from Gen. Meade directing him to send two divisions to Gen. Warren's position for an assault with Warren on the Confederate lines at 5 P.M. Gibbon and Birney were withdrawn to the other side of the Po, and as Hancock was to command the movements of Warren's corps and his own, he accompanied them, leaving Barlow to hold the ground south of the river. When Birney began to withdraw, the regiments he had sent toward Andrews Tavern, having driven back Wade Hampton's cavalry, were attacked by infantry, and this evidence that Barlow was likely to be attacked caused Gen. Meade to order Barlow to be withdrawn, as he did not wish to bring on an engagement south of the Po. Hancock was directed to give the matter personal supervision. It was about 2 P.M. when Barlow began to withdraw, at which time Brooke's and Brown's brigades were south of the Shady Grove road, and Miles' and Smyth's brigades along the road, the left resting on a crest a few hundred yards from Block House bridge. In rear the ground was open back to the bridges, and swept by the artillery of Lee's left. As the withdrawal began Barlow was attacked; Heth's Confederate division of three brigades and a battalion of artillery, which had crossed the river below the Block House bridge, attacked Brooke and Brown vigorously as they were withdrawing, and was driven back with severe loss when the two brigades passed to the rear and took position on a wooded crest on the right of Miles. Heth followed closely, Miles and Smyth were now retired to a crest in front of the bridges, and all the artillery, except Arnold's battery, was withdrawn and put in position on the north bank of the river. Heth again attacked Brooke and Brown, and was again repulsed with heavy loss. During the heat of this contest the woods

on the right and rear of the two Union brigades took fire, and the flames approached so close that upon the second repulse of Heth the brigades were ordered to abandon their position, and fell back through the burning forest in good order. Many men were killed and wounded, numbers of the latter perishing in the flames. They immediately recrossed the river, under heavy artillery-fire. One gun of Arnold's battery, becoming entangled in the woods, was abandoned. Smyth's brigade was now crossed and deployed to protect the crossing of Miles; but before Miles could move, the Confederates opened a furious fire of artillery from the front and left. Under cover of this their infantry attempted to cross the open ground in front of Miles, but Miles held the infantry in check, and the many Union batteries on the north side of the river silenced the Confederate guns, and Miles, taking advantage of the repulse, withdrew in order by the two pontoon bridges, one of which was immediately taken up, the other destroyed, and the operation on the Po River was closed with severe loss on both sides. Consult: 'Official Records,' Vol. XXXVI.; Humphreys, 'The Virginia Campaign of 1864-5'; Walker, 'History of the Second Army Corps.'

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**Po'a.** See GRASSES IN THE UNITED STATES; PASTURE; PRAIRIE, etc.

**Poaching.** See TRESPASSING.

**Pocahontas**, pō-ka-hōn'tas, Indian princess: b. Virginia about 1595; d. England 21 March 1617. She was the daughter of Powhatan (q.v.), a celebrated Indian sachem in Virginia and chief of the Chickahominy tribe. She discovered the warmest friendship for the English colonists, and undoubtedly did render many services to the struggling outpost. Investigations have, however, cast doubt on the traditional narrative of the rescue by her of Captain John Smith (q.v.). Smith, during his explorations, was taken prisoner by Powhatan, and after six weeks sent back to Jamestown. But he makes no allusion to the familiar story until 1616, when Pocahontas was in England; although in his 'True Relation' (1608) he had testified to her services to the colony. In 1616, in a letter to the Queen, he says that "at the minute of my execution she hazarded the beating out of her own brains to save mine." But not until the appearance of his 'Generall Historie' (1624) does the tale appear in full elaboration. It has been thought that Smith's known tendency to embellishment and his desire to satisfy English curiosity led him to interpolate the story. Several writers have, nevertheless, contended for the general accuracy of Smith's account. It is argued, among other things, that it is very difficult to understand Smith's statements in the 'True Relation,' the employment of Pocahontas on difficult missions to the whites, and Pocahontas' own benefactions, such as the supplying of starving Jamestown with provisions, except on the supposition that Smith's narrative is substantially veracious. After Smith had left the colony in 1609 Pocahontas fell into the hands of an English expeditionary party (1613), who kept her as a valuable hostage. Her marriage to John Rolfe (q.v.) was solemnized in presence of the uncle of Pocahontas and her two brothers. This event relieved the colony from the enmity of Powhatan, and preserved peace be-



tween them. During her visit to England in 1616-17, Pocahontas attracted much attention, being apparently invested in English minds with quite a degree of royal dignity. She was often called the Lady Rebecca from the name received in Christian baptism. Consult Deane's edition of Smith's 'True Relation' (1866); Eggleston and Seelye, 'Pocahontas' (1879); Robertson and Brock, 'Pocahontas and her Descendants' (1887); Poindexter, 'Captain John Smith and his Critics' (1893); Fiske, 'Old Virginia and her Neighbors' (1897).

**Pocatello**, pō-ka-tě'lō, Idaho, city, county-seat of Bannock County; on the Port Neuf River, and on the Oregon S. L. and the Utah N. R.R.'s; about 135 miles north of Ogden, Utah. It is in a volcanic region, that has been made productive by irrigation. It has large railroad shops, machine shops, and stock-yards. There is an extensive trade in mining products, live-stock, and farm products. Pop. (1900) 4,046.

**Po'chard**, an English name for the male of a species of sea-duck (*Aythya ferina*), but often extended to both sexes and related species. It very closely resembles the American red-head duck, one of the book names of which is American pochard. The bill is broad and flat at the end with a terminal hooked nail and is less than the head in length. The hind toe bears a prominent flattened lobe. The inferior larynx of the male ducks is of strong bony construction. These ducks inhabit the Arctic regions, but migrate southward in winter to the coasts of Europe. They are marine in habits, and feed upon crustaceans, worms, mollusks, and aquatic plants. The plumage is thick and dense, that of the male pochards being lustrous, and more brilliant than the plumage of the female. The pochard is represented in North America by the red-head, canvas-back and scaup ducks (qq.v.) and in Asia and Africa by related species.

**Pocket-mouse**, a small burrowing nocturnal gray mouse of the genus *Heteromys*, which inhabits the arid regions of the southwestern United States, and is related to the kangaroo rats and mice. They have cheek-pouches in which they carry into their burrows seeds, etc., for storage preparatory to winter famine.

**Pocock, Edward**, English Arabic scholar: b. Oxford 1604; d. 10 Sept. 1691. He was graduated at Corpus Christi College, Oxford, in 1622; entered the Church in 1629; became chaplain to the English Turkey Merchants in the same year; became lecturer in Arabic at Oxford in 1636 and Hebrew professor 1647; suffered some inconvenience because of his royalist sympathies under the Commonwealth; and lived in comfort after the Restoration. The first English Arabic scholar of note and a great Biblical commentator, Pocock is best known for his 'Specimen Historiæ Arabum' (1649) and an edition of Abulfaragius (1663).

**Pocock, Richard**, English Oriental traveler: b. Southampton 1704; d. 1765. He studied at Corpus Christi, Oxford; took holy orders and was advanced rapidly. He wrote 'Description of the East' (1743); 'Observations on Palestine' (1745); and 'Tours in Scotland' (1887, with biography by Kemp). He became bishop of Meath shortly before his death.

**Podag'ra** (Greek, "a trap for the feet"), that species of gout which recurs at regular intervals, attacking the joints, particularly the large joint of the great toe, and attended with sharp pain. See GOUT.

**Podestà**, an Italian word, equivalent in its original meaning to a holder of power or authority. In several of the Italian cities it is applied sometimes to the chief of police, and sometimes to the chief magistrate or burgomaster. The office was first established in the 12th century by Frederick I. in the principal towns of Italy, and was in the Middle Ages a much more important one than it is now. The podestà was entrusted almost with dictatorial power, the only limitation being that there was an appeal from his decisions.

**Pod'iceps**, or **Podicipididæ**. See GREBE.

**Podiebrad**, pōd'yě-brād, and **Kunstat**, **George Boczko of**, Bohemian king: b. Podiebrad, Bohemia, 6 April 1420; d. 22 March 1471. In youth he favored the Hussite movement but remained with the moderate party during the reign of Sigismund; after the election of Albert V. of Austria as Sigismund's successor he supported the Utraquists; invited Casimir of Poland to become king of Bohemia and compelled Albert to retire to Prague. Albert retained the title of king until his death in 1439 and Lipa was chosen regent of Bohemia. In 1444 after Lipa's death Podiebrad became regent during the reign of Ladislaus, Albert's posthumous son, and though the young king came to reside at Prague in 1453 Podiebrad continued to wield the authority of a monarch. Ladislaus died in 1457 and in 1458 Podiebrad was unanimously elected king. He was crowned in 1459 and proceeded to institute various reforms in the government. In endeavoring to conciliate the Pope he banished the Taborites and other sects from the country, but was excommunicated in 1463, and a German crusade was inaugurated against Bohemia in 1466. Podiebrad then recalled the banished Taborites, crushed the insurrection, defeated the German invaders and in order to secure the support of the Poles declared Ladislaus, heir of the Polish throne, his successor, his own sons to retain merely the family estates. He succeeded in firmly establishing his kingdom and died shortly after. Consult: Jordan, 'Das Königtum Georgs von Podiebrad' (1861); Richter, 'Georg von Podiebrads Bestrebungen' (1863).

**Podium**, in architecture, a low wall, generally with a plinth and cornice, placed in front of a building. A projecting basement round the interior of a building, as a shelf or seat, and round the exterior for ornamental adjuncts, as statues, vases, etc.

**Pod'more, Frank**, English psychical student: b. 5 Feb. 1856. He was educated at Oxford, was one of the founders of the Fabian Society and is a member of the Society for Psychical Research. He was published 'Apparitions and Thought Transference' (1894); 'Studies in Psychical Research' (1897); 'Modern Spiritualism: a History and Criticism' (1902).

**Podocar'pus**, a genus of trees and a few shrubs of the order *Coniferae*. The species, of which about 40 have been described, are mostly tropical, distributed in the Australasian Archipelago, adjacent Asia, Japan, the South Pacific



Islands, the Andes Mountains and in Africa. They are resinous, have fern-like leaves, small monœcious or diœcious flowers borne singly or in spikes either in the leaf-axils or subterminally. The pistillate blossoms are followed by small, berry-like fruits upon thick purple stalks, and subtended by fleshy bracts. Some species, which have flowers in spikes and not fleshy fruits, are referred by various botanists to the genus *Prumnopitys* (*Stachycarpus*). The fleshy seed-stalks of some are used for food. In America a few are sometimes cultivated in greenhouses; others are sparingly planted in the South and in California. Well drained loam suits them. Where indigenous, several species are highly prized timber trees. Of these the best known are probably the following: Totarra or totarra pine (*P. totarra*) which approximates a height of 100 feet and a diameter of 12, is largely used for ship-building in New Zealand where it is native; the gagali (*P. elata*) of Queensland, rises 100 feet, but has a diameter of only about three feet, and is used for cabinet work; and *P. cupressina*, a Java species, which approximates 65 feet in height and whose easily polished yellow wood is used for house-building, furniture, etc.

**Podolia**, pō-dō'li-ā, or **Kamenetz**, kā'mě-něts, a government of West or "White" Russia, north of Bessarabia, and bordering on the Austrian frontier; area, 16,224 square miles. The surface is a table-land, strewn with hills; nearly three fourths is either arable or available for pasturage. The capital is Kamenetz-Podolsk. There is considerable manufacturing; the chief manufactures are flour, sugar, spirits, and tobacco products. Pop. (1897) 3,031,513.

**Podophyl'um**, **Mandrake**, or **May-apple**, a genus of hardy perennial herbs of the order *Berberidaceæ*. The four species are natives, two of China, one of the Himalayas, and one of North America. The last species grows about 15 inches tall, bears one or two dark green leaves; in the axil of two-leaved specimens one or sometimes two fragrant saucer-like cream-colored flowers are borne. These are followed by a yellow, tender, insipid fruit which is somewhat edible. The dried roots and a resin obtained from them have been used in medicine, but are less popular than formerly. The fruits are sometimes called wild lemon and hog-apple. The name mandrake (q.v.) is more correctly applied to *Mandragora*, which is the mandrake of ancient history and romance.

**Podu'ridæ**. See BRISTLE-TAILS.

**Poe, Edgar Allan**, American poet and prose writer: b. Boston, Mass., 19 Jan. 1809; d. Baltimore, Md., 7 Oct. 1849. His father was of a good Maryland family, and his mother was a daughter of the once celebrated English actress Mrs. Arnold. Both parents were actors and were engaged at the Boston Federal Street Theatre at the time of their son's birth. Mrs. Poe, who outlived her husband, died in great poverty, leaving three children, who were adopted by friends. Edgar was taken into the home of his godfather, John Allan of Richmond, and was treated in many respects as a child of the family. He was beautiful and precocious, and the over-indulgence and unwise petting of his adopted parents aided in developing a naturally imperious and self-indulgent nature. When he was six years old the Allans took him to England and placed him at Stoke-Newington. He re-

mained at the school for six years, and there laid the foundation of his curious classical lore. The autobiographical story of William Wilson describes the old Manor House School and its quiet round of duties and pleasures. On his return to Richmond in 1821 he entered the English and Classical School of Joseph H. Clarke where he was prepared for college. He was quick and brilliant, and excelled in languages and in athletics. But in spite of his talents Poe was unpopular; his extreme sensitiveness, his moody disposition, his pride of intellect kept his school fellows at a distance. He formed, during this time, a passionate devotion to the mother of one of his schoolmates, and after her sudden death spent night after night of a bleak, dreary autumn, by her grave. At 17 he matriculated at the University of Virginia. He devoted himself to Latin, Greek, French, Spanish, Italian, and took the highest honors in Latin and French. But his gambling debts were heavy and he was not allowed by Mr. Allan to return. After a short enforced stay in Mr. Allan's counting-house he determined to make his own career and ran away to Boston. There he published his first volume, 'Tamerlane and Other Poems' (1827), verses without any special originality and rough in execution. Poor and friendless he now enlisted in the army. He made an efficient soldier, was promoted to sergeant-major and was so attracted to army life that he again asked Mr. Allan's aid, and, through his influence, was allowed to enter West Point. He disliked the discipline of the school, however, and deliberately gave such grounds for offense that he was dismissed. Just before he entered West Point he had published a second volume of poems containing among others a revision of 'Tamerlane' and 'Al Aaraaf,' and after his dismissal he determined to make literature his profession. A second edition of his poems (1831), in such verses as 'Israfel' and 'To Helen,' gave promise of a real poet. In 1833 he competed for the prize offered by the 'Saturday Visitor' for the best short story; and the award was made to 'A MS. Found in a Bottle,' one of the six stories which he had submitted. Mr. John Kennedy, the novelist, was one of the judges; he became the warm friend of the young writer and rescued him from deepest poverty by obtaining for him magazine hack work. Poe was at this time living with his aunt, Mrs. Clemm, and her daughter Virginia, in Baltimore, but soon moved to Richmond to write exclusively for the 'Southern Literary Messenger.' He gained constantly in reputation and his weird tales and biting critiques rapidly raised the subscription list of the magazine from 700 to 5,000. In 1836 he married his young cousin, Virginia Clemm. Poe's life was restless and stormy, he left one position after another, just as he seemed on the point of a great success; his indulgence in opium and in intoxicants increased and he was often plunged into dire poverty, but his love for his beautiful wife was steadfast. Mrs. Clemm lived with her daughter and took care of the home. His wife was the inspiration of some of his purest poetry, of 'Eleonora,' of 'Annabel Lee,' of 'Lenore.' He uttered his forebodings over her desperate illness in 'The Raven,' and his grief for her death in the tender stanzas 'To One in Paradise,' and in the hopeless 'Ulalume.'



## POE — POERIO

The letters he wrote to his mother-in-law are natural, simple, and winning, and show Poe in a most attractive light. To her he wrote also the beautiful lines 'To My Mother.' In 1838 he moved with his family to New York where he held, for a short time, a position on the 'New York Quarterly Review,' but the magazine was not so successful financially as had been hoped and Poe entered into an engagement with the 'Gentleman's Magazine' and removed to Philadelphia. Mr. William Gowans, a well-known bookseller, who boarded with Mrs. Clemm in New York, gives emphatic testimony to Poe's courtesy and sobriety at this time. In 1839 his best stories were published in two volumes entitled 'Tales of the Arabesque and Grotesque,'—among them 'Ligeia,' Poe's favorite tale, and the masterly 'Fall of the House of Usher.' A year later he began his work for 'Graham's Magazine' in Philadelphia, and the fame of his poems, stories, and critiques, together with Mr. Graham's excellent management, in two years raised the subscription list from 5,000 to 52,000. Much of his best writing was done for this magazine; in it were published among many other stories 'The Murders in the Rue Morgue,' which was immediately translated into French; 'The Descent into the Maelstrom'; and 'The Mystery of Marie Roget.' In 1842, either from native restlessness or because his fits of intoxication were increasing, he resigned the editorship of Graham's and two years later again moved to New York. In 1841 Mrs. Poe ruptured a blood-vessel and the next six years were filled with poverty, illness, and agonizing alternations of hope and fear. At one time Poe achieved his desire of having a magazine of his own, as he had sole management of the 'Broadway Journal,' but he had little executive ability and this enterprise failed. In January 1847 his wife died at Fordham, a suburb of New York, and after this overwhelming sorrow, for two years and a half he struggled feebly against illness, weakness, and opium. His most notable works during this period were 'Eureka,' 'The Bells,' and 'Ulalume.' In October 1849 he fell ill in Richmond as he was starting for New York and was found delirious in the streets of Baltimore. He died in the City Hospital and was interred in the burial grounds of Westminster Church, near the grave of his grandfather, General David Poe.

Poe's character was complex and difficult; he was self-willed and self-indulgent, too often regardless of the rights of others, intensely proud and reserved, sometimes courteous and kindly, oftener moody and abstracted. He was keenly sensitive to sound and easily excited by stimulants. That he was not the degraded inebriate that Griswold depicted has been abundantly proved, but there is no doubt that his poverty and his frequent change of promising positions were caused in part by vacillating will and by recurring spells of intoxication. He was a dreamer and his imagination dwelt with the mystic and horrible; his mind was brilliant and acute and his sense of form and proportion exquisite.

The themes of Poe's poetry were few;—man's loneliness, the hopelessness of struggle, remorse for a wrecked life. His poems bring no breath from the outer world. Theirs is a land of dreams, of tempest, of fantastic terrors,

of ashen skies, and through this land glide ghosts, birds of ill omen, and crawling shapes. His poetry is not stimulating and has no moral quality; but has frequently an almost faultless literary form, vivid, if distorted imagination, and a haunting melody. His theory was that a poem should have complete unity in itself, and consequently should never be of great length, and that the poet must compose only when in a state of highly excited emotion. Poetry he defines as the "rythmical creation of beauty." His fame as a poet rests on a few short poems, 'The Raven,' 'Lenore,' 'Ulalume,' 'The Bells,' 'Annabel Lee,' 'The Haunted Palace,' 'The Conqueror, Worm'; and these in unity of design, in exquisite choice of melodic words, and in concentrated passion are well nigh faultless.

His stories are weird, filled with horrors, and often glow with the putrescence of physical decay. They are carefully wrought and in such masterpieces as 'The Fall of the House of Usher,' and 'Ligeia' every word heightens the desired effect. The disintegrating power of fear on a sensitive and highly organized soul has never been more powerfully portrayed than in the former story. Poe's analysis of morbid and tortured souls is unsurpassed. His acute analytical powers are shown in such stories as 'The Murders in the Rue Morgue' and 'The Gold Bug'; his speculations usually hovered about the improbable and the horrible. His originality, his literary craftsmanship, are unquestioned, but he lacked the will and the moral conviction which would have brought his great gifts to their highest fruition.

Consult: Griswold, 'Memoir' (1850); S. H. Whitman, 'Edgar Poe and His Critics' (1860); Ingram, 'The Life and Letters of Edgar Allan Poe' (1880); Woodberry, 'Edgar Allan Poe' (1885).

EMILIE W. McVEA,  
*University of Tennessee.*

**Poe, Orlando Metcalfe**, American soldier: b. Navarre, Ohio, 7 March 1832; d. Detroit, Mich., 2 Oct. 1895. He was graduated from West Point in 1856, and in 1861 was chief of engineers in the Department of the Ohio. In that year he was commissioned colonel of the 2d Michigan Volunteers, served in the Virginia and Maryland campaign, was appointed brigadier-general of volunteers in 1862, and in 1863 was mustered out of the volunteer service and became chief of engineers in the 23d corps of the Army of the Ohio. He served in a similar position under Sherman in his invasion of Georgia, and was brevetted brigadier-general in the regular army in 1865. In 1865-70 he was engineer secretary of the United States lighthouse board, engaged in constructing the lighthouse on Spectacle reef, Lake Huron, in 1873-84, and had charge of various river and harbor works in the Great Lakes. He was a member of the United States board of lighthouse commissioners, aide-de-camp to General Sherman, and at his death was chief engineer of the Northwest district.

**Pœcile**, pē'sī-lē, a portico in Athens, containing a picture gallery. The philosopher Zeno (q.v.) taught his doctrines here. See STOICISM.

**Poerio**, pō-ā'rē-ō, **Carlo**, BARON, Italian patriot: b. Naples 10 Dec. 1803; d. Florence 28 April 1867. Having espoused the cause of the Neopolitan liberals in 1828, he participated in the





Courtesy of the Booklovers Magazine.

From engraving by F. Childsack.

EDGAR ALLEN POE.







## POET LAUREATE — POETRY

conspiracy of Avellino, and thereby incurred a long imprisonment. He was again imprisoned after the unsuccessful revolutionary attempt of 1847. Liberated in January 1848, in consequence of the revolution begun at Palermo, he organized the historic demonstrations of the 27th of that month, from which resulted the constitution of 10 February, under which he was nominated director of police and minister of public instruction. He soon resigned and was chosen to the parliament as deputy for Naples. In July 1849 he was charged with conspiracy and, although not justly convicted, was sentenced to imprisonment for 24 years. In 1859 he, with many other political prisoners, was placed on an American ship for transportation, but was landed at Cork and returned, by London, to Turin. In 1860 he was elected to parliament from Tuscany, and later became vice-president of that body.

**Poet Laureate**, an officer in the lord-chamberlain's department of the royal household of Great Britain. The appellation was derived from *laurus*, a bay or laurel, in allusion to the ancient practice of crowning poets with a laurel wreath. Graduates in rhetoric and versification in the English universities were presented with a laurel wreath, and were, in consequence, styled *Poetæ Laureati*. The royal laureate was merely one of these in the king's service. The first patent of poet laureate was granted to Ben Jonson in the reign of James I. The laureate was required to furnish an ode on the birthday of the sovereign or on the occasion of a national victory; but this custom was discontinued toward the close of the reign of George III. Since the time of Charles II. the following poets have in succession held the office of laureate: John Dryden, Thomas Shadwell, Nahum Tate, Nicholas Rowe, Lawrence Eusden, Colley Cibber, William Whitehead, Thomas Warton, Henry James Pye, Robert Southey, William Wordsworth, Alfred Lord Tennyson, and Alfred Austin. The salary is \$360 yearly.

**Poet at the Breakfast Table**, *The*, a work by Oliver Wendell Holmes, first printed as a series of papers in the 'Atlantic Monthly' in 1872. Like the earlier 'Autocrat' and the 'Professor at the Breakfast Table' it consists of rambling, discursive talks on many subjects,—religion, science, literature,—with a frequent excursion into the realm of philosophy. The principal persons at the table are the Poet; the Old Master, a scholarly philosopher; the Scabee, a withered entomologist; the poetic young astronomer; Scheherazade, a young girl who writes stories; and the Lady. All of these occasionally take part in the conversation, but more frequently the writer in his own person addresses the reader directly.

**Poetry** (from *poet*, Gr. *poiētēs*, a maker, from verb *poieo*, I make). Without attempting to define poetry it may be broadly stated as that form of expression which language takes when it consists of a definite number of measures or periods in some fixed relation to each other, and accompanied by discernible and more or less definite rhythm.

The history of poetry has been as comprehensive as that of the human race. With the Hebrews it begins with accounts of the world's creation. This is the earliest poetry of which we have record. Later we have it in the Psalms, the songs of David, and the songs of Solomon.

We have fragments of Indian poetry that existed centuries before Christ. Among the poetic peoples of Greece it flourished, first as the exalted language of pagan worship; in the Homeric period Greek poetry reached its zenith as the impassioned expression of Greek culture and of the dramatic art; it then declined until the Alexandrian era. From the Greeks the Romans caught the art but never mastered it. With the advent of Christianity it became, Latinized, first a vehicle for the Christian tenets, and later one of more general use. The 9th, 10th, and succeeding centuries saw the rise of French poetry among the Troubadours of the south. From this sprang the Italian and the Spanish, although native Sicilian and Castilian poetry flourished during the 13th, 14th and 15th centuries. The origin of German, of Scottish, and of English poetry seems obscure. The German, influenced by the Norman, as was the English to a great degree, itself influenced the Scandinavian and Norse poetry, which, in turn, acted upon the Scottish and English poetry. Geoffrey Chaucer, the creator of the Canterbury Tales, is commonly called the father of English verse, and the Elizabethan era the period of its greatest development.

As regards subject and the relation of subject and treatment to the poet, poetry may be classed as lyrical, the poetry of the subjective feelings; epic poetry and the ballad, being the poetry of narration; didactic poetry, in which is presented some moral, æsthetic, or scientific precept; satirical, or the poetry of forum and debate; and dramatic, the poetry of the stage.

As regards structure, poetry consists of *stanzas*, made up of two or more *lines*, consisting each of one or more *feet* or *measures*. For practical purposes, all measures are of two classes, double and triple. Double measures consist of two or four syllables, one of which is accented; if there are four syllables there may be a subordinate accent, as well. Triple measure consists of three syllables, one of which is accented. The accented syllable may be at the beginning of the measure, or *initial*; near the middle of the measure, or *medial*; at the end of the measure, or *terminal*. It is the combination of these two elements, the number of syllables in the measures and the positions of the accented syllables, that determine the nature of the verse. Examples of the six elemental measures, giving them the Greek names by which they are commonly known, are as follows:

*Trochee*: Once up | on a | midnight | dreary  
Initial double measure with the last syllables short.

*Spondee*: Love will | come and | love will | go  
Initial double with the last syllables long.

*Iambus*: The shad- | ows lay | along | Broadway  
Terminal double with the first syllables short.

*Dactyl*: Out of the | cities and | into the | villages  
Initial triple with the last two syllables short.

*Amphibrach*: The Marquis | of Càra- | bas richest |  
of men  
Medial triple with the first and last syllables short.

*Anapæst*: In a gown | even you | would admire  
Terminal triple with the first two syllables short.

The earliest form of versification which we have preserved to-day is to be found in the Old Testament, and consists of the Hebrew parallelism, so-called because it contained two parallel



## POETS' CORNER — POHLE

or similar statements of like or approximate length:

Behold I was shapen in iniquity;  
And in sin did my mother conceive me.  
—Psalms xix. 1.

The heavens declare the glory of God;  
And the firmament sheweth his handiwork.  
—Psalms li. 5.

Besides being named from the arrangement of their accented syllables verses are also named according to the number of measures to the line. Following the Greek nomenclature a line of one measure is in *Monometer*:

By the twanging  
And the clanging.—'The Bells,' E. A. Poe.

of two measures is *Dimeter*:

Ride boldly ride,  
The shade replied.—'Eldorado,' E. A. Poe.

of three measures, *Trimeter*:

Why do ye fall so fast?  
Your date is not so past.  
—'To Blossoms,' R. Herrick.

of four measures, *Tetrameter*:

The shadows lay along Broadway.  
—N. P. Willis.

of five measures, *Pentameter*:

Here rests his head upon the lap of earth.  
—'Elegy in a Country Churchyard,' Thos. Gray.

of six measures, *Hexameter*:

This is the forest primeval. The murmuring pine and  
the hemlock.—'Evangeline,' H. W. Longfellow.

of seven measures, *Heptameter*:

What a world of solemn thought their monody compels.  
—'The Bells,' E. A. Poe.

of eight measures, *Octometer*:

Comrades leave me here a little while as yet 'tis  
early morn.—'Locksley Hall,' Alfred Tennyson.

There are, of course, many variations from these elemental forms. By the addition or subtraction of a syllable, by the changing of the length of a line, or of the kinds of measures employed, or by the arrangement of various measures in a line are obtained varieties of stanzas and of verse forms as differing and as limitless as the human fancy may dictate and ingenuity devise. The line of four terminal measures, the *Iambic Tetrameter*, is supposed to be the easiest of English verse forms and is commonly used. That of five terminal measures, the *Iambic Pentameter*, is often referred to as the "heroic measure," having been used in many long compositions and in translations from the classics. It is the meter in which most of the English blank verse is written. Blank verse is composed of lines the final endings of which do not agree in sound with other lines in the same stanza, as opposed to rhymed verse, in which the opposite is the case. Two selections from 'Romeo and Juliet' illustrate these points:

(Blank): Lady, by yonder blessed moon I swear,  
That tips with silver all these fruit tree tops.

(Rhymed): If I profane with my unworhiest hand  
This holy shrine, the gentle fine is this,—  
My lips, two blushing pilgrims, ready stand  
To smooth that rough touch with a gentle  
kiss.

Of all poetic forms the most famous, probably, and certainly the most famous in the form of a single stanza, is the sonnet. This poem consists of fourteen lines, which, in sonnets of classic mold, are thus divided: The first four lines introduce the subject of the poem; the second four introduce some new meaning, or are an elaboration or explanation of the first four; these eight lines are called an *octet*;

the last six, the *sextet*, make an application of the whole, with the point of the entire poem in the last line if possible. Often the last two lines give some twist or additional meaning to the application. The sonnet is an Italian form of verse, the Italian poet Petrarch being its father and master. It has been used with great effect by other Italian poets, such as Dante, Tasso, Ariosto, Michelangelo; and by English poets, notably, Milton, Wordsworth, Keats, Mrs. Browning, and, finally, Shakespeare, whose sonnets are the most perfect in the language.

*Bibliography.*—For more detailed information on the history and the science of poetry the reader is referred to E. C. Stedman, 'Nature and Elements of Poetry'; Sidney Lanier, 'Science of English Verse'; E. A. Poe's essays, 'The Poetic Principle,' and 'The Rationale of Composition'; R. W. Emerson, 'Poetry and Criticism'; G. L. Raymond, 'Rhythm and Harmony in Poetry,' and 'Poetry as a Representative Art'; Wm. Sharpe, 'Sonnets of this Century,' with critical essay on the sonnet form, and 'American Sonnets'; also to the compendious works of Wm. Hazlitt, Thos. Campbell, William Wordsworth; and to the works of Engel, Schiller, Goethe, Schlegel, Hegel, and other German poets, excellent translations of which can be had in English.

VIVIAN MORDAUNT MOSES.

**Poets' Corner, The**, a popular name given a corner in Westminster Abbey in England, where there are memorials to many famous poets. Among those represented are: Addison, Beaumont, S. Butler, Campbell, Cowley, Davenant, Drayton, Dryden, Gay, Goldsmith, Gray, Dr. Johnson, Ben Jonson, Longfellow, of America, Macaulay, Mason, Milton, Philips, Prior, Rowe, Shakespeare, Shadwell, Sheridan, Spenser, and Thomson.

**Poey**, pō'āy, **Felipe**, Cuban naturalist: b. Havana, Cuba, 26 May 1802; d. there 28 Jan. 1891. He was graduated in law from the University of Madrid, but abandoned his law practice and engaged in the study of natural history, later continuing his studies in Paris where in 1827 he aided in founding the Société Entomologique. He returned to Havana in 1833 where he made a study of Cuban fauna and in 1842 became professor of comparative anatomy and zoology at the University of Havana. In 1863 he was transferred to the chair of botany, mineralogy, and geology. He published: 'Memorias sobre la historia natural de la Isla de Cuba' (1860); 'Enumeratio Piscium Cubensium' (1875); 'Geografia de Cuba' (19 editions); etc. His most important work, 'Ictiología Cubana,' was unpublished at the time of his death.

**Poggio Bracciolini**, pōdg'ō brä-chō'lē-nē. See BRACCIOLINI, POGGIO.

**Po'gy**. See MENHADEN.

**Pohle**, pō'lē, **Leon**, German painter: b. Leipsic 1 Dec. 1841. After studying at the Dresden Academy and afterward at Antwerp and Weimar he became professor at the above institution in 1877. Although at first inclined to genre and historical themes he has since confined his attention more to portrait work. Among noted portraits by him are those of Ludwig Richter (1872), and of the Baron Tauchnitz, both in the Leipsic Museum.



## POI—POINT PLEASANT

**Po'i**, a native food or porridge made from flour obtained by grinding the roots of tara or taro, a plant grown in most of the Polynesian islands, especially in Hawaii. The tops are used by the natives as pot herbs. The root is ground on stones by the native women, and made into mush which, among the Hawaiians of the lower classes, is eaten with the fingers out of a common dish.

**Poincaré**, pwän-kä-rä, **Jules Henry**, French mathematician and physicist: b. Nancy 29 April 1854. In 1873 he entered the Ecole Polytechnique, and in 1875 the School of Mines. In 1879 he was made a doctor of sciences, and in the same year began work as an engineer. Having been called to Paris in 1881, he was made professor of mathematical physics and calculus of probabilities in the faculty of sciences in 1886, and ten years later was transferred to the chair of celestial mechanics. For a work on the problem of three bodies (see ASTRONOMY, THE SCIENCE OF), he received the prize offered by the king of Sweden and Norway. In both mathematics and physics he has added greatly to the investigation of modern theories, and has introduced new solutions of leading problems in both departments. Among his writings are: 'Leçons sur la Théorie Mathématique de la Lumière' (1889-92); 'Electricité et Optique' (1890-1); 'Thermodynamique' (1892); 'Leçons sur la Théorie de l'Elasticité' (1892); 'Les Méthodes nouvelles de la Mécanique Céleste' (1892-9); 'Cinématique et Mécanismes Potentiels et Mécanique des Fluides' (1899). His 'Cours de Physique' (13 vols. 1890) included some of the works afterward separately published.

**Poincia'na**, a genus of leguminous trees of the family *Eucisalpinieæ*, which is native to the Oriental region, but was long ago introduced into all tropical countries. These trees have very showy scarlet or orange flowers, called peacock flowers in some regions. There are three species of which the royal (*P. regia*) is familiar in southern Florida.

**Poindexter**, poin'dëks-tër, **George**, American politician: b. Louisa County, Va., 1779; d. Jackson, Miss., 5 Sept. 1853. He studied law, practised in Milton, Va., and in 1802 established himself in Mississippi Territory where he was commissioned attorney-general in 1803. In 1806 he served in the territorial legislature, was a delegate to Congress in 1807-13, and in the latter year was appointed United States judge for Mississippi, an office which he filled with much ability. He was the first representative of Mississippi in Congress after her admission to statehood in 1817, and in 1819 ably supported General Jackson's conduct of the Seminole war. He was twice elected governor of Mississippi and in 1830 was chosen United States Senator, in which office he ceased to support Gen. Jackson and was even suspected by the latter of complicity in the plot to murder him. In 1835 he removed to Kentucky, but subsequently returned to Mississippi, where he resumed his old political associations.

**Poin'ding**, in Scotch law, a seizure of the goods of a debtor by the creditor. See ATTACHMENT.

**Poin'sett**, Joel Roberts, American diplomat: b. Charleston, S. C., 2 March 1779; d. Statesburg, S. C., 12 Dec. 1851. He completed

his education at the University of Edinburgh and at Woolwich Military Academy, England, and in 1809 was United States commissioner to South America to investigate political conditions prevailing there. While in Chile he obtained the release of American merchantmen who had been seized by the Spanish authorities of Peru on a rumor of the declaration of war with the United States. He was elected to the South Carolina legislature on his return and in 1821-5 was a member of Congress; he served in 1825-9 as minister to Mexico and afterward allied himself with the "Union" party in strenuous opposition to the nullification issues. He was secretary of war in 1837-41 and in 1840 was instrumental in the passage of the bill to reorganize the militia. The last years of his life were spent in retirement; he founded an academy of fine arts in Charleston, and published: 'Notes on Mexico, Made in 1822; with an Historical Sketch of the Revolution' (1824).

**Poinset'tia**, a shrub (*Euphorbia* or *Poinsettia pulcherrima*) of the order *Euphorbiaceæ*. It is a native of shady and damp tropical and subtropical Central America and Mexico, whence it was introduced into cultivation by Dr. Poinsett of Charleston, S. C., and distributed by Robert Buist of Philadelphia. The plant grows six feet or more high, bears small, yellow terminal flowers surrounded by brilliant vermilion bracts, for which the plant has become famous as a greenhouse subject. These bracts, in well grown specimens, often extend nine inches on each side of the centre. They are sometimes cut for decorative purposes, but usually the plants are left in pots. In mild climates, such as Bermuda, southern Florida, and California, the plants are grown out of doors, but they never reach perfection, and must generally be grouped with other plants to conceal their bare, crooked stems.

**Point-de-Galle**, point de gäl, or **Galle**, Ceylon, a fortified seaport town on a peninsula on the south coast, 21 miles west of Matura, and 66 miles south-southeast of Colombo. The appearance of Galle from the sea is singularly beautiful and picturesque. To the right is the fort, further on is the quay, surrounded by multitudes of canoes, while close to the harbor is the native town, white, and shaded by numerous trees. The hills nearby are covered with trees, and back some distance is Adam's Peak, 7420 feet high. Outside the town is a Buddhist temple. The trade of Galle consists chiefly in coir rope, cocoanut oil, arrack, chaya root, coffee, cotton, rice, ivory, cinnamon, and tortoise-shell. Pop. (1891) 33,505; (1901) 37,326.

**Point-lace**. See LACE.

**Point Pleasant, Battle of**, fought 10 Oct. 1774, in what is now West Virginia. The action took place at the mouth of the Great Kanawha River; on one side were some 1,200 Virginians commanded by Andrew Lewis (q.v.); on the other, a force of Indians numbering about 1,000, led by Cornstalk (q.v.), the Shawnee chief. The battle lasted throughout the day, and was fought with desperation on both sides, Indian tactics being adopted by the whites, who finally gained the victory. Both sides lost heavily, the whites 75 killed and 150 wounded, among the killed being Col. Charles Lewis. The Indian loss has never been definitely ascertained,



## POINTE-A-PITRE — POITIERS

but is believed to have been quite as great as that of the men under Lewis. By a treaty following the battle the Indians gave up to the whites an extensive tract south of the Ohio River. The battle proved to be of much importance in connection with the Revolutionary developments in that part of the country, and its results had much to do with opening Kentucky to the whites. See COLONIAL WARS IN AMERICA, *Lord Dunmore's War*.

**Pointe-à-Pitre**, pwänt-ä-pêtr, Guadeloupe, W. I., the largest and richest town in the island of Grande Terre, the smaller of the two composing Guadeloupe, with a good harbor at the mouth of the Rivière Salée, which separates Grande Terre and Basse Terre (see GUADELOUPE). The city was built in 1763, was destroyed by earthquake 8 Feb. 1843, and suffered from fires in 1871. Once a great port, it still carries on some business, exporting sugar, cocoa, hides, coffee, rum, molasses, etc. Pop. (est.) 18,000.

**Pointed Architecture**, a name for the Gothic styles. See ARCHITECTURE.

**Pointer**, a race of bird-hunting dogs, allied to the setters but smooth-haired. See DOG.

**Pointer**, (1) in astronomy, a name given two stars, Merak and Dubhe, in Ursa Major, so called because they point to the pole star. (2) In bricklaying, a tool for clearing out to the required depth the old mortar between the courses of bricks in a wall, to be replaced by a fresh body of mortar. (3) In shipbuilding, one of the pieces of timber fixed fore-and-aft and diagonally inside of a vessel's run or quarter, to connect the stern frame with her after body. (4) In navigation, a graduated circle, with one fixed and two adjustable radial legs. By placing them at two adjoining angles taken by a sextant between three known objects, the position of the observer is fixed on the chart.

**Poiré**, pwä-râ, **Emmanuel**, French caricaturist, known also by his signature **CARAN D'ACHE**: b. Moscow, Russia, 1858. He first gained considerable reputation in France by drawings in various Parisian journals. He made particular study of military types, and especially came to depict French cavalry with great facility and truth. His work was collected into albums, that called 'Psst!' (1898) containing drawings evoked by the Dreyfus case. His signature is an adaptation of the Russian word for "pencil."

**Poison Alder**, or **Sumac**. See PLANTS, POISONOUS.

**Poison Ivy**. See PLANTS, POISONOUS.

**Poison-nut**, a name for *Strychnos nuxvomica*. See NUX VOMICA.

**Poison of Serpents**. See SERPENT: RATTLE-SNAKE, etc.

**Poison Springs** (Ark.), **Engagement at**. On 17 April 1864 a train of 198 wagons left Camden, Ark., and went westward 18 miles on the Washington road to collect forage and other supplies. It was guarded by 195 cavalry, 500 infantry, and 2 guns, under command of Col. James M. Williams, 1st Kansas Colored Volunteers. Next morning Williams was reinforced by cavalry, infantry, and two guns, raising his force to 285 cavalry, 875 infantry, and four guns.

A greater part of the wagons had been loaded on the 17th, and on the morning of the 18th Williams started on his return to Camden, gathering forage on the way, and when about 12 miles from that place was intercepted by Marmaduke's cavalry. Gen. Maxey soon joined Marmaduke, the united commands of about 3,200 men and four guns attacked Williams, and, in a four hours' fight, routed him, capturing about 100 prisoners, his four guns, and the entire wagon-train. The Union loss was 92 killed, 97 wounded, and 106 missing. Incomplete Confederate returns make their loss 17 killed, 88 wounded, and 10 missing; their entire loss was about 155. Consult 'Official Records,' Vol. XXXIV.

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**Poisons and Poisoning**. See TOXICOLOGY.

**Poisson**, pwä-sôn, **Siméon Denis**, French mathematician: b. Pithiviers, France, 21 June 1781; d. Paris 25 April 1840. He was educated in the Ecole Polytechnique, Paris, and occupied positions as examiner and professor in that institution for nearly 40 years. He was a member of the Bureau des Longitudes, professor of mechanics on the Faculty of Sciences at Paris, was appointed a member of the council of the university in 1820, and in 1837 made a peer by Louis Philippe. He wrote over 300 scientific papers and other works of great value, covering mathematics, physics, and astronomy, the most famous of his works being 'Traité de Mécanique' (1811). Among other works are: 'Théorie Mathématique de la Chaleur' (1835); 'Recherches sur la Probabilité des Jugements en Matière Criminelle et en Matière Civile' (1837).

**Poisson's Ratio**. See ELASTICITY.

**Poissy**, pwä-sê, France, a town in the department of Seine-et-Oise, on the left bank of the Seine, 11 miles southwest of Versailles. The weekly cattle market, chiefly for the supply of the capital, is said to be the largest in France. The town possesses considerable historical interest from the famous conference of Poissy in 1561, in which the differences between Roman Catholicism and Protestantism were discussed at great length, but with no decisive result. Among the attendants were Charles X. and Catherine de' Medici; the principal debaters were Theodore Beza and the papal legate Ippolito d'Este. Pop. (1901) 7,506.

**Poitiers**, pwä-tê-â (formerly spelled **POICTIERS**), France, the former capital of the province of Poitou, at present of the department of Vienne, 61 miles southwest of Tours. It stands mainly on an eminence at the junction of the Clain with the Boivre, and retains its old walls and towers. The principal edifice is the cathedral, founded by Henry II. of England about 1162, and built in a style exhibiting the transition from the Romanesque to the Gothic. Other ecclesiastical buildings include the ancient Church of St. John, originally a baptistery; and the Church of Saint Radegunda, the patroness of the town, with a crypt containing her tomb. The modern town-hall, the law-courts, occupying the palace of the former counts of Poitou, the museum, the library and university building, also deserve notice. There are some interesting Roman and early Gallic remains. The manufactures are not of much importance. Poitiers is a very old place, and is historically celebrated for two battles fought in its vicinity



## POITOU — POLAND

between Poitiers and Tours, when Charles Martel defeated the Saracen army 18 Oct. 732, and when the French under their king John II. were defeated by the English under Edward the Black Prince 19 Sept. 1356. Pop. (1901) 39,565.

**Poitou** pwä-too, or **Poictou**, France, a former western province now comprised in the departments of Vienne, Deux-Sèvres, and Vendée. This district was anciently inhabited by the Gallic Pictavi, from whose name that of Poitou is derived. Henry II. of England acquired possession of Poitou by his marriage with Eleanor, heiress of the last Duke of Aquitaine. Philip Augustus conquered it in 1204. It was ceded to the English by the Peace of Bretigny (1360), but was recovered by Charles V. See FRANCE, *History*.

**Pokanoket**, the name of a tribe of North American Indians. See WAMPANOAG.

**Poker**, or **Draw-poker**, a card game said to have originated in the United States, and of which there are several varieties, the most common being draw-poker, played with a pack of 52 cards and any number of players. The game begins by the dealer staking a sum agreed on, called the ante, after which he deals five cards to each person. Each then successively looks at his cards, beginning on the left of the dealer, and according to their value he may either throw up his hand or play, in the latter case putting double the ante into the pool. The dealer who looks at his hand last may in like manner either "go out of the game," or "make good" his ante by adding enough to double it. The dealer then asks those who are to play if they wish to "fill their hands," that is, receive one or more cards from the pack in exchange for others discarded, or if they will play their original hand. When this is arranged the players, beginning with the one on the left of the dealer, have the "say" as to whether they will now go out of the game and lose their stakes or "raise," that is, add a sum to that already staked. When any one agrees to raise, the next in succession must declare whether he is to go out of the game; "see the raise," that is, add an amount equal to that just added by the previous player; or "go better," that is, add more than an equivalent. This goes on till either all are out but one, who accordingly takes the stakes, or several are left in who all "have seen the raise" but not "gone better." In this latter case the hands have to be shown, and the holder of the best hand takes the pool. The most valuable hand is when a player has a sequence of five cards of the same suit, called a "straight flush," the absolutely best hand being the sequence of ace, king, queen, knave, ten. The hands next after a straight flush in descending value are: "fours," or four cards of the same rank and another card; a "full," or three cards of the same rank with other two forming a pair; a "flush," that is, five cards of the same suit not in sequence; a "straight," or sequence of five cards of more than one suit; "triplets," three cards of the same rank and other two not forming a pair; two pairs; one pair, with other three cards of different ranks; lastly, the highest card. The cards rank in value as at whist, except that the ace may be the highest or lowest card in a straight.

**Poke'weed**, **Pokeberry**, **Pokeroot**, or **Pocan**, a strong-smelling perennial herb (*Phyto-*

*lacca decandra*) of the order *Phytolaccaceæ*. It is a native of the United States from Maine to Florida and westward to Minnesota and Texas. It becomes 12 feet high, bears smooth, entire leaves, and long racemes of small flowers followed by dark purple berries which ripen in late summer and autumn. The young shoots and the seedlings are often eaten; the former like asparagus, the latter like spinach; the berries are a favorite food of birds especially robins, whose flesh is often tinted by the deep crimson juice, which is used for coloring and adulterating wines. Its name is said to be derived from the Indian *pocan*, a dye-yielding plant; for example, blood-root. Other popular names are garget, pigeonberry, inkberry, and sroke. The dried roots and a fluid extract have been used in medicine for reducing corpulency, but they seem to be losing in favor. In Europe the plant has become naturalized and there, as at home, is sometimes a troublesome weed. Two Asiatic species, *P. esculenta* and *P. acinosa*, as well as the above species are occasionally cultivated for their young shoots and foliage.

**Pola**, pō'lā, Austria, a seaport in the peninsula of Istria; on the Adriatic Sea; 55 miles south of Trieste. It is a fortified town of the first rank, and the chief station of the Austro-Hungarian navy. It was once a place of importance; but it had sunk to the level of a mere fishing-village when the Austrian government (1855) selected it as their chief naval station, and by the construction of dockyards, an arsenal, barracks, and other government establishments infused new life into it. The entrance to the harbor is narrow, but the water is deep, and with it expands into a large basin, landlocked and safe. Forts and batteries on hills forming the background protect the harbor. Among the ancient remains are the ruins of an amphitheatre, estimated to have been large enough to accommodate 18,000 persons; there are also two temples, one of which is in good preservation. Pola was most flourishing in the reign of Severus, when it is said to have had a population of 30,000. A triumphal arch, erected by Salvia Posthuma in honor of her husband Sergius Lepidus, is in a good condition, and under the name of Porta Aurea is used as a gate of the town. The principal modern edifice is the cathedral, which dates from the 9th century. Pop. (1880) 25,173; (1890) 30,714; (1900) 45,052.

**Polac'ca**, or **Polacre**, a small sailing vessel common in the Mediterranean. The masts are usually three in number, and consist of only one spar, so that they have neither tops nor cross-trees. They are usually rigged with square sails.

**Poland**, pō'land, **John Scroggs**, American military officer: b. Princeton, Ind., 14 Oct. 1836; d. Asheville, N. C., 8 Aug. 1898. He was graduated from West Point in 1861, served in the Army of the Potomac until 1863, participated in the battles of Antietam, Fredericksburg, and Chancellorsville, and from 1863 to 1865 was commissary of musters for the Department of Washington. He was brevetted lieutenant-colonel for gallantry at Chancellorsville and was assistant professor at West Point 1865-9. He then engaged in frontier duty and in 1881-6 was chief of the department of law at the United States Infantry and Cavalry School at



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Fort Leavenworth, Kan. In 1898 he was commissioned brigadier-general of volunteers and died while in command of the 2d Division of the First Army Corps at Chickamauga. He wrote: 'Digest of the Military Laws of the United States from 1861-1868' (1868); 'Saint Petersburg International Commission' (1886); etc.

**Poland**, formerly a kingdom of Central Europe, which, at the time of its greatest territorial expansion, in the third quarter of the 16th century, exercised direct rule or suzerainty over an area of more than 380,000 square miles, with a population of 35,000,000; its territory is now included, as the result of three successive partitions in the latter half of the 18th century, within the boundaries of Russia, Austria-Hungary, and Prussia. In Prussia, the former Polish territory is now embraced within the provinces of Posen, West Prussia, and a portion of East Prussia; in Austria-Hungary it is practically co-equal with the kingdom of Galicia; in Russia, which now possesses more than three fourths of the original Polish kingdom, it is included within Courland, Livonia, Lithuania, Volhynia, part of Little Russia, and the so-called governments on the Vistula, comprising the governments of Kalisz, Kielce, Lomza, Lublin, Piotrkov, Plock, Radom, Siedlce, Suwalki, and Warsaw.

*History.*—From the mythical history of Poland we derive only some knowledge of the early inhabitants of the country who were known by the general designation of Liaches or Leches, and were subdivided into a number of tribes of which the most important were the Polani, the Masovians, and the Silesians. From about 840 dates the legendary origin of the Piast dynasty of dukes which in the male line ruled over Polish territory till 1370. Miecislav I., who ruled from 962 to 992, was forced to acknowledge the suzerainty of the German emperor and in 966 embraced Christianity, founding the bishopric of Posen. His son Boleslaw I. (992-1025) made conquests in Pomerania, Bohemia, and Silesia, successfully asserted his independence of the empire, and shortly before his death assumed the kingly title. He favored the spread of Christianity and largely promoted this object by the foundation of the archbishopric of Gnesen in the year 1000. Under his successor Miecislav II. (1025-34) the Danes, Russians, and Hungarians made considerable conquests in Poland, but these were recovered in part by Boleslaw II. (1058-81). After the death of Wladislaw I. (1081-1102) the territory of Poland was divided among his sons, and there followed a long period of civil strife and anarchy in the course of which a large part of the population disappeared, their place being taken by German immigrants who established themselves in large numbers. Other events of evil fortune for the country were the invasion of the Mongols in 1240-1 and the beginning of the activity of the Teutonic Knights who now entered upon their career of conquest in the lands south of the Baltic. A new era began with the accession of Wladislaw Lokiltek (1306-1333), who succeeded in uniting under his rule Cracow, Masovia, Cujavia, and minor principalities, and who with the papal consent adopted the royal title of Wladislaw I. His son Casimir I. the Great (1333-70) was forced to

make cessions of territory to the Teutonic Order and to Bohemia, but acquired more than compensation for the loss on the conquest of the Russian principalities of Halecz and Vladimir or Lodomeria. He brought greater unity into the administration of the various territories of the crown, caused a code of laws to be drawn up for the state, favored the spread of education, and acquired great popularity by his concern for the welfare of the peasantry who gave him the name of the Peasant King. He was also a friend of the Jews, who now began to enter the country in very large numbers owing to the persecutions to which they were subjected in Germany. Casimir was the last of the male line of Piast and was succeeded by his nephew Louis of Anjou, king of Hungary, who died in 1382, leaving two daughters, of whom the elder, Hedwig, was chosen Queen of Poland two years later. In 1386 she married Jagello, grand prince of the still heathen Lithuania, who on adopting Christianity was crowned at Cracow as Wladislaw II. The house of Jagello ruled over Poland till 1572.

For the welfare of Poland the union with Lithuania, though in form personal, was of the highest importance. The united strength of the two countries was now able to cope successfully with their common enemy, the Teutonic Order, the influence of which had greatly grown during the preceding period. On 15 July 1410 the knights were overwhelmingly defeated in the battle of Tannenberg, the first of a series of conflicts which were terminated only in 1466 by the second peace of Thorn by which Poland acquired West Prussia with Ermland, thus obtaining an outlet on the Baltic Sea, and established its suzerainty over East Prussia, which was left in the possession of the Teutonic Order. Wladislaw I. Jagello, though successful in his wars, sought vainly to assert the privileges of the crown against the nobility in whose hands the political power was being rapidly concentrated at the expense of the king, of the middle classes, who were deprived of many privileges, and of the peasantry, who, from a condition of personal freedom, were reduced to the severest state of servitude and were subjected to the harshest oppression. The successor of Jagello, Wladislaw III. (1434-44), was elected in 1440 to the throne of Hungary, but perished four years later in the disastrous battle of Varna while defending his new kingdom against the Turks. It was under his successor, Casimir IV. (1444-92) that the Polish arms gained their most notable victories over the Teutonic Order, but while the kingdom thus obtained a notable increase of territory, the royal power suffered further diminution. Casimir placed the members of the lower nobility on an equal basis with the high dignitaries of the realm, and Poland thus rapidly assumed its character of an aristocratic republic which it was soon virtually to become. Sigismund I. (1506-48), the youngest son of Casimir IV., waged unsuccessful wars with Russia and carried on a long struggle against the Tartars. In 1525 Albert of Brandenburg, the last grandmaster of the Teutonic Order, made himself Duke of Prussia and received the province from the Polish king as a secular fief. Sigismund I. was succeeded by his son Sigismund II. Augustus (1548-72), whose reign marked the very apex of the Polish



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power and whose death was the beginning of its speedy decline. By the Union of Lublin in 1569 Lithuania was incorporated with Poland, and the boundaries of the new state were further enlarged by the acquisition of Livonia from the Knights of the Sword and by conquests in Russia and Wallachia. Poland then extended from the Baltic Sea to within 50 miles of the Black Sea and from the Oder River in the west to the Dnieper in the east. It was the most powerful kingdom of eastern Europe, but its continued ascendancy was soon to be seriously threatened by the preponderant influence of the nobility, whose class interests were destined to plunge the country into anarchy. A further cause of civil dissension was the Reformation, which won over a large number of the people but met with the most bitter opposition from the Jesuits in league with the nobility. Sigismund II. Augustus died in 1572 leaving no heir, the last of the male line of Jagello, and Poland was henceforth an aristocratic republic with a king elected by the nobility and limited in his power by the fundamental statutes which vested the supreme authority in the Diet. Bribery now became a recognized means of securing elections to the throne and factions reigned supreme. What further tended to demoralize the entire governmental fabric were the frequent exercise of the *liberum veto*, in accordance with which a single negative vote on any legislative measure served to bring about the dissolution of the Diet and to annul its entire work, and the so-called right of "confederation" by which any number of nobles might take up arms for the purpose of executing their will. Henry of Anjou, a brother of Charles IX. of France, was the first elected king, but after a brief reign of four months he fled secretly from the country. He was succeeded by Stephen Báthory (1575-1586), who failed to secure an increase of power for the crown. During his reign there was a bitter struggle carried on between the adherents of the Reformed religion and the Roman Catholic party, and after his death civil war raged for a year before the Catholics succeeded in establishing on the throne their candidate, Sigismund III. (1587-1632) of the house of Vasa. Sigismund sought to interfere in the affairs of Russia with little profit and lost Livonia to Sweden. He was succeeded by his sons Wladislaw IV. (1632-48) and John Casimir (1648-69), under the latter of whom occurred a formidable revolt of the Cossacks in 1648. The insurgents transferred their allegiance to Russia and after a long war with that power Poland was forced to cede in 1667 Smolensk, Kiev, and the lands east of the Dnieper. Livonia had been surrendered to Sweden by the peace of Oliva in 1660. The patriotic efforts of the succeeding rulers Michael Wisnowiecki (1669-73) and John Sobieski (1674-96) failed to check the rapid decline of the country.

On the death of Sobieski the choice of the Diet fell upon Augustus II. Frederick, elector of Saxony. Augustus joined with Russia and Denmark in the war against Sweden and this was followed by the invasion of Poland by Charles II., the capture of Warsaw (1703), and the election of a rival king, Stanislas Leszczynski, in whose favor Augustus was compelled to abdicate. After the downfall, however, of Charles XII. at Poltava (1709), Stanislas was

driven from the country and Augustus was reinstated with Russian aid. On his death in 1733 the majority of the Diet chose Stanislas Leszczynski as king, but Russian troops compelled the election of the son of the dead king, Augustus III. Frederick (1733-63), whose election led to the so-called Polish Succession war (q.v.), and whose incompetent rule hastened the downfall of the country. Weakened by internal strife, Poland retrograded also in comparison with the growing power of her neighbors, Prussia and Russia. The influence of the latter power triumphed over that of France, whose partisans at one time were numerous, and was exerted to intensify the anarchic condition of the country by checking all efforts at reform and thus accelerating the impending ruin. On the death of Augustus III., in 1763, Catharine the Great of Russia forced the selection of her lover Stanislas Poniatowski as Polish king and the Russian influence thus became absolute. Religious disputes afforded Russia the desired opportunity for armed intervention, the patriotic party was overwhelmed, and Poland seemed destined to become the sole prey of Russia, when Prussia and Austria, to safeguard their interests, agreed to enter into a treaty of partition, and in 1772 this was accomplished. Austria obtained eastern Galicia with Vladimir, 27,000 square miles with 2,700,000 inhabitants; Prussia secured West Prussia and the Netze district, 13,400 square miles with 400,000 inhabitants; Russia acquired territory in Lithuania, 42,000 square miles with 1,800,000 inhabitants. The national disaster spurred on the party of reform to new efforts. In 1791 a constitution was adopted which provided for the abolition of the *liberum veto* and the right of confederation. The Russian faction, however, took up arms against the new constitution and called in the Russian troops to their aid. The Poles under Kosciuszko (q.v.) were defeated at Dubienka (14 July 1792), the weak King Stanislas was forced to give his consent to the annulment of the constitution, and in 1793 followed the second partition of Poland in which only Prussia and Russia were concerned, the former receiving 22,500 square miles with 1,100,000 inhabitants, and the latter 96,000 square miles with a population of 3,000,000. A national outbreak now followed, Kosciuszko was made dictator, and fighting with heroic courage, the Poles won a number of victories over the Russians, who were driven from Warsaw and Vilna; but dissensions arose among the insurgents and their forces were insufficient to cope with the united strength of Russia, Austria, and Prussia. On 10 Oct. 1794 Kosciuszko was decisively defeated by the Russians at Maciejowice, Warsaw was stormed and fearful punishment was inflicted upon the inhabitants. In October 1795 came the third and final partition of Poland, 21,000 square miles (including Warsaw) with a million inhabitants going to Prussia, 18,000 square miles with more than a million inhabitants to Austria, and 45,000 square miles with 1,200,000 inhabitants to Russia. Poland had been wiped out of existence.

The leaders of the national party went into exile and there nourished the hope of a restored Polish kingdom. Their chief reliance was in Napoleon (q.v.), who in 1807 by the treaty of Tilsit (q.v.) erected the grand duchy of Warsaw



## POLANGUI—POLAR RESEARCH

out of Prussian Poland and in 1809 added to it Cracow and West Galicia, taken from Austria. The grand duchy of Warsaw fell, however, after the disastrous campaign of 1812, and the Congress of Vienna once more parceled out the Polish dominions, assigning West Prussia and Posen to Prussia, Galicia with the exception of Cracow to Austria, and the rest of Poland to Russia, to constitute a kingdom of Poland with the czar as king. Alexander I. issued a liberal constitution for Poland in 1815, but the harshness of the Russian officials and the aspirations of the nobles for national independence led to a formidable insurrection in 1830. So sudden was the uprising that the Russians were compelled to abandon the country. A provisional government under Prince Adam Czartoryski sought to negotiate with the Czar, but the latter refused all concessions and poured troops into the country. The Poles led by Chlopicki, Skrzynecki, and Dwernicki were repeatedly victorious in the winter and spring of 1831, but their forces were exhausted with time, Skrzynecki met a disastrous defeat at Ostrolenka (26 May), and in September Warsaw surrendered to Paskevitch. The constitution of 1815 was annulled and Poland was given up to the despotic régime of Russian officials. The national life, however, was not dead and unsuccessful insurrections of more or less importance occurred in Prussian and Austrian Poland in the years 1846–8. In Russian Poland a series of reforms initiated by Alexander II. in 1861 lent renewed hope to the democratic faction of the national party. The outbreak was hastened by the enactment of an obnoxious recruiting law. Uprisings took place in the early months of 1863 all over the country and the revolutionary movement was guided by a central committee in Warsaw. The Russian government was energetic in stamping out the insurrection, and the interposition of Great Britain, France, and Austria in behalf of the Poles was of no avail. Russia profited, too, by the civil strife which now broke out between the Polish peasants and their masters, and by proclaiming the emancipation of the peasants in March 1864, broke the backbone of the insurrection. Russia's vengeance was severe. Many of the Polish leaders were executed, and thousands were transported to Siberia. The Russian rule was restored in greater severity and with such effect that Poland since 1864 has dared to make no resistance. The policy of Russification has been ruthlessly carried out by the government; and by the introduction of the Russian language into the courts, the administration and the educational system, Russia is patiently seeking to effect the denationalization of the Polish people.

For *Language and Literature*, see POLISH LANGUAGE and LITERATURE.

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**Polangui**, pō-lān'gē, Philippines, pueblo, province of Albay, Luzon; on the Inaya River; 18 miles northwest of Albay, the provincial capital, near the boundary of Ambos Camarines (Sur). It is also on the main road and its situation gives excellent advantages for trade in hemp. Pop. 10,050.

**Polar or Ice Bear.** See BEARS.

**Polar Circles**, two imaginary circles of the earth parallel to the equator, the one north and the other south, distant  $23^{\circ} 28'$  from either pole. The surfaces enclosed by these circles are known as frigid zones.

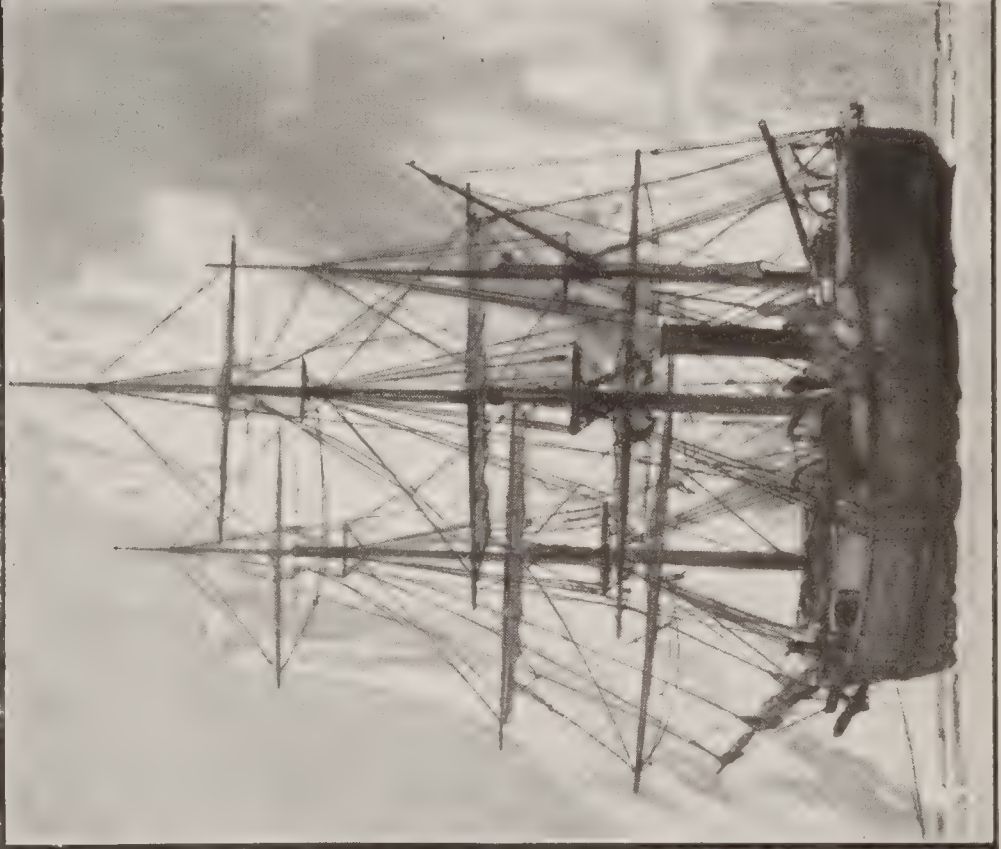
**Polar Clock**, a tube containing a polarizing apparatus, turning on an axis parallel to that of the earth. It indicates the hour of the day on an hour circle by being turned toward the plane of maximum polarization of the light of the sky, which is always  $90^{\circ}$  from the sun.

**Polar Distance**, in astronomy, the angular distance of any point on a sphere from one of its poles; more especially, the angular distance of a heavenly body from the elevated pole of the heavens. It is measured by the intercepted arc of the circle passing through it and through the pole, or by the corresponding angle at the centre of the sphere. According as the north or south pole is elevated we have the north polar distance or the south polar distance. The sum of the two polar distances of any point is obviously  $180^{\circ}$ .

**Polar Exploration.** See POLAR RESEARCH.

**Polar Research.** American exploration in the Arctic divides itself readily into three parts. The expeditions, 1851–5, incident to the Sir John Franklin search; those promoted by the United States Government, 1870–2 and 1881–4, and those projected, financed and led by Commander Robert E. Peary, U. S. N., 1891–1906. The first American ships to participate in the Franklin search were the *Advance* and *Rescue*, in command of Lieut. De Haven, which, leaving New York 24 May 1850, searched the Greenland coast as far north as practicable, returning late the same year, with no tidings of the lost explorer. Henry Grinnell, a New York merchant, who had given liberally to the work, renewed his offer of aid, and equipping the brig *Advance*, despatched her from New York 30 May 1853, in command of Elisha Kent Kane, U. S. N., surgeon of the De Haven Expedition, with John Brooks as first officer, and Capt. J. Wall Wilson navigator. The *Advance* wintered in Rensselaer Harbor, on the western coast of Greenland,  $78^{\circ} 37' N.$ , but, unable to free herself from the ice, was detained a second winter, during which a party retreated about half-way to Cape York, where they were obliged to turn back, and on 17 May 1855 the whole company, with their boats, left the *Advance* and after an arduous journey reached Upernavik 9 August. Dr. Kane found no trace of Sir John Franklin, but his explorations by sledge were extensive and the scientific results of his expedition valuable. William Morton, leading one of the sledge parties, reported that at Cape Constitution ( $82^{\circ} 27' N.$ ) on 21 June 1854 he had seen the open Polar Sea, and upon this statement much subsequent discussion was predicated. One death, that of Christian Ohlsen, carpenter, occurred 12 June 1854, in the Kane Expedition, of which one





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1. THE DISCOVERY

2. THE GAUSS

3. THE FRAM

4. THE ROOSEVELT (NEW PEARY SHIP)

5. THE PANTHER

6. THE POLAR STAR







## POLAR RESEARCH

member, Capt. Amos Bonsall, of Philadelphia, still survives.

In 1860 Dr. Isaac I. Hayes, surgeon of the Kane Expedition, returned to the North in the schooner *United States*, and during the spring of 1861 accomplished a memorable sledge journey, crossing Smith Sound and carrying the flag of his country to Cape Lieber, Grinnell Land,  $81^{\circ} 35'$ , and losing by death the astronomer of his party, Sonntag, at the head of Foulke Harbor, the winter quarters of the *United States*. In 1871 Capt. Charles Frederick Hall, who had extensive experience, principally among the Eskimos of Labrador and Baffin Land, sailed from New York on the steamer *Polaris*, outfitted and equipped by the *United States*, and on 3 September went into winter quarters in Thank God Harbor, lat.  $81^{\circ} 38' N.$ , lon.  $61^{\circ} 44' W.$  Capt. Hall, on 10 October, left on a sledge trip, reaching  $82^{\circ} 2' N.$ , and on 8 November, after an illness of a few days, died on board the *Polaris*, Capt. Samuel Buddington succeeding to the command. Scientific investigations were continued during the winter, but no extensive field work attempted, and on 12 Aug. 1872 the *Polaris* started south. During the night of 15 October the floe to which the ship had been fastened, parted from it, and from that date 19 men, women and children drifted over 1,500 miles, until they were picked up 30 April 1873 off Grady Harbor, Labrador, by the Newfoundland sealer *Tigress*. Capt. Buddington and the remainder of the party wintered at Lifeboat Cove, north of Littleton Island and, retreating southward in the spring, were picked up 23 June by the whaler *Ravenscraig* and landed in due course at Dundee, Scotland, a relief expedition under command of Captain, afterward Admiral, D. L. Braine, with Lieutenant, afterward Captain, George F. De Long, of the *Jeannette*, second in command, having made a fruitless search of the Greenland coast and of Melville Bay as far as Cape York.

The *United States*, participating with the principal European countries in a system of circumpolar weather stations, on 21 July 1881 despatched from Saint Johns, N. F., in the chartered steamer *Proteus*, an expedition in command of Lieut. Adolphus G. Greely, Fifth cavalry, U. S. A., which took station at Lady Franklin Bay, Grinnell Land, lat.  $81^{\circ} 44' N.$ , lon.  $64^{\circ} 45' W.$ , the *Proteus* returning after discharging supplies and equipment. The station, named Fort Conger in honor of the senator from Michigan, to whose efforts it was largely due, was amply equipped, and early in the season Dr. Octave Pavy, surgeon of the expedition, made a sledge journey along the eastern coast of Grinnell Land to its extreme northern point, near Cape Joseph Henry, and other field parties worked in the interior, discovering abundant deposits of coal at Water Course Bay, but a few miles from the station. In April 1882, Lieut. James B. Lockwood, accompanied by Sergeant David L. Brainard and Frederick, an Eskimo, supported by other members of the party, crossed Robeson Channel to the Greenland coast, and on 5 May 1882 reached  $83^{\circ} 24' 5''$ , the farthest north then attained by man, and for many years the highest reached by the American flag. On 9 Aug. 1883 the entire party retreated from Fort Conger, and in September went into winter quarters near Cape Sabine,

whence they were, on 26 May 1884, rescued by Capt. W. S. Schley, commanding the *Bear* and the *Thetis*, 19 of the party, including Lieut. Lockwood, having perished from starvation. The scientific work of the Greely party was of the first importance, and its magnetic and meteorological data, all of which were preserved, complete and valuable. A privately equipped expedition, that of the *Jeannette*, under Lieut. George W. De Long, U. S. N., left San Francisco in 1879, and passing through Bering Strait, entered the ice at about the 83d parallel. The *Jeannette* was crushed and sunk on 12 June 1881, when in lat.  $77^{\circ} 14' 57'' N.$  and lon.  $154^{\circ} 58' 45'' E.$ , and upon retreating to the Siberian coast in three parties, one boat commanded by Lieut. Charles W. Chipp, U. S. N., was separated from the others, and never again heard of. Capt. De Long, reaching the mouth of the Lena Delta, perished from starvation, only two of his party surviving, while the third boat under command of Chief Engineer, now Admiral, George W. Melville, U. S. N., reached land in safety without the loss of a man. The English Government in 1875 despatched the *Discovery*, Capt. George Nares, and the *Alert*, Commander Albert Markham, by way of Smith Sound to the north, and during the following winter sledge parties accomplished much work to the westward of Cape Joseph Henry, carrying the reconnoissance to  $75^{\circ} 30' W.$ , while a party advanced from Cape Hecla directly over the sea-ice to the Pole to  $83^{\circ} 20'$ . Both ships were beached during the winter, but were successfully floated the following summer and returned in safety.

Lieut. Robert E. Peary, U. S. N., having, in 1886, made a summer's reconnoissance of the Greenland ice-cap, sailed from New York 6 June 1891 in the *Kite*, accompanied by Mrs. Peary and his own party of five, the expedition being sustained wholly by his private resources and the assistance of a few friends. Establishing winter quarters on the eastern side of McCormick Bay, lat.  $78^{\circ} 10'$ , lon.  $69^{\circ} W.$ , the winter was passed in preparation for the land journey, and on 10 April 1892, accompanied by Eivind Astrup, Peary began his attempt to cross Greenland to the northeast, which ended on 4 July at Navy Cliff, Academy Bay, lat.  $83^{\circ} 27'$ , lon.  $61^{\circ} 10'$ , where he gained an unbroken and commanding view of the Arctic Ocean, demonstrating the insularity of Greenland, an achievement for which he subsequently received the gold medal of the Royal Geographical Society and the Cullum gold medal of the American Geographical Society. Returning in 1893 with a larger party, Peary established headquarters at the head of Bowdoin Bay, also an arm of Inglefield Gulf, lat.  $77^{\circ} 43'$ , lon.  $63^{\circ} 10'$ , where on 12 Sept. 1893, Marie Ahnighito Peary was born, and in March 1894 renewed his attempt to cross the inland ice-cap and to push his explorations farther to the northward. An unprecedented equinoctial storm and a plague among his dogs frustrated his plans, and on 29 August the party, except Peary, Hugh J. Lee and Mat Henson, returned to the States. In the following spring the three men made a successful attempt to again cross the ice-cap, though failure to recover the provisions cached the previous year, 120 miles from headquarters, was a serious obstacle and compelled return with only about 15 miles farther north than had been made two



## POLARIS

years before. In 1896 and 1897 Peary again visited Greenland, bringing home on the former the smaller, and on the latter voyage the larger, the 90-ton meteorite, which had been seen 70 years before by Sir James Ross at Meteor Island, near Cape Sabine, and which had furnished the natives with tools and cutting implements, and is the largest known meteor in the world. Having organized the Peary Arctic Club, of a few of his personal friends, on 4 July 1898 Peary sailed from Saint Johns, Newfoundland, in the *Windward*; wintered in her in Allman Bay, lat.  $79^{\circ} 10'$ , lon.  $75^{\circ} 20'$ , on the west side of Smith Sound, rectifying and recharting the whole Bache peninsula and Buchanan Sound country, and on 1 Jan. 1899, sledging along the ice-foot, reached Fort Conger, isolated since Gen. Greely's departure, 18 years before. In June, Peary pushed westward, crossing the divide of Grinnell Land, and looked down upon the open and ice-free sea beyond. Leaving his headquarters at Etah early in March 1900 and Fort Conger, 15 April, he reached "Lockwood's farthest," 8 May, and a disintegrated pack and an open sea preventing further advance to the Pole, rounded the northern end of the Greenland archipelago, discovering the most northern known land in the world, which he named in honor of the president of the Peary Arctic Club, Cape Morris K. Jesup. Pushing his explorations southeastward to  $82^{\circ} 10'$ ,  $61^{\circ} 30'$  W., on 21 May Peary saw before him to the south the peaks of Independence Bay, which he had discovered nine years before and realized that the demonstration was complete, and that the mystery which had surrounded the northern end of Greenland for a thousand years had been dispelled. The winter of 1900-1 was passed in the field, near Lake Hazen, Grinnell Land, and on 6 May 1901 Peary joined the *Windward* with Mrs. Peary and Miss Peary on board, which had been ice-bound since the previous September at Payer Harbor, near Cape Sabine. Wintering at Cape Sabine, 1901-2, in February, accompanied only by Matthew Henson and natives, Peary returned to Fort Conger and endeavored to attain the Pole, from Cape Hecla as a point of departure, but on 16 May, at  $84^{\circ} 17'$ , the highest then attained by the American flag, he was compelled by insurmountable pressure ridges and the condition of the ice to give up the attempt, and returning to Cape Sabine he was met, 5 August, by the *Windward* with Mrs. Peary on board, and reached Sidney, C. B., 15 September, thus concluding 12 years of arduous and most successful work. In the spring of 1906 he succeeded in reaching  $87^{\circ} 6'$  north latitude in the *Roosevelt*, or within about 203 miles of the north pole, thus creating another "farthest north" record.

In 1893 Frithiof Nansen in the *Fram*, specially constructed for the purpose, entered the ice off the northern coast of Asia and for the next three years drifted northward, one of the objects of the expedition having been to demonstrate the theory of the drift from east to west. On 12 March 1896 Nansen, accompanied by Lieut. Johansen, left the *Fram* in lat.  $84^{\circ}$ , and with dogs and sledges pushed his way over the sea ice poleward to  $86^{\circ} 14'$  on 20 May, when farther advance was impossible. Retracing his course Nansen and Johansen finally, without dogs, landed on the northern shore of Franz

Josef Land, where in a hut and subsisting upon seal and walrus meat the two explorers passed the winter. While advancing southward on 12 May 1897 they were descried by Frederick Jackson from his headquarters at Cape Flora, and remained with him at his camp until his return the following summer. The *Fram*, under command of Capt. Sverdrup, after Nansen's departure, drifted still farther to the north, attaining only 18 miles less than Nansen's highest, and by almost superhuman exertion, was broken out of the ice later in the season, reaching Tromsø but a few days after Nansen. The entire party and ship returned together to Christiania, from which they had departed three years before.

Alfred C. Harmsworth, proprietor of *The Daily Mail* and other London publications, in 1892 despatched an expedition led by Frederick C. Jackson, with Lieut. Albert H. Armitage, R. N., second in command, to Franz Josef Land for a thorough reconnoissance of the archipelago and an advance to the north as far as practicable. The *Windward* remained ice-bound near Jackson's headquarters at Cape Flora for the first winter, and for three succeeding summers visited the station with supplies and reinforcements. The work of Jackson included the charting and mapping of a large portion of the Franz Josef Land archipelago, though in consequence of unfavorable conditions not attaining a latitude higher than had been previously accomplished.

In 1901, Prince Luigi, Duke d'Abruzzi, in the *Stella Polari*, reached Teplitz Bay on Franz Josef Land, where the ship was beached and winter quarters established. The following spring the sledge parties led by Capt. Umberto Cagni achieved, on 3 April,  $86^{\circ} 33'$ , the highest latitude then attained by man, for which achievement both the Prince and Cagni received upon their return gold medals from the Royal Italian Society and recognition by the scientific bodies of the world. Other attempts upon the Pole by the Franz Josef Land route have been made by Walter Wellman and Evelyn B. Baldwin, the latter under the patronage of William Ziegler, whose second expedition, led by Anthony Fiala, left Tromsø in July 1903.

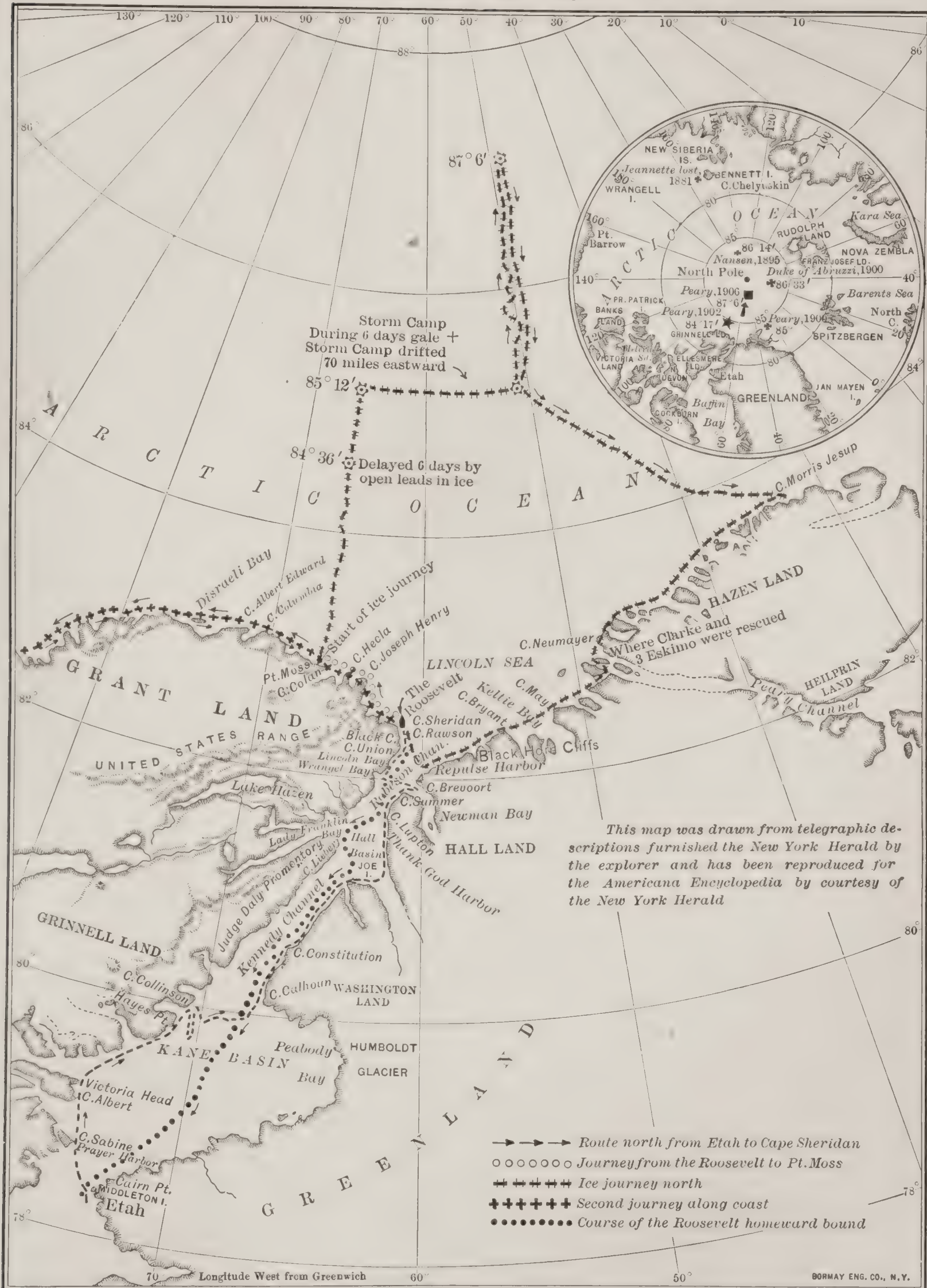
Capt. Otto Sverdrup, of the Nansen expedition, sailed in 1898 to Smith Sound in the *Fram*, and after having been ice-bound for the winter of 1898-9 in Rice's Straits, in the autumn of the latter year entered Jones' Sound, where he remained for the next two winters, pushing a line of extensive exploration northward and westward by the former of which he practically determined the insularity of Grinnell Land, and by the latter carrying the flag of his country to  $85^{\circ} 42'$  and definitely mapping much coast which had before been inaccurate or imaginary. Capt. Sverdrup's surgeon, Dr. Jensen, died during the first winter in Rice's Straits, but with this exception his entire party, after a diligent and arduous three years, returned in good health. For South Polar Research, see ANTARCTIC REGIONS, *Exploration*.

HERBERT L. BRIDGMAN,  
*Secretary Peary Arctic Club.*

**Polaris**, pō-lā'rīs, in astronomy, the star  $\alpha$  of the constellation Ursa Minor. It is at present near the north pole, and many centuries must elapse before precession will cause the



Map showing route and journeys of Com. Robert E. Peary in the *Roosevelt* in his latest endeavor to find the North Pole (1905-6).



POLAR RESEARCH.







## POLARISCOPE — POLARIZATION OF LIGHT

north pole to be defined by any other star. Two stars called the pointers, in the constellation Ursa Major (the Great Bear, commonly called the Plough), always point in the direction of the pole-star, and enable it to be found readily.

**Polariscope**, an instrument used for polarizing light and analyzing its properties. See POLARIZATION.

**Polarization of Light**, an effect upon the mode of vibration of light produced by reflection, ordinary refraction or double refraction. The term *polarization* is due to Newton who in the development of his emission theory of light made use of a supposed analogy between the phenomena of magnetism and those observed in optics. The distinction between polarized and unpolarized or as it is sometimes called natural light may be most readily illustrated by means of the phenomena observed when a beam of light is reflected from the surface of a plate of glass or from any other transparent material.

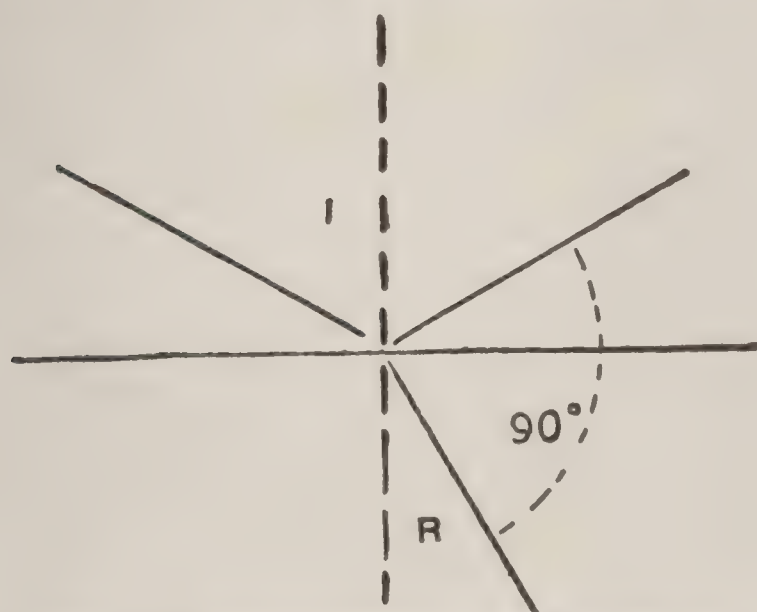


FIG. 1.—The angle of complete polarization.

At whatever angle a beam may strike the surface a portion will be reflected and the remainder will penetrate the glass following a path the direction of which is determined by the well-known law of ordinary refraction. According

to this law  $\frac{\sin i}{\sin r} = n$ , where  $i$  (Fig. 1) is the angle of incidence,  $r$  the angle of refraction and  $n$  the index of the glass or other material. The reflected ray, although weaker than the incident ray appears, if we judge it by many of its ordinary properties, to be precisely similar to the latter. It is not, however, in all respects the same, for if it be again reflected from the surface of glass the reflecting power of this second mirror will be found to depend upon its position. If for example both mirrors be so mounted (Fig. 2) that the angle of incidence for each is about  $57^\circ$  and if the second mirror be turned upon an axis so situated as to permit of its rotation without changing the angle of incidence, it will be found that the second mirror reflects the beam received from the first mirror just as it would any ordinary ray so long as its position is such as not to divert the beam from the plane in which it is first reflected. When, however, in consequence of the rotation, the plane of reflection at the second mirror deviates from that at the first mirror, the proportion of light reflected diminishes. When the angle between these two planes becomes  $90^\circ$  no light is re-

flected from the surface of the second mirror. This striking phenomenon was first noticed by Malus in 1811.

It is clear that the beam of light, as the result of the first reflection, has undergone some

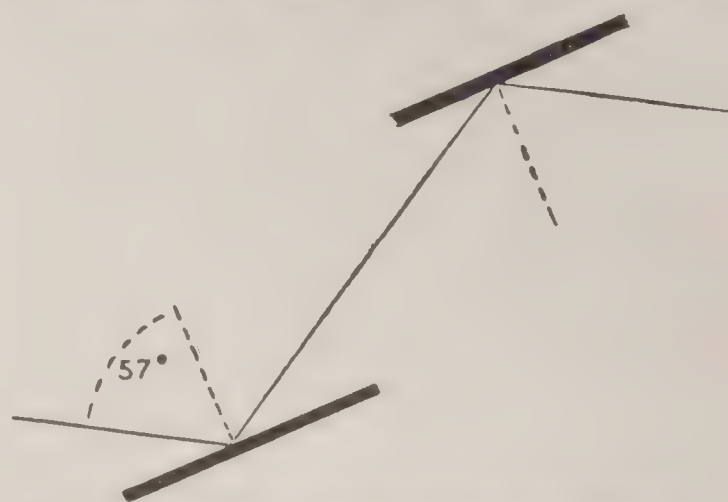


FIG. 2.—Mirrors for polarization by reflection.

modification which renders it incapable of being reflected the second time under the conditions just stated. Light thus modified by reflection is said to be polarized. To understand the nature of this modification let us consider that in accordance with the accepted theory, light consists of exceedingly rapid transverse vibrations of the luminous ether. These transverse vibrations, the progressive motion resulting from which constitutes the light-wave, are supposed to be rectilinear. When, however, in the case of a beam of unpolarized light, we attempt to determine the plane in which the vibrations take place we find that they appear to occur equally in all planes at right angles to the axis of the wave. This is, indeed, the quality which is expressed by the term *unpolarized* light. This is not strange, however, when we consider that in one second of time about 500 million million vibrations of the ether have taken place. It is supposed that the plane of vibration gradually shifts so that, in the relatively very long interval of time necessary to produce an effect upon the eye, vibrations will have taken place in every possible plane to an equal extent.

That this shifting of the plane of vibration of light is really very slow appears from the ingenious experiments of Lummer and Gehrcke (Deutsche Physikalische Gesellschaft, 1902) who have shown that there is no appreciable shifting of the plane of vibration during an interval of time sufficient to allow of at least 2,600,000 vibrations of the ether. Better to grasp these relations, imagine a vibratory movement with a period of one second. More than 2,000,000 years would then elapse before the number of vibrations would equal that executed in the vibration which causes light in a single second of time. In the case of this slow vibration we should expect to be able to detect a slight change in the plane in which the vibrations take place after about four days. Even with this very gradual shifting of the plane of vibration, however, it is obvious that in the course of 2,000,000 years the opportunities for variation are so great that one would not any longer be able to determine what the original plane of vibration had been.

We may for convenience in considering the effect of reflection on a beam of light regard it as made up of two sets of rectilinear vibrations, equal and at right angles to each



## POLARIZATION OF LIGHT

other; and that one of these sets of vibrations is in the plane of incidence. When the ray reaches the surface of the glass obliquely the component which is vibrating at right angles to the plane of incidence will have its motion parallel to the surface, while the other vibration will penetrate the surface of the glass. One of these will pass on into the glass while the other will be reflected. The result of reflection, therefore, will be to separate the beam of unpolarized light into two parts and the reflected ray will vibrate in a single fixed plane. Light modified in this way is said to be *plane polarized*. The complete separation of the two components by reflection occurs only at a certain angle of incidence, called the *angle of polarization*. Brewster ('Philos. Transactions,' 1815) discovered that this angle varied with different substances and that  $\tan a = n$ , where  $a$  is the angle of polarization and  $n$  is the index of refraction. This relation is fulfilled whenever in a given case the refracted ray makes an angle of  $90^\circ$  with the reflected ray (see Fig. 1). When the polarized beam reaches the second mirror it will be freely reflected provided the planes of incidence of the two mirrors coincide. When the second mirror is turned so that these planes are at right angles, the ray will penetrate the glass without reflection.

When the theory of light was first developed at the hands of Fresnel, Neumann and numerous other mathematicians, it seemed difficult to determine positively which component of the unpolarized incident ray at the first reflection would be transmitted and which would be reflected. It became customary, therefore, to speak of the plane of polarization rather than of the plane of vibration of the polarized ray; leaving it undetermined whether polarized light vibrated in the plane of polarization or at right angles to the same. The plane of polarization is defined as the plane of incidence. According to the assumptions made by Fresnel, the plane of vibration is perpendicular to the plane of polarization so that it is the component of the incident ray whose vibrations are parallel to the glass, which is reflected.

Some remarkable experiments which afford direct experimental evidence concerning the plane of vibration of polarized light were made by Wiener in 1890 (Wiedemann's 'Annalen,' Vol. 40, page 203). Wiener was able to locate by photographic means the position of the nodes of a standing system of light-waves produced by the interference within a collodion film on glass of the incident and the reflected ray. His interpretation of the results led him to the conclusion that the plane of vibration of polarized light is, as Fresnel had assumed, perpendicular to the plane of polarization.

*Polarization by Double Refraction.*—Another method by which it is possible to separate a beam of unpolarized light into two polarized components consists in causing the beam to pass through a doubly refracting medium. Many crystals have a structure such that the velocity at which light-waves are transmitted by them depends upon the plane of vibration. A beam of light entering such a crystal is in general resolved into two components, one of which vibrates in the direction which will permit the light to travel with the maximum velocity, the other at right angles to the same. These two polarized beams travel through the crystal

independently, the latter being more retarded than the former. If the light enters the crystal obliquely the index of refraction for the two components will differ. The component ( $O$ ) which is most retarded will be more bent from its original path than the other ( $E$ ) and will take a somewhat different direction through the crystal (see Fig. 3). If the two polarized

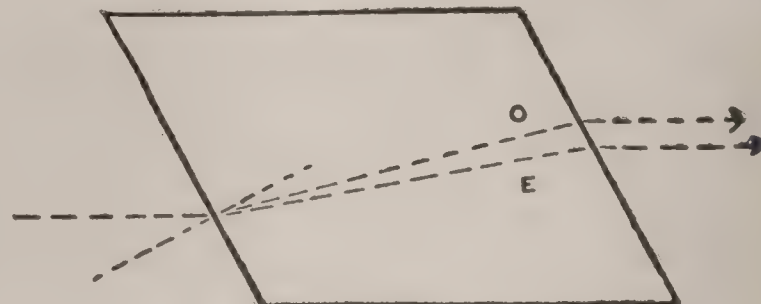


FIG. 3.—Double Refraction.

beams thus produced by the action of the crystal leave the crystal through a face parallel to that at which they entered, both will be restored to their original direction and instead of one beam of unpolarized light we then have two beams traveling along parallel paths. The distance between them will depend upon the thickness of the crystal, the angle of incidence and the extent to which the crystal is doubly refracting. If, for example, in the path of a beam of unpolarized light a diaphragm with a circular opening be placed and between this and a screen a lens be mounted in such a position as to produce an image of the diaphragm upon the screen we shall have a circular spot of light at that point on the screen where the image falls. If now in the path of the ray we interpose a rhomb of calcite (Iceland spar) the surfaces of which form an oblique angle with the path of the ray, the latter upon entering the crystal will be bent from its course and divided into two as already described. These upon reaching the screen will form two images of the diaphragm. One of these polarized rays is spoken of as the *ordinary* and the other as the *extraordinary* ray.

To obtain a single beam of polarized light by means of the action of a doubly refracting crystal it is only necessary to interpose a screen which will intercept one and not the other of the two polarized components, or what is more convenient, to devise some way of intercepting one of these rays within the crystal itself. The device usually employed for this purpose was invented by Nicol (1828). The so-called Nicol prism consists of a rhomb of calcite of the form shown in Fig. 4. The rhomb is cut through diag-

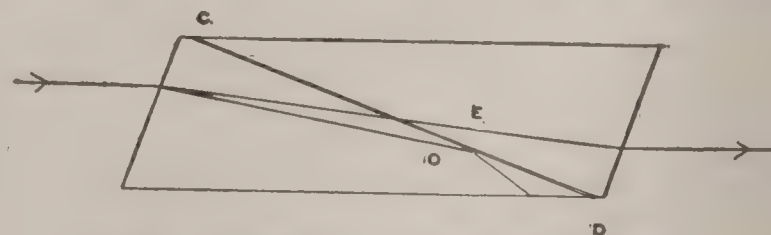


FIG. 4.—Diagram of the Nicol prism.

onally at  $CD$  and is then cemented together by means of a layer of Canada balsam. The extraordinary ray meets the interface thus produced at an angle which permits its passage while the ordinary ray which is more bent from its course is totally reflected at  $O$  and passes out through the side of the prism. In this way a single ray of polarized light the plane of polarization of which is known is obtained. This method of produc-



## POLARIZATION OF LIGHT

ing polarization has the advantage over the method of reflection that the intensity of the polarized light is nearly half of that of the unpolarized ray. The intensity would be exactly 50 per cent but for the slight losses by reflection at the surfaces and by the absorption within the crystal. Various modifications of the Nicol prism have since been devised by Foucault, Glan, Thompson and others.

By means of certain doubly refracting crystals, of which tourmalin is the best example, it is possible to obtain a single plane polarized ray of light without recourse to any artificial device for the separation of the two rays. Such crystals possess the property of absorbing one of the polarized components much more strongly than the other, so that when light is seen through a layer of moderate thickness a considerable percentage of one of the components is transmitted while the other component is completely absorbed. The use of tourmalin has the disadvantage that the intensity of the transmitted ray is greatly reduced and that owing to the selective character of the absorption within the crystal the composition of the light is greatly modified. Thus white light transmitted by tourmalin is changed by the almost complete absorption of the blue and violet rays to a yellowish green color.

*Polariscopes.*—An instrument by means of which the investigation of the properties of polarized light and of the numerous effects obtained with the same is carried on is called a *polariscope*. In its simplest form this instrument consists of two parts. The function of the first which is called the *polarizer*, is to produce plane polarized light; that of the second to enable one to determine the direction of the plane of polarization of the ray thus produced. This part is called the *analyzer*. The most convenient form of polariscope for many purposes consists of two Nicol prisms *P* and *A*, Fig. 5, mounted

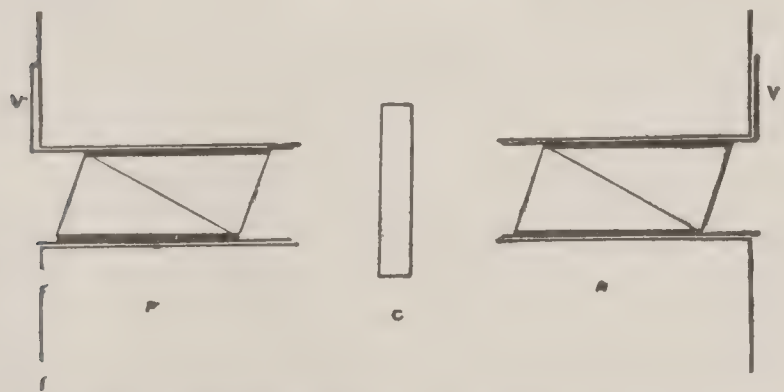


FIG. 5.—Essential parts of a simple polariscope.

in a common axis, each of which is capable of rotation about this axis. The position of the polarizing plane of each of these prisms is indicated by means of a pointer *V* attached to the prism and moved as the prism is turned around a graduated circle. The polarized ray produced by the passage of light through the first Nicol prism enters the second where it is separated into two components, one of which, the extraordinary, is polarized in the polarizing plane of this prism, while the other is polarized at right angles to that plane. The intensity of these components depends upon the angle which its polarizing plane makes with the polarizing plane of the first Nicol prism. When these two polarizing planes are parallel the *ordinary* component in the second prism becomes equal to zero and

the whole of the polarized ray is transmitted; subject only to losses by reflection. As the angle between the polarizing planes of the two prisms increases, the intensity of the extraordinary or transmitted ray falls off and that of the ordinary ray increases until, when this angle reaches  $90^\circ$ , the intensity of the extraordinary ray is reduced to zero and no light is transmitted. Whatever be the angle between the polarizing planes of the two prisms the intensity of the ray transmitted by the analyzer is proportional to  $I \cos^2 \alpha$  where  $I$  is the intensity of the incident ray and  $\alpha$  is the angle between the polarizing planes. When the angle is  $90^\circ$ , so that no light is transmitted, the prisms are said to be *crossed*.

When between the polarizer (*P*) and analyzer (*A*) of a polariscope (Fig. 5), with prisms crossed, a layer (*C*) of any transparent doubly refracting crystal is placed there is restoration of light. Although as already explained the polarized beam from the first prism was unable to pass through the second, the insertion of the crystal between the two prisms has enabled it to do so. The explanation of this beautiful phenomenon is as follows:

The beam of plane polarized light from the first Nicol, which we may suppose to be vibrating in a vertical plane, enters a medium when it reaches the crystal, in which in general light vibrating in two oblique positions at right angles to each other, and in those positions only, is transmitted. The beam then is resolved into two components having these oblique directions of vibration. The light which reaches the analyzer after passing through the layer of crystal is vibrating in these two oblique planes each of which has a horizontal component which is capable of passing through the prism. Not the whole of the light from the polarizer is transmitted by the analyzer, the vertical component of each of the oblique rays being suppressed.

A great variety of crystalline substances, such as quartz, mica, selenite, calcite and indeed all doubly refracting substances, are capable of producing this effect. If the crystalline layer be of proper thickness not only do we have transmission of light but likewise a change of white light into light of other colors produced by the interference of the two components after passage through the second prism. This production of colors by means of a polariscope is one of the most striking phenomena known in optics. The two polarized rays in the crystal, the ordinary and the extraordinary rays, move with different velocities. We have, therefore, emerging from the crystal two similar rays, one of which is somewhat behind the other on account of its greater retardation and which consequently differs from it in phase. So long as these rays have planes of vibration at right angles to one another they cannot interfere, but in the second prism those portions of each which are transmitted are vibrating in the same plane and interference becomes possible. The result of this interference is the destruction of certain of the wave-lengths of which the light is made up. If the incident beam consist of white light that emerging from the analyzer will be white minus the particular constituent or color which has been destroyed by the interference and the beam will have a color other than white. The character of the color of the ray will depend upon the thickness of the crystal layer since it is this



## POLARIZATION OF LIGHT

which determines the degree of relative retardation of the two components passing through it. If the thickness of the crystal be everywhere the same, the color produced in different parts of it will be uniform, but difference in thickness gives change of color so that the field of view is in many instances most varied and striking.

The effects produced by passing a beam of convergent or divergent light through crystals are still more striking. If plates of crystalline material, placed between the prisms of a polariscope which is provided with a lens for the production of a conical beam of light, are viewed through the analyzer, symmetrical patterns in color the form of which depends upon the character of the crystal and the plane, with reference to its axis, in which the layer has been cut, are seen. Any detailed description or explanation of these phenomena lies beyond the scope of this article, nor can any idea of the beauty and intricacy of the color-patterns thus produced be conveyed to the mind by words.

Isotropic substances, such as glass, show temporary double refraction, which manifests itself by restoration of light and display of colors between crossed Nicols, when subjected to distortion or stress. Such effects in glass, for example, are produced by compression under a clamp, by bending or twisting, by sudden unequal heating or cooling, or even by setting up standing sound-waves within the substance. Permanent strains, which show themselves in the same way, may be formed in glass by sudden chilling. Blocks of glass thus treated, and known, in French, as *verre trempé*, are among the most beautiful of objects under the polariscope.

**Circular and Elliptical Polarization.**—When the vibratory motion, to which a beam of light is due, is capable of being resolved into two components at right angles to each other, of equal amplitude, and differing in phase by a quarter period, the beam is said to be *circularly polarized*.

The actual motion of the ether particles in such a case, could we observe it, would be found to consist of rotation in a circular orbit, either clock-wise or counter clock-wise (looking in the direction from which the wave comes) hence the names, *right-handed circular polarization* and *left-handed circular polarization*.

Circular polarization may be produced by sending light through a crystalline layer of such thickness that the difference of phase of the two rays on emerging is  $\frac{\pi}{2}$  (a quarter period).

Such a layer is called a *quarter-wave plate*.

When the difference of phase of the two components differs from  $\frac{\pi}{2}$ , the emerging beam is said to be elliptically polarized.

**Rotation of the Plane of Polarization.**—Certain substances have the property of rotating the plane of polarized light which passes through them. Quartz cut perpendicularly to the optic axis possesses this property to a remarkable degree, and many organic liquids possess rotatory power. Such substances are said to be *optically active*. A plane polarized ray upon entering such a medium is converted into two circularly polarized rays, respectively right-handed and left-handed. The resultant of the superposition

of these two rays is a plane polarized ray the plane of polarization of which varies with the depth within the layer at which the angle is taken. We may, therefore, think of the plane of polarization as rotating uniformly about the path of the ray.

The rotatory power of solutions of optically active substances depends upon the strength of the solution and this fact has been utilized, in the case of sugar, for determining the amount of saccharine matter present. The instruments employed in this process are special forms of polariscope of great sensitiveness. They are known as *saccharimeters*.

**Magnetically Active Substances.**—When a beam of plane polarized light passes through a magnetic field in the direction of the lines of force, the plane of polarization is turned.

Looking along the lines of force in the direction in which, by convention, they are assumed to run, the rotation is always clockwise to the observer, whether the light travels with or against the lines. The angle of rotation is proportional to the strength of the field, and to the distance through which the light passes. It depends also upon the medium through which the light moves; being nearly four times as great in carbon-disulphide than in water and more than five times as great in glass as in water. These relations may be expressed by means of the equation  $\alpha = \gamma lH$ ; where  $\alpha$  is the angle of rotation,  $l$  the distance traversed,  $H$  the strength of the field and  $\gamma$  a constant (known as Verdet's constant) which depends upon the character of the medium.

This rotatory power of the magnetic field was discovered by Faraday (1845). To observe it a tube containing carbon-disulphide or water (Fig. 6) is placed between crossed Nicol prisms.

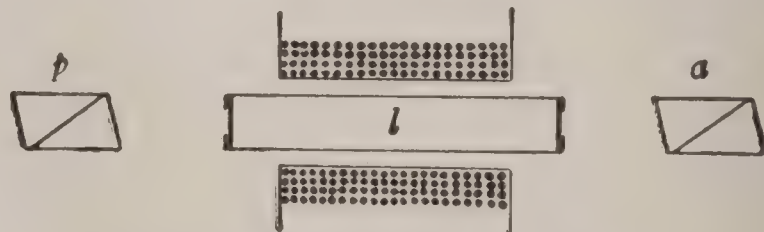


FIG. 6.—Rotation in the magnetic field.

The tube is surrounded by a coil of wire of many turns.

A beam of light is plane polarized by the prism ( $p$ ), traverses the tube of liquid ( $l$ ), but cannot pass  $a$ , the polarizing plane of which is at right angles to that of  $p$ .

When a strong current is sent through the coil, lines of force of the magnetic field thus produced traverse the tube from end to end. Some light now passes through  $a$  and the angle of rotation may be measured by turning that prism until the light is again cut off. Upon reversing the current in the coil the direction of rotation is reversed.

**Bibliography.**—For popular discussions see Spottiswoode: 'The Polarisation of Light'; Tyndall, 'On Light'; Stokes, 'On Light'; Tait, 'On Light'; Lewis Wright, 'On Light'; etc. For a very complete modern statement of the theory see Drude, 'Theory of Light' (translated by Mann and Millikan). See PHYSICAL CRYSTALLOGRAPHY.

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## POLARIZED HEAT—POLEMON

**Po'larized Heat.** Radiant heat and light are found to be analogous in their reflection, refraction, and absorption. See RADIATION.

**Polarized Light.** See POLARIZATION.

**Pol'der**, a name used in Holland for a class of agricultural lands consisting of extensive tracts reclaimed by drainage from what had originally consisted of lakes or morasses, and generally lying below the level of the sea. The transformation of the Lake of Haarlem is a striking illustration of what can be effected through energy and patient perseverance. The usual method of procedure in the formation of a polder is to encircle the portion to be reclaimed by an embankment, and construct a canal having its bed sufficiently high to cause a current toward the sea or river. The water is then pumped into this canal by means of various pumping apparatus, worked for the most part by means of wind-mills, but not unfrequently by steam-power. After the water has been drained off, the land is put into the hands of the husbandman, and this kind of soil is in general found to be very productive.

**Pole, Reginald**, English Roman Catholic prelate: b. Stourton Castle, Staffordshire, 3 March 1500; d. London 8 Nov. 1558. He was the son of Sir Richard Pole, Lord Montacute, by Margaret, daughter of the Duke of Clarence, brother of Edward IV. He was educated at Oxford, where Linacre and Latimer were among his teachers, entered into deacon's orders, and received several benefices from Henry VIII., with whom he was a great favorite. In 1519 he visited Italy, and at Padua acquired the friendship of such men as Erasmus, Bembo, and Sadoleto. He returned to England in 1525, but in consequence of the affair of Henry's divorce from Catherine of Aragon, withdrew to Paris (1529), under the pretext of continuing there his theological studies. In 1536, in compliance with Henry's order that he should give his opinion regarding the divorce, he drew up an elaborate epistle, 'Pro Ecclesiasticæ Unitatis Defensione,' in which he boldly condemned the divorce as unlawful, and the rejection of the papal supremacy as a breach made in the unity of the Church. This act cost him the loss of all his preferment in England, and he endeavored to form a party against Henry, a design which ended in the destruction of his brother, Lord Montacute, and of his aged mother, then Countess of Salisbury, whom Henry sent to the scaffold. Pole was declared a traitor by the king, a price was set on his head, and he lived in exile during the rest of Henry's reign. But papal support was given to him, and he was raised to the dignity of cardinal and employed in many important affairs. He was one of the three papal legates to the Council of Trent; and on the death of Pope Paul III., Pole came but little short of election as his successor. On the accession of Mary I. his attainder was reversed, and in 1554 he returned to England as legate and plenipotentiary of the papal see, and endeavored to secure lenient measures for the reformers and correction of clerical abuses. On the death of Cranmer, Pole, then for the first time ordained a priest, became Archbishop of Canterbury, and was at the same time elected chancellor of the universities of Oxford and Cambridge. He undertook to rebuild the

churches and to re-establish the ancient discipline, and to a rigorous persecution of Protestants which was instituted he at least assented. His death occurred on the same day as that of Queen Mary, and he was buried in Canterbury Cathedral. Besides several treatises on questions relating to the Church, he wrote 'Liber de Concilio' (1562) and 'A Treatise on Justification' (1569). Consult Lee on his life (1887), and the 'Life' by Zimmermann (1893).

**Pole, William**, English playwright: b. London 1852. He was manager of Royal Victoria Hall, London, 1881-3, and in 1895 established the Elizabethan Stage Society for the purpose of awakening interest in the Elizabethan drama. Among old plays which he has revived are Webster's 'Duchess of Malfi' (1892); 'Arden of Feversham'; Marlowe's 'Dr. Faustus'; Ford's 'Broken Heart'; Ben Jonson's 'Sad Shepherd' and 'Alchemist'; and 'Everyman.' He has dramatized several novels, among others W. D. Howells's 'Foregone Conclusion' as 'Priest and Painter' (1884); and Baring-Gould's 'Mehalah' (1886).

**Pole**, (1) in astronomy, the name given to each of the two points in which the axis of the earth is supposed to meet the sphere of the heavens. In spherical trigonometry, the pole of any circle drawn on the surface of a sphere is one of the points in which the perpendicular to its plane through its centre cuts the sphere. (2) In geography, either extremity of the axis round which the earth revolves is called a pole, or a terrestrial pole. The northern one is called the north pole, and the southern the south pole. Each of these poles is 90° distant from every part of the equator. (See EARTH.) (3) In physics, the points of a body at which its attractive or repulsive energy is concentrated, as the poles of a magnet, the north pole of a needle, the poles of a battery. (4) In distance, see PERCH.

**Pole, Magnetic.** See MAGNETISM.

**Pole-axe**, an axe attached to a pole or handle of which the length varies considerably. It was formerly used by mounted soldiers, and is yet used in the navy for boarding purposes; in the latter case the back of the axe is furnished with a hook and is called a boat-hook.

**Pole Star.** See POLARIS.

**Pole'cat**, a small European carnivore (*Mustela putorius*) of the weasel family. It has an elongated body, short legs, long and flexible neck, and blunt muzzle. Its anal glands are large and discharge a fetid liquor of extremely nauseous odor, almost impossible to remove from clothing or any absorbent material upon which it falls. Hence it is known provincially in Great Britain as fou'mart (that is, foul marten), and the term "polecat" has been applied to the American skunk and other stinking animals; "fitch" (or fitchew) is another name. The general habits are those of the furbearing animals (*Mustelidæ*) generally, with a special predilection for preying on poultry and game. A domesticated variety is the ferret (q.v.).

**Polemon**, pŏl'e-mŏn, Greek geographer: b. Troas, 2d century B.C. He removed to Athens, became a citizen there, and after traveling extensively throughout Greece wrote several geo-



## POLEMSCOPE — POLICE

graphical works which were especially valuable in that they contained definite information concerning public monuments, inscriptions, paintings, etc., which had hitherto remained unnoticed by geographers. He wrote several polemical works against Timæus and Eratosthenes, and references to his writings are frequently made by later writers, including Athenæus and Pausanias. The few remaining fragments of his works were first collected and published by Preller (1838).

**Pol'emoscope**, an antiquated mechanism used in war. It consisted of a stand or frame high enough to rise above a parapet or other similar object, having a plane mirror at top so fitted as to reflect any scene upon another mirror below, and thus enable a person to see a scene in which he is interested without exposing himself.

**Polen'ta**, a food preparation common in Italy, consisting of semolina or Indian-corn meal, mixed with water, and boiled until it thickens. It is then poured into a dish, where it becomes firm enough to be cut into slices, in which state, after being seasoned, it is eaten.

**Police** (Greek, *politeia*, government, from *polis*, a city), a judicial and executive system, and an organized civil force for maintaining order and enforcing the laws. There are traces to be found in every organized society of some system of rules for the maintenance of peace and order. At the same time, a system of police in the special modern sense of the term did not exist in ancient times. In Greece it was mixed up with the totality of their institutions. In Rome, not until the time of Augustus do we find the police becoming a special institution, with a numerous staff of various grades of officers. When the barbarians swept across the Roman Empire and obtained the mastery every trace of a regular system of police disappeared, and only when Charlemagne ascended the throne was there a successful attempt made to re-establish anything of the kind. But after the death of Charlemagne everything fell into confusion again. The Normans, established in the north of France, were the first who made stringent police regulations for the assurance of public tranquillity. In France, previous to the middle of the 15th century, the Provost of Paris and his lieutenants were charged with maintaining the peace of the city and suppressing vagrancy. Under Louis XIV. the police attained its highest measure of perfection as a repressive force. A universal system of espionage was established, and the slightest indication of impatience under the yoke of oppression, or the smallest departure from the monarch's views of what was right, was visited with summary arrest and punishment. In 1794 the National Convention reorganized the police and defined its duties, which comprised almost every department of administrative government. During the administration of Napoleon I. the city police of Paris attained a high degree of efficiency. As existing at present the French police generally is presided over by the minister of the interior; the departments and communes are under the prefects of police and other municipal agents; Paris is under sub-prefects, and maires, assisted by commissaries, the prefect of police and his numerous assistants. The police organization on

the Continent generally partakes largely of a military character.

In England, from the time of the Saxon kings there had existed an organization of a partially voluntary character for the repression of crime, the arrest of criminals, and the maintenance of good order. The population was divided into hundreds, and these into tithings, or companies of 10 freeholders with their families. As this system, however, was not always found to work well, the high sheriff of the county, his deputies, and the constables appointed by the parishes, were eventually substituted for the voluntary officers of the earlier period. But in process of time this system was also found ineffectual for the maintenance of public peace and security; yet no great improvement was made until 1829, when the remodeling of the police system of London led the way to the adoption of a uniform system for the whole country. In 1839 and 1840 acts were passed providing for the appointment of a county constabulary, organized and maintained in accordance with rules prescribed by the home secretary.

The Local Government Act of 1888 entrusted the control and organization of the county police in England and Wales to the standing joint committee of the quarter sessions and the county council. County boroughs and other large boroughs were left with the control of their police, but in the case of small boroughs the control of the borough police was transferred to the county council. The Police Act of 1890 makes provision for the payment of pensions to superannuated constables. Gratuities may be paid to constables or to their widows and children in certain cases. The strength of the county and borough police of England and Wales in 1900 was 27,123, of whom 1,460 belonged to Liverpool, 1,000 to Manchester, 700 to Birmingham, 500 to Leeds, 499 to Bristol and 465 to Sheffield. The Metropolitan Police has charge of an area of over 688 square miles, comprising 21 land divisions besides the river Thames. Each division is under the charge of a superintendent. The Criminal Investigation Department, organized in 1878, comprises a central body at New Scotland Yard, and branches in each of the divisions. The Convict Supervision Office, founded in 1880, is a branch of the last-mentioned department. The strength of the Metropolitan Police in 1900 was 15,847, comprising 32 superintendents, 570 inspectors, 1,977 sergeants, and 13,268 constables. The City of London Police are better paid than the other police forces of the kingdom. Their number in 1900 was 1002, of whom 865 were constables. The total number of police in England and Wales was 44,054 in 1900.

In Scotland the organization of an efficient police in the large towns dates from 1833, when a statute was passed enabling burghs to establish a general system of police. The strength of the Scottish police forces was 4,874 in 1900, of whom 1,760 belonged to county forces. Glasgow has a force of 1,360 men.

In Ireland, previous to 1814, the police was in a very disordered condition. In that year a law was passed by which some minor improvements were effected. The act of 1836, and its subsequent modifications in 1848 and 1857, have greatly improved the police. In 1867 the title of Royal Irish Constabulary was conferred on



## POLICE COURTS — POLIGNAC

the force by royal command. This force numbers 11,200, and is organized on a semi-military plan. They live in barracks, and are armed with rifles, swords, and other weapons. They are under the immediate authority of the government in Ireland, and are controlled by an inspector-general. The city of Dublin and its suburbs, with an area of 32 square miles, is under a separate police force known as the Dublin Metropolitan Police. The strength of the force in 1900 was 1,198.

In the United States the provisions for the repression of crime and the detection and arrest of criminals were copied from those of Great Britain. New York was the first of the cities to have a police force organized similarly to that previously adopted in London. The ordinary police of a city are dressed in a particular uniform. The secret police, more commonly known as detectives, are not uniformed. The regulation and control of the police in a city are usually in the hands of the municipal authorities, and the cost of their maintenance is paid out of the local taxes. In New York city a division of the force is known as harbor police, and there is a police boat for their convenience in patrolling the harbor. In Washington there exists a special force known as capitol police, employed by the government to patrol the buildings and grounds of the National Capitol. In most large cities there are squads of sanitary police, and in some smaller towns volunteer bodies of citizens are organized under the name of fire-police. The secret police of the United States government are known as secret service agents. See SECRET SERVICE; also CONSTABLE; DETECTIVE.

**Police Courts.** See COURT.

**Police Justices.** See COURT.

**Police Magistrates.** See COURT.

**Police, Military.** See MILITARY POLICE.

**Police Power.** No adequate definition can be given of this subject, the courts usually deciding in each case as to its extent. In its general acceptation it means the power of a municipal government to preserve the welfare of the public by prohibiting everything that is contrary to it, and demanding that which is best for its welfare and safety. The proper exercise of police power is merely to regulate the use and enjoyment of property by its owner; it is founded upon the duty of the State to aid in the protection of its citizens. Legislatures have jurisdiction of police power through a federal system of government, and it is delegated by the State to the municipalities throughout the State, and is exercisable only within its limits. Standard laws and the preservation of the public health are one of the most important duties of the police or State municipality, and they have the right to enact such ordinances as may be required for this purpose,—such for example, as preventing the spread of contagious diseases, and, in some instances, compelling vaccination, the killing of diseased cattle, the destruction of improper food products, compelling proper drainage, prohibiting smoking and expectorating where necessary, and the regulation of burials. An important function of the police power is to provide safety for the public in regulating places of public amusement and meetings; compelling the erection of fire escapes, pro-

viding for street lighting, and to protect the public morals by prohibiting gambling, improper publications, cruelty to animals, prostitution, and drunkenness. The municipalities' general welfare is another important function, for example: protection against fire, regulation of buildings, and the erection of telephone and telegraph wires, the care of the insane and poor, abatement of nuisances of all kinds, and regulation and control of animals. The regulation of certain classes of business enterprises come within police power, for example: theatres, markets, paint shops, warehouses and wharves, or any such business that if unrestricted may become injurious to the public welfare. Police power regulates the practice of law, medicine, surgery, also plumbers, and the business of insurance, banking, trust and railroad companies; it is also within their power to regulate the manufacture and sale of articles of food, the prevention of fraud, and the hours of labor. The proper limitation of the police power is largely within the discretion of the legislature, but the reasonableness and character of the regulations and whether or not they are consistent with the constitution, and proper public policy, are questions for the courts to decide. Police power cannot be exercised for the benefit of particular individuals, classes, or for private purposes; it must not be arbitrary or unreasonable in infringing upon the personal rights of persons, and its main object must be for the public good. See POLICE.

**Pol'icy**, the name given a lottery or gambling system, common in New York and large cities. A combination of numbers like 3-11-44 is selected by the player who marks his numbers or "guesses" on a strip or ticket, for which he pays a small sum. The lottery drawing of three numbers awards prizes to those persons having guessed correctly. A favorite or common combination of numbers is called a "gig." The person playing policy stands only a very small chance of winning a prize.

**Policy, Insurance.** See INSURANCE.

**Polidoro** (CALDARA) **de Caravaggio**, pō-lē-dō'rō dā kā-rā-vā'jō. See CARAVAGGIO DA POLIDORO.

**Polignac**, pō-lēn-yāk, **Jules Auguste Armand Marie**, PRINCE DE, French statesman: b. Versailles, France, 14 May 1780; d. Saint Germain, France, 2 March 1847. He was implicated in a conspiracy against Napoleon in 1804, and imprisoned, but in 1814 escaped to Edinburgh, where the Comte d'Artois, afterward Charles X., then was. After the restoration he entered the chamber of peers and in 1820 obtained from the pope, as a reward for services to the Church, the title and arms of a Roman prince. In 1823 he succeeded Chateaubriand as ambassador at London; and in 1829 was placed at the head of the new ministry, with the portfolio of foreign affairs. On 27 July 1830 the people were roused to open insurrection by the ordonnances issued on the 25th, and the dynasty of Charles X. was overthrown. Polignac accompanied the king to Cherbourg, and then went to Granville, where he was apprehended. The house of peers condemned him to imprisonment for life, but by the amnesty of 1836 he recovered his liberty and fixed his residence in England.



## POLIGNAC—POLISH LANGUAGE AND LITERATURE

**Polignac, Melchior De**, French cardinal and diplomat: b. Puy-en-Velay, Haute-Loire, France, 1661; d. 3 April 1742. He was educated for the priesthood and in 1693 was named ambassador extraordinary from France to Poland, for the purpose of detaching John Sobieski from the league with Austria, and drawing him over to an alliance with France. On the death of Sobieski in 1696 he was employed in endeavoring to effect the election of the Prince of Conti to the Polish throne. His intrigues, though successful in securing Conti's election in 1691, were defeated by Augustus the Strong; Polignac was compelled to leave Poland in 1702. He returned to Paris and in 1712 was appointed plenipotentiary to the Congress of Utrecht, and was afterward minister to the court of Rome. He became cardinal in 1713. Banished during the regency by reason of his intrigues, he was recalled in 1721, and in 1725 was despatched as ambassador to Rome, successfully performed his task of reconciling the quarreling factions of the Gallican Church and was raised to the archbishopric of Auch. He returned to France in 1732 and thereafter lived in retirement. As a writer Polignac is known by his didactic poem 'Anti-Lucretius, seu de Deo et Natura' (1745).

**Polillo**, pō-lē'lyō, (1) a group of islands of the Philippine archipelago, lying to the north of the entrance of Lamon Bay, Southern Luzon, and east of central Luzon. The group consists of the chief island Polillo and 21 small islands, lying to the south and east; area of the island of Polillo, 131 square miles; area of the group, 203 square miles. The formation of the islands is volcanic; the soil is good, and the inhabitants are engaged mostly in agriculture and fishing for home consumption. The island of Polillo is mountainous; the central summit is Malolo, from which short ranges extend in every direction toward the coast. The chief town of the group, Polillo, is situated on the west coast on a bay that affords a good harbor. The group, which was included in the province of Infanta by the act of the Philippine Commission of June 1902, was afterward annexed to the province of Tayabas. Pop. (estimated) 1,500.

**Po'lish Fowl**, a breed of domestic fowls. See POULTRY.

**Polish Language and Literature.** The Polish language is one of the Slavic family of tongues and is most nearly related to the Bohemian branch of that family. It is spoken by about 15,000,000 people, in its various dialects. The language is remarkable for its phonetic richness. It contains 10 vowels and 35 consonants. The alphabet is the Latin, diacritic marks and combinations being used in addition. The principal peculiarities of pronunciation are the following: *c* is pronounced like *ts* in English; *ch* is a strong guttural, as in German; *cz* is pronounced like *ch* in English; *rz* has a sound compounded of that of *r* and the sound of *z* in the word azure, sometimes almost the same as the latter sound alone; *sz* is pronounced like our *sh*; *w* has the sound of *v*. The consonant *c'* has a sound absolutely peculiar to the Polish language: it resembles that of *t* followed by or combined with a very soft *sh*. The barred *l* (*ł*) has a sound common to the Polish with other Slavic tongues: it is produced by sounding the letter *l* with the point of the tongue firmly pressed against

the teeth. Among the vowels *ę* and *ą* are pronounced respectively like the French semi-nasals *in* and *on*; *i* has the sound of *i* in the English word pique; and *y* has a sound resembling that of the German *ü*. The tonic accent in Polish words is nearly always on the penult.

The Polish is a highly inflected language. There were formerly three numbers, but the dual has been preserved only in the Masovian dialect. There are three genders, masculine, feminine, and neuter; and seven cases, the nominative, genitive, dative, accusative, vocative, instrumental, and locative. The diminutives and augmentatives are numerous. The inflections of the verbs indicate not only person and number without the aid of personal pronouns, but also the gender of the person speaking, and the person spoken about. The great variety of inflections in Polish permits the extensive use of inversion in the structure of sentences.

The principal dialects of Polish are the Masovian or Mazurian, spoken in the districts round Warsaw and in east Prussia; that of Great Poland, which is spoken chiefly in the districts round Posen, Gnesen, and Kalisz; the Silesian, spoken to the east of the Oder; the Cracovian, or the dialect of Little Poland; and the Polish-Luthuanian, as distinguished from the Lithuanian proper, the language of some of the greatest Polish writers.

Standard grammars of the Polish language include those by Malecki (1879); Smith (1864); Kalina (1883); Poplinski (1901), and in English, Morfill, 'A Simplified Grammar of the Polish Language' (1884). Chief among dictionaries is that of Linde in 6 volumes (1854-60); other useful works are the Polish-German work of Boock-Arkossy (1890), and in English, Chodzko, 'Complete English-Polish and Polish-English Dictionary' (1884).

**Literature.**—The oldest monuments of the literature of Poland consist of warlike, political, and religious poems, didactic writings, and works of a more or less scientific and historical character. They have come down to us partly in Polish and partly in Latin, these being probably translations of Polish originals. The most celebrated of the religious poems are the 'Bogurodzica Dziewica,' a battle hymn in honor of the Virgin, said to have been composed at the end of the 10th century, and the Florian Psalter dating from the latter part of the 14th century. The earliest of the Latin chronicles date from the 12th century, and the principal are those by Martin Gallus (1110-35), Wincenty Kadlubek (d. 1223), and Boguchwal (d. 1253). After a long period of comparative inactivity literature revived in the 14th century under Casimir the Great, founder of the University of Cracow. The mathematical sciences became especially flourishing, the two best-known names in that field being Johannes Glogoviensis (d. 1507) and Wojciech Brudzewski (d. 1497), the latter the reputed teacher of Copernicus. A monumental work of this period is the 'Historia Poloniæ' of Jan Dlugosz (d. 1480). Under the prosperous reigns of the first two Sigismunds (from 1506 to 1572) Polish supplanted Latin as the literary language and the proper literature began. Nicolas Rej (d. about 1568) and Jan Kochanowski (d. 1584) attained eminence as poets, the latter as a lyrist of the highest rank. Among other writers and poets of the period were Piotr



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Kochanowski, a younger brother of the preceding, Sep Szarzynski (d. 1581) and Szymonowicz (d. 1629), known as the Polish Pindar. There was considerable activity during this period in the historical and the theological field, the latter being stimulated by the introduction and spread of the Reformed faith. Controversial works were numerous, and translations of the Bible or parts of it were made by scholars on both sides. The first translation of the New Testament for Protestants appeared at Königsberg in 1521 and of the whole Bible, for Catholics, at Cracow, in 1561. The flourishing period of Polish literature continued into the first quarter of the 17th century and was followed by a period of literary decline which lasted till about the middle of the 18th century. The original productions of this period are few and unimportant. Translations, on the other hand of the classics and of the French dramatists are numerous. History was perhaps the most flourishing branch of literature. The names of Kojalowicz, author of the 'Historia Lituanie'; and Jędrzej Węgierski, author of 'Slavonia Reformata,' an exhaustive history of the Dissidents in Poland, may be singled out as the chief. After the middle of the 18th century the influence of the French civilization was widely felt in Poland, and prepared the way for the revival of letters. The most distinguished writers of this period were Naruszewicz (1733-96), poet, satirist, and historian; Ignacy Krasicki (1734-1801), the unquestioned head of Polish literature during his own time, Trembecki (1723-1812), Węgierski (1755-87), Kniaźnin (1750-1807), Karpiński and others, all cultivators of the French classicism. The representative name in the dramatic literature of this period is Niemcewicz (1758-1841), who also wrote patriotic songs.

The literary activity of Poland did not cease after the overthrow of the political independence of the country. Oppression and exile served only to stir the natural consciousness. After 1815 the French classicism gave way to the Romantic movement led by Mickiewicz, Slowacki, and Krasinski (qq.v.), the three greatest names in Polish poetry. Adam Mickiewicz (1798-1855) wrote epics ('Konrad Wallenrod,' 'Pan Tadeusz') which exercised a tremendous influence on the national spirit; Juliusz Slowacki (1809-49) was equally distinguished as a lyricist and dramatist, and was also the author of a considerable number of short epics. Zygmunt Krasinski (1812-59) wrote in mystical style of the past and future of the Slav race. Among other poets may be mentioned Odyniec, Malczewski, Goszczynski, and Zaleski, all ardent romanticists. The disasters of 1831 offered no check to the literary life of the Poles, and the national spirit appears strong in writers like Wincentz Pol, Kaczkowski, Kondratowicz, Lenartowicz, and Norwid. The contemporary school of poetry has its most prominent representatives in Adam Asnyk, Marya Konopnicka, Tetinajer, and Zulawski. The novel was much cultivated during the 19th century among Polish writers, and attained its highest development in Kraszewski (q.v.) who represents the calmer view of life that was now taking the place of the storm and stress of the Romanticists. Other notable names in this field are Rezewulski, Czojkowski, Chodzko, Kropinski, and Starbek, of the earlier school: Korzeniowski, Kaczkowski, and Milkow-

ski of the later period, and best known of all, perhaps, without the limits of Poland, Eliza Orzeszkowa with her studies of peasant and Jewish life, and Henryk Sienkiewicz, whose novel of Roman times, 'Quo Vadis,' and Polish national novels, 'Pan Michael' and 'With Fire and Sword,' attained great popularity in English. In the drama the Poles have been most successful with comedy. Of the earlier dramatists the most prominent are Karzenwoski, Magnuszowski, and Kaminoski, while Swietochowski, Kozłowski, Sukiewicz, and Gabriela Zapolska are some of the leaders of the later generation. Greatest in comedy and force, however, is Count Alexander Fredro (1793-1876), who has been followed by writers like Zaleski, Marzyski, and Blizinski. History, in a spirit of laudation of the ancient Poland, has been written by Lelwel, Moraczewski, Morawski, and Marbutt, while newer and more scientific methods find their exponents in Szujski, Smolka, Kubala, Kalinka, Maciejowski, and others. Philosophy has been cultivated by Goluchowski, Kremer, Ochrowicz, Mahrburg, and others. Much has been done in the 19th century in the way of collecting and preserving the ancient popular songs, fables, and proverbs. Careful collections of popular songs and ballads have been published by Wojcicki (1836), Wacław (1833), Pauli, Lipinski, and Roger (1863). The popular legends have been published by Wojcicki (1857).

*Bibliography.*—Among the best works on the history of Polish literature are those in Polish by Wiszniewski (1840-57); Maciejowski (1851-3); Kondratowicz (1851-4); Wojcicki (1859-61); and in German, the 'Geschichte der polnischen Litteratur' of Nitschmann (1888). Estreicher has published in 13 volumes a 'Bibliografia Polska' (1870-94). An excellent general work is that by Brandes, 'Poland, a Study of the Land, People, and the Literature' (1903).

**Polish Succession War**, a conflict arising in 1733 from the contest for the Polish throne, between Stanislas Leszczyński and Augustus III. of Saxony. (See POLAND.) Stanislas Leszczyński was supported by France, while Russia and Austria embraced the cause of Augustus III. The war, however, speedily assumed the character of a struggle on the part of France to undermine the power of Austria. While Leszczyński was besieged in Dantzic by a Russian force and finally compelled to flee, France, in alliance with Spain and Sardinia, overran Lorraine, Milan, Sicily, and Naples. There was little active fighting, however, and in 1735 preliminaries of peace were signed at Vienna, confirmed by a definitive treaty three years later. Augustus III. was recognized as king of Poland; Stanislas Leszczyński received the honorary title of king, with the duchies of Lorraine and Bar, which, on his death, were to revert to France; the dispossessed duke of Lorraine was to be compensated with the duchy of Tuscany on the extinction of the house of Medici; and Naples and Sicily were bestowed by the emperor on the Spanish infante, Don Carlos, in exchange for Parma and Piacenza. See also POLAND.

**Pol'ishing and Polishing Materials.** The name polishing is applied to the process by which the surface of a material is made to assume the most brilliant appearance of which it is capable. The degree of polish or brilliancy which a given



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surface can take on is in general proportionable to the hardness of the material. The article to be polished must first be made smooth. The softer bodies, such as wood, alabaster, ivory, are smoothed by means of glass-paper and pumice-stone; metals, with emery, pumice-stone, and polishing-stones; glass, with sand and emery; and precious stones with emery. In the case of wood the polishing is effected by rubbing with French polish. Polishing wheels are commonly used in the case of metals, being disks of wood covered with leather, and on which pulverized tripoli, chalk, rouge, tin-putty, etc., is sprinkled. Diamond powder, or the powder of other hard stones, is used to polish gems. See EMERY; PUMICE-STONE.

**Polishing Slate**, a rock occurring mostly in beds of the Tertiary formation. Texture, earthy; soft; friable. It consists of the silicious shells or envelopes of various species of *Diatomaceæ*, the number contained in a cubic inch having been reckoned to be about 41,000,000,000.

**Polishing Wheels.** See POLISHING.

**Politianus**, pō-līsh-ī-ā'nūs, **Angelus** (Latinized form of ANGELO POLIZIANO), Italian scholar and poet: b. Montepulciano, Tuscany, 14 July 1454; d. Florence 24 Sept. 1494. His name was taken from his native town, the family name having been Ambrogini. He was educated at Florence, where he acquired great proficiency in the classics and in Hebrew; and studied the philosophy of Plato under Marsilio Ficino, and the philosophy of Aristotle under Argyropulo. The first production which brought him into notice was a Latin poem on the tournament of Giulio de' Medici. He assumed the ecclesiastical habit, and acquired by his accomplishments the favor of Lorenzo de' Medici, who made him tutor to his children, and presented him with a canonry in the cathedral of Florence. In 1484 he visited Rome, and met with a flattering reception from Pope Innocent VIII. After his return to Florence he lectured with distinguished success on the Latin and Greek languages. Among the most famous of his writings are an account of the conspiracy of the Pazzi; a Latin translation of Herodian; and a collection of Greek epigrams; beside some miscellaneous works in prose and verse, and a drama on the story of Orpheus, printed in 1475. This latter piece was set to music, of the science of which he was passionately fond. As a Latin writer he may be reckoned one of the first who introduced that age of revived classical Latinity which forms so prominent a feature in modern literary history. He was an industrious and skilful collator of ancient manuscripts, and gave great assistance to the editors in the early period of typography. He also extended his researches to jurisprudence, and contributed greatly to the correction and illustration of the 'Pandects.' Consult: Gresswell, 'Life of Politian' (1805); Serassi, 'Vita di Angelo Poliziano' (1808); Roscoe, 'Life of Lorenzo de' Medici' (10th ed. 1851); Symonds, 'The Renaissance in Italy' (1875-86), and 'Sketches and Studies in Italy' (1879).

**Political and Social Science, American, Academy of.** See AMERICAN ACADEMY OF POLITICAL AND SOCIAL SCIENCE.

**Political Economy.** Political economy (or Economics—the terms are essentially equivalent) is the science which undertakes to

show how men satisfy their needs, by procuring (commonly through effort, or exchange) useful objects or the services of others. In describing the processes by which human wants are satisfied, it deals, for the most part, not with the conditions or methods peculiar to one industrial pursuit or another, but rather lays down certain broad principles applying to industry in general. It discusses in this way the production of goods and the circumstances generally favorable or unfavorable to their abundance or excellence; the sale of goods, prices and money; labor and the conditions affecting its quality or quantity; wages, capital in productive use and loans at interest; the function and reward of the employer, the landowner and land rent; the consumption of goods, especially as it affects production and distribution. This science, as it has developed in Europe and America, naturally concerns itself for much the larger part with the recent life of these countries, rather than that of existing or earlier peoples industriously less advanced. It has therefore little to say of the free gifts of nature or of gratuities between persons and little of the efforts of isolated persons to supply their needs by solitary labor, as fishing or the chase; but in most of its propositions assumes a somewhat dense population, a considerable division of labor, an intricate system of exchanges and the use of money.

*History—Antiquity.*—This science is modern. In antiquity even the Greeks, the leaders of ancient thought, were not advanced enough in their industries or their scientific intelligence and scientific method, to produce such a science. Their deficiency has several causes: (1) The industrial life of the Greeks scarcely provided materials for a science of exchanges. They never ceased to be predominantly agricultural. (2) The contempt of the learned for craftsmen and merchants tended further to prevent a careful study of trade. The labor assigned to slaves was necessarily discredited; free workmen and traders were overshadowed in public opinion by the warriors, and by the landowners, who, possessing the form of wealth then chiefly important, held most of the power and prestige always enjoyed by the wealthy. (3) Ethics overshadowed economics. The fact in life, which, more than any other engaged the attention of the Greek philosophers, was the perpetual struggle for mastery between the soul and the body, the reason and the appetites. The sages of all antiquity commonly regarded the material desires with extreme mistrust and dread scarcely consistent with careful examination. Though the evils of poverty are recognized, the emphasis falls, not on those evils, but rather on the danger of abundance. According to Plato "There is such a gulf between wealth and virtue that when weighed, as it were, in a balance, one of the two always falls and the other rises." The appetitive nature of man, the appetites of hunger, thirst and sex, he calls also "the money-loving nature," because money is the chief agent in the gratification of such appetites. The highest life is that of the philosophers, who "contemplate not the perishing world, but the real world, the essential Form of Good." Like opinions were common. It would be hard to study with respectful care these suspicions or repre-



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hensible desires. (4) Science as a whole, was unformed. The human mind, as an instrument of research, was new and untrained. Men had not learned the art of forming, by careful analysis of facts, general principles for use in explaining facts.

Among Greek writers who concerned themselves with economic matters, it is necessary to take serious account of three — Plato, Xenophon and Aristotle. First of all they sought to determine whether certain institutions or practices were good or bad. Labor in manufactures they thought enfeebling to body or soul. All accepted or expressly justified slavery, though the contrary opinion was not infrequent among their contemporaries. The rightfulness of private property appears frequently to have been questioned, but none of the writers mentioned seriously favors common ownership. Though Plato has often been mentioned as an advocate of communism, he merely suggests it as an ideal, favorable to harmony among men, and freedom from envy; but in his plan for a city, private property is, for most of the people, continued and there is no nearer approach to common ownership than the denial of private property to the ruling class, who are supported by the public on salaries. Plato is superior to most writers, even up to the present time, in recognizing the importance of economic history in its bearing on political and social history; society arises, he says, from men's economic wants, the division of labor and exchange, and he attempts to generalize regarding the succession of changes in political life as due to economic facts; but in place of a theory of evolution, he gives a theory of continued deterioration, due to the growth of covetousness and luxury. He makes no serious attempt at analysis of any such economic fact as price or wages. His examination of the industrial division of employments (sometimes mentioned as having a scientific value) advances no further than the observation that goods are produced in superior quantity and quality when men employ their peculiar aptitudes and do work at the right time without being interrupted by other work. It is evident that he scarcely at all grasps the economical importance of a division of labor, but rather thinks of it in a mystical fashion as desirable because everything ought to fulfil its *destined* function and no other, for when he imagines a concrete instance of industrial specialization and indicates numerically the comparative quantity of product he assumes that there is no increase whatever. Plato assumes in this instance as throughout his whole philosophy that social phenomena are controlled by purposes outside of and above those of men, that these superior purposes may be known and human conduct conformed to them.

It is Aristotle's habit, likewise, to classify acts or institutions as being or not being in accordance with nature, and he frequently consecrates as "natural" what merely accords with his own prejudice because it is familiar and traditional, the easy use of an epithet taking the place of analysis. Thus agriculture is "natural"; its fruits are the bounty of nature. Simple barter also "had its beginning in nature," as when men give one necessary article for another. But trade for profit, employing the gifts of nature not for use but for gain, is reprehensible because it is not natural but a work of man's art

and because men seek thereby to gain money without end, intent not upon living well but upon excessive or sensual enjoyments. As the natural riches of all men arise from fruits and from animals, interest on money is detestable; that money should be born of money is "contrary to nature." He sees that money and wealth are not the same; and should thus have known that money is not the substance of a loan and interest is not the payment for the use of money loaned. He replies to Plato's advocacy of common ownership that too great unity in a state would be unfortunate, "for it is the *nature* of a state to be a plurality"; but adds the argument which is still first in the opposition to socialism, "what is common to the greatest number has least care bestowed upon it."

Xenophon, after the manner of his time, denounces luxury, praises agriculture, expresses contempt for the base mechanic arts which ruin the bodies of those "who hug the loom or crouch before the furnace" and with the body enfeeble the soul. But in marked contrast with Plato and Aristotle and somewhat in the spirit of the mercantilists of a later age he wished to employ the power of the state to encourage foreign trade and to increase the money supply of Athens. His notions as to money as well as his confidence in the fertilizing power of the state in industry are crude, but his appreciation of trade and his approval of interest mark an advance beyond his more subtle contemporaries on the road which it has since appeared economic speculation was destined to travel.

*The Middle Ages.*—In the Mediæval period many of the ancient hindrances to economic study were still influential. The overwhelming problem of sin, presented anew by Christian doctrine, seemed alone worthy of study by men of genius. Agriculture was long to continue the chief industry. The two great streams of traditional authority then quoted—the classical tradition and the Christian as it was then interpreted—united in the literature of that time not merely to wage war against the dangers of worldliness but to condemn trade and the uses of money. Christ had driven the bargainers from the temple; "One who buys and sells," it was said, "cannot be free from falsehood"; "A merchant cannot be pleasing to God." There were those even who regarded labor as an evil, the only good being a calm and Godlike contemplation. At most labor was only commended but not required as a duty. Though Christian writers and the authors of the Canon law admitted that man since his fall by sin could not be brought to live in the ideal state—a brotherly community of goods—yet they were able to force upon the civil authorities policies implying that the rich man's title to his property was unsound. Men were advised not to demand the repayment of debts; the law was made to favor the debtors. It was a common doctrine that, since private ownership was merely tolerable, property might in time of necessity be seized by public authority for the relief of the poor. Those who examined economic facts scarcely thought of investigating them, but only of applying the precepts of Christianity to these facts as they were superficially apprehended. One fundamental defect impaired in all its chief parts the whole structure of mediæval economics. Students conceived only in a dim way the idea



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(fundamental in economics, making it, subject to limitations, an exact science) of general purchasing power or value. They assumed with Aristotle that things are for use, not for exchange; their imagination failed to go beyond the useful thing itself and apprehend distinctly the psychological relations of comparative value which arise between different commodities in exchange. They saw indeed that values varied though the thing itself remained unchanged, and they approached close to an explanation of such variation, but they attempted to brush aside this obvious fact as "abnormal," and asserted broadly that a bushel of grain at one time and a similar bushel at another are really alike and equally sufficient for fulfilling a contract however much prices might change. In money likewise they saw not an embodiment of general purchasing power equal in value to the commodities but only a tangible coin which was itself the value of a commodity. It was assumed that money, as itself the measure of value, was invariable. Variation in the prices of goods were not only abnormal but unjust as implying that persons were compelled by their necessity to pay more for goods or accept less than their just price. Here the Church, through its writers and its law, appeared once more as the protector of the weak. It was proposed that a bishop or some other public authority should prepare schedules of prices which all must observe. Variations of demand and supply at different times or places were allowed force only within upper and lower limits of price. The same misunderstanding of value led to error regarding interest on loans. Since in money men saw only the palpable coin, not a representative of value, it was, of course, concluded that money borrowed could be in no way productive and could not justify payment to a lender beyond the replacement of the principal. Goods might, it was thought, be let for hire, if, like a book or a house, they were durable and so yielded a utility without being consumed, but loans in consumable goods could have no use except as they were consumed and therefore could yield no increase. The matter-of-fact Mediæval moralists did not see that while the commodity was consumed in production and seemingly destroyed, its value, in the sense of a measurable utility, might be re-embodied like an immortal spirit in new commodities with augmented force. This theoretical condemnation of interest was confirmed by many of the classical writers and, it was said, also by the Bible; in particular the 6th chapter of Luke's Gospel (verse 35) was so interpreted that it became the chief weapon in the war against interest. Land was durable and in its use there was manifested strikingly the generative power of nature, so that it seemed for the two reasons pre-eminently productive, and a payment for its use was thought just. This theory of productivity as to land, in contrast with capital left free from reproach, and so probably encouraged investment in land for the sake of income, and influenced decisively the Canonist doctrine of taxes, which it seemed might most properly be drawn from the gifts of God in nature,—not from usury which represented no real product.

These efforts by precept and force to restrain the self-interest of men in its most powerful

manifestations, were necessarily weakened and discredited as manufactures, trade and credit transactions continued nevertheless to develop, as production for exchange ceased to be exceptional, and the trading class became too powerful to be restrained. Much of the Mediæval economics has quietly and gradually become obsolete, though the limitation of prices by law has survived in exceptional instances. The policy of prohibiting interest, however, yielded in theory and practice only after long struggle. The prohibition was at all times disobeyed and was increasingly liable to exceptions or tolerated evasions. It was disguised as an indemnification for risk or for delay in payment; as a partner's share of profits; in exchange transactions as payment for the service of transportation; in pawnshop loans, regarded as a charity, it was sanctioned by the Church as a charge for expenses; deposits in pawnshops drew interest disguised as profits on a useful business; this opened the door to payment for deposit in other banks and general banking under a pretense of charitable lending. As money lending was a sin, a violation of Christian duty, the Jews were often treated as exempt. Most important of all—the lender might claim compensation for damage to his business ("damnum emergens") or for a diminution of profit ("lucrum cessans") as either of these resulted from the lack of his capital. The condemnation of interest had become an established doctrine of the Church, as early as the 4th century; it became frantically severe as the mercantile interest grew powerful beyond restraint. Interest takers were denied the sacrament of the Lord's Supper and Christian burial, and in 1311 a church council condemned even the defense of usury as heresy. In the same century and those following the civil authorities here and there gave their sanction to interest (Prussia in 1385; Marseilles, 1406; Brandenburg, 1565; Denmark, 1554; England temporarily in 1545, permanently in 1571). In Italy the prohibition early lost force by the usual evasions which the civil authorities sanctioned. The revolution in practice was well advanced before the old theory had ceased to prevail among scholars. The literary revolt against the prohibition began (though for the most part timidly and doubtfully) at the time of the Protestant revolution. Zwingli, Melancthon, Luther (in the latter part of his life) and Bacon, a half century later, tolerated interest without justifying it. But Calvin and the French lawyer Dumoulin (Molinæus) declared that the prohibition was not justified by the authority of the Bible or by reason and that other property as well as land was productive. Another century of industrial development gave the attack overwhelming force,—particularly in the Netherlands under the leadership of Salmasius, whose argument (1638-40) was for a generation unsurpassed. By the end of the 18th century the old doctrine no longer found scientific defenders. The revolution in doctrine was at bottom hardly more than a gradual recognition of a slow change in fact by which loans for commercial use between persons economically equal had come to be the prevalent form instead of the primitive borrowing from a rich man by a poor man in distress.

*Mercantilism.*—As the clergy from about the 14th century began somewhat to lose in-



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nuence, and especially as they lost their monopoly of letters, a set of economic opinions characteristic of the rising middle class and designed not to restrain but to encourage trade and the accumulation of wealth forced themselves forward, gaining expression both in legislation and in books. They were not scientific, as they rested on no fundamental principles derived from analysis of facts and consisted less in well defined propositions than in certain tendencies of thought and certain corresponding rule-of-thumb maxims for use in furthering the economic welfare of the people and the economic power of the State. This class of writers exhibit naturally great diversity of thought, but in general their ideas may be summarized as follows (adopting Roscher's account with slight modification): They show most characteristically (1) an excessive estimate of the importance of money in contrast with other forms of wealth (sometimes men said outright that "money is wealth," though that proposition could scarcely be meant in its literal force by any rational person); (2) an excessive estimate of the importance of density of population; (3) an over-estimate of foreign trade, especially of export trade as a means of gaining money; (4) an over-estimate of manufactures in contrast with the production of raw materials; (5) an over-estimate of the power of the state to secure abundance of money and density of population and to encourage manufactures and shipping and foreign trade. As a corollary appears the doctrine of the "balance of trade," according to which a country which exports more than it imports receives the difference or balance in money, so that such a country has a "favorable" balance. The mercantilist opinions appeared early in England, when foreign trade was becoming important and when, as Bacon remarks, men were no longer satisfied with mere sufficiency of goods but began to desire a supremacy over foreign nations. At the end of the 14th century and the first half of the 15th Parliament enacted a whole system of legislation to give English merchants a monopoly of trade and to increase the money supply. English exports might be sold only at a specified market or "staple" subject to the government supervision, and situated on the Continent, so that Englishmen might gain the profit incidental to transportation; the price of exports must be (in part, at least) coin, but the payment for imported goods must be taken out only in English goods. Similar measures were adopted in other countries. Prohibitions on the exportation of coin were frequent. The mercantilist doctrines were given especially frequent expression in economic writings from the 16th century, stimulated by the great development of international trade in the age of Columbus, and they dominated the economic thought and public policy of the 17th century. Mercantilism has also been called "Colbertism," after Colbert, the minister of Louis XIV., who, believing that the abundance of money within a state determines its greatness, not only sought by an extensive system of legislation to develop the manufacture in France of expensive goods, but even interfered with the exportation of the precious metals. It was, however, the policy of Colbert, like other mercantilist legislators, to free domestic trade from the restriction of an earlier age. Among 17th century writers the doctrine

became less crude. It was now sometimes held (notably by the English merchant Thomas Mun, who wrote in the first half of the 17th century) that the exportation of money might be advantageous, as it would stimulate foreign trade and thus bring about yet greater importation of the precious metals. Though these opinions affected in some degree nearly all the writers of the 17th century, they were evidently losing ground. Various writers (as William Petty and Dudley North) asserted that a nation's money supply might be excessive, and Petty noticed, with reference to Ireland, that a nation might grow poor even with a favorable balance of trade. By a gradual process of decay these doctrines had for the most part disappeared among scholars at the end of the 18th century, though the opinion is still frequently heard to-day that an unfavorable "balance" may be disastrous in continuously depriving a nation of its money supply. The mercantilist policy should not be condemned as altogether absurd though the argument in its favor was generally unsound; part of its restrictions upon trade have at any rate that degree of justification which belongs to a protective tariff, and may well have aided in hastening the commercial development of nations. Other purposes were sometimes blended with those commonly considered mercantilistic, especially the exclusion of foreign imports was sometimes favored in the ancient spirit of hostility to luxury.

*The Reaction in Favor of Industrial Freedom, and the Origin of Modern Economics.*—In the 18th century economic writings were subjected to a new group of dominant influences: (1) State aid to industry and commerce began to seem superfluous or even harmful; the tendency toward industrial liberty was reinforced by the general reaction against despotism, as the commercial class were no longer dependents, but approached a position of power equal to that of monarchs. (2) At the same time the contempt with which the learned from the earliest time had almost invariably regarded the laboring classes of town and country was rapidly giving away in enlightened minds throughout all western Europe to a feeling of compassionate interest, and studious men for the first time in history gave to the humble facts of industrial life the respectful attention necessary to scientific treatment. (3) The economic desires of men, which are the immediate subject of all economic speculation, were regarded with less suspicion. Since the Middle Ages man had become a more self-confident being, in facing, like Columbus, the dangers of unknown seas, in proposing, like Bacon, that nature should be made by science the servant of man, and finally, in confronting, not fleeing, the moral dangers of the world. This new view of material enjoyments at times appeared (as with Mandeville or Voltaire) in a marked commendation of luxury. And there appear now and then in glimpses the infinitely suggestive ideas of indefinitely expanding wants and of progress conditioned upon improvements in industry. (4) Men had gained by long effort an aptitude in what may be called the art of science; the art, namely, of forming general principles by analysis of facts. Many of the sciences had their origin in the 17th and 18th centuries. Bacon, about the beginning of the period, and then Descartes, had, each in his



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way, urged the necessity of doubt and investigation. Physics in its various departments was founded, by Newton's study of gravitation at the end of the 17th century, by the application of the wave theory to sound, light and heat, and by the preliminary study of electricity and magnetism. The chemical composition of substances as formed from elements was discovered; Harvey described the circulation of the blood.

A body of economic principles at the same time and in a manner not dissimilar crowded out both the scholastic moralizing and the mercantilist maxims. The study of economics increased where industry increased; the double primacy in economic speculation and in trade rested in the first half of the 17th century with the Netherlands and then passed to Great Britain. The method of study by observation of facts showed itself in the Political Arithmetic of Petty and other writers, both English and continental. The possibility of formulating laws of human conduct, and so constructing systematically a science of politics in economics comparable to the physical sciences was asserted by various writers;—notably David Hume offered the opinion that from the principles of political life conclusions might be drawn "almost as general and certain as any which the mathematical sciences afford us." The study of economics was, moreover, consciously taking shape as a science of desires in which the prevailing force is self-interest. "The principle of self-interest," said Helvetius (1759), "is to the moral world what the principle of gravitation is in the physical one." The same idea appears in many other writers, and the play of self-interest is often regarded as being, within limitations, somewhat uncertain, beneficent in its effects. Thus, according to Josiah Tucker, self-love cannot be extinguished "and it might be questioned whether it would be right even to diminish it, for all the arts and sciences, and the very being of government and commerce, depend upon the right exertion of this vigorous and active principle." Without it, "human nature would make but feeble efforts toward anything great or good." "Benevolence is some check on this selfish principle," but a feeble check; public policy should "give to self-interest such a direction that it may promote the public interest in pursuance of its own." Confidence in the beneficent operation of self-interest implies a condemnation of such legal restraints upon industry and commerce as legal monopolies in trade, the guild regulations, and the regulation by law of prices or wages. Economic theory here justified the contemporary tendency of growing industry to burst the bonds of its infancy. Modern economics as it arose in the 18th century was thus at first predominantly a science of self-interest, with a strong propensity toward freedom of industry and trade.

*The Physiocrats.*—In the second half of the 18th century there arose in France a group of writers known as Physiocrats —(including Quesnay, writing about 1756–68; Mercier de la Rivière, 1767; Dupont de Nemours, 1764–8; the elder Mirabeau, 1763; Turgot, 1766). In them three currents of thought and sentiment converged: (1) the prevalent conception of beneficent self-interest and industrial freedom; (2) the doctrine of a "law of Nature," which with variations has prevailed widely, as in Aris-

totle, the Stoics, the Roman Law and numerous writers of the 17th and 18th centuries, the doctrine, namely, that a superior power governs the universe including human society, according to law, and that men may study out its purposes and conform their action to it; (3) sympathy with the poor; they continued the work of earlier French writers, especially Boisguilbert and Vauban, in demanding a reform of the oppressive tax-system of France, as well as the removal of restrictions on trade. The modern idea of nature and its law differed strikingly from the ancient in this: the physiocrats and others of their time regarded human desires as essentially natural, and looked to the impulses of man in trying to find out the natural law:—the ancients tended to regard man's desires as being in conflict with nature. Influenced doubtless by the example of physical science, the physiocrats attempted to construct a whole system of principles which seemed to them natural, making much pretense of rigid logic, but in fact (as always happens in this use of the word "natural") merely ascribing to nature their own opinions and purposes, fortunately, on the whole, more enlightened than the prevailing opinion of their time. The social order, says one of these writers, is the work of the author of nature, through a combination of physical causes. Since life without food is impossible, rights and institutions necessary to subsistence are "of a physical necessity," such as private property in land and chattels, the laborer's property in his own power to labor, the right of free exchange or free contract at the most favorable terms one can get. This doctrine of industrial freedom was expressed by Gournay in a phrase since common (not really original with him, however), "Laissez faire, laissez passer." The physiocrats proposed, however, to entrust the maintenance of freedom to an absolute monarchy. They generally asserted in the spirit of the mediæval and ancient economics, and in consonance with their reverence for Nature, that agriculture alone is productive, in the sense that it alone yields a "net product" above what is consumed in production. From this doctrine a "single tax" on income from land followed logically. If income from land is the sole addition to the national wealth, it alone can be drawn upon for public use without encroaching upon capital and earnings. Turgot, the great minister of Louis XVI. (an economic writer also of great force and originally), accepted the fundamental principles of the physiocrats and tried courageously but with only partial and momentary success, to relieve the inequality of public burdens, to free the trade in grain and to terminate the industrial tyranny of the guilds. The opposition of the interests assailed was for the time insuperable, but the work of the Revolution a few years later was in a large part a realization of the Physiocratic plan of reform.

*Adam Smith and the English "Classical" Economists.*—Adam Smith ('An Inquiry into the Nature and Causes of the Wealth of Nations,' 1776) was the founder of economics only in that he presented comprehensively and with added force and clearness the more or less fragmentary materials for a science of economics which had resulted from the whole preceding discussion. The assumption of divine or natural guidance in the affairs of men is less conspic-



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uous in Smith than in the Physiocrats or Aristotle, but it strongly affects his whole system. Men are in many cases (he does not say always) "led by a divine hand," so that the pursuit of their individual interests results to the general good, as when each man, striving to increase his own product, augments the total revenue of society. Freedom of industry from legislative restraints (save in exceptional cases), the freedom, that is, of each individual to increase the general welfare, through the operation of an enlightened self-interest, is therefore the most important practical principle of the *Wealth of Nations*, and the book is historically important as the chief text-book of English Liberalism. The division of labor (to which he ascribes immense importance as the chief cause of improvement in the productiveness and skill of laborers) is again attributed substantially to divine guidance (though that expression is not used here). It is not due to human wisdom but to a "propensity of human nature which has in view no such utility," the (unexplained) "propensity to exchange one thing for another." Specialized industry is advantageous (says Smith) because (1) by practice at the same operation, the workman gains skill; (2) he saves time which would be lost if he changed tasks; (3) inventions are often made when men direct their whole attention to one simple task. The employment of peculiar talents (mentioned by Plato) he omits from this list of advantages and even asserts that "the philosopher and the street porter differ little except from habit, custom and education." Smith's account of value and, apart from rent, the distribution of wealth, was the basis of most discussion on these subjects for a century. Labor he regards as the only invariable measure of value (not money or grain). The determination of prices in a market by demand and supply, at a point where demand and supply are equalized; the tendency toward a normal price proportioned to the cost of production; the dependence of wages on the demand for labor, the influence of the accustomed standard of living on wages—these doctrines presented by Smith have for the most part been ever since widely if not generally accepted; but his theories of rent, interest and profits are vague and incomplete, while his fundamental concepts and propositions—representing the state of the science at his time—are often characterized by crude inexactness and inconsistency.

Economics as a study of self-interest had theretofore concerned itself chiefly with the desire for wealth. Thomas Robert Malthus ('*Essay on the Principle of Population*' 1798 and 1803) widened the scope of economics by considering more thoroughly than any previous writer, the economic importance of the tendency of population to increase and the restraints upon its growth. In answer to contemporary writers, particularly Godwin, who favored a system of equal wealth, he said that such an arrangement could have no permanent good effect because population is always stimulated by an increase in the means of subsistence, and the poor, relieved of their poverty, would multiply until what had for a moment been abundance would mean scarcity for the increased number. Malthus showed that under favorable circumstances (as in America, where food was abundant) population might double

once in 25 years. But he says, it is impossible that with the more intensive cultivation of the soil by this growing population the means of subsistence should increase at an equal ratio; at most it might be increased only by an addition for each quarter-century equal to the product at the outset, increased that is in arithmetical ratio, while population increased in geometrical ratio. Malthus describes at length the operation of disease, want and war in limiting the population in various lands. He concludes with a warning against imprudent marriages and systems of poor-relief which encourage such imprudence. No warning could be wiser, yet Malthus has been bitterly criticized, by persons who misapprehend him, for casting upon the poor and relieving the rich of all the responsibility for poverty.

David Ricardo ('*Principles of Political Economy and Taxation*,' 1817) undertook to construct a system of economics,—particularly a theory of the distribution of national income between landlords, laborers, and capitalists—by deductions like those of geometry from a few fundamental assumptions. His fundamental propositions are largely those of Smith, but he states with greater precision and applies in more thorough-going fashion the doctrine that prices are fixed by cost of production; he also makes prominent for the first time doctrines already known and since then of the greatest importance: (1) the doctrine of rent; (2) the doctrine (commonly called the "iron law") that wages are fixed by the laborer's standard of living, and (following Malthus) are prevented from rising by the tendency of population to increase when wages rise. Ricardo did, however, recognize the mere possibility of a rising standard and so of rising wages. John Stuart Mill in his '*Principles of Political Economy*' (1847) stated more clearly the doctrines of Smith and Ricardo. In this work the "classical" English Economics, with its fundamental doctrine of free trade, reached its highest development.

*The Reaction Against Liberalism—The Protectionists; The Historical School; Socialism.*—In various quarters tendencies opposed to the English economics (which prevailed widely also on the continent) manifested themselves with increasing force through the 19th century, influenced by a widening knowledge of history and institutions, by the doctrine of evolution (then being worked out at the same time in biology and in history) and by the growing humanitarian spirit. It was said in substance, that the economists, with their talk of natural laws, were still, like the physiocrats, employing the "metaphysical" or semi-theological method of arguing from hasty assumptions of what is "natural" without proper examination of facts; that their few simple principles could not serve to describe facts and relations so complex as those of human society; that man has other motives than the desire for gain; that economic life must be studied in connection with non-economic life and institutions; that principles of economics which apply fairly to one country at one time (as 19th century England), may probably be inapplicable to other times and places. Finally, the Ricardian economics was assailed most bitterly (often beyond doubt with ignorant exaggeration of faults) by writers like Carlyle and Ruskin



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as a system designed exclusively in the interests of the commercial and employing class — justifying greed and cruel competition. Many writers of this school had opposed in the name of industrial freedom the efforts to improve the condition of the working classes by labor organizations or by factory laws, and had declared (in the "Wages-fund" doctrine now generally discredited) that any attempt by wage-earners to increase their earnings through combination is futile, because wages are determined simply by the amount which the all-powerful employers at their discretion choose to devote to the employment of labor. Conspicuous in this criticism was the German Historical School, which began, so far as such beginnings can be assigned to precise dates, with William Roscher in 1843. This school undertook to supplement, rather than replace, the Ricardian economics, by broadening and strengthening its foundations, through a study both wide and detailed not only of economic history, but also, as a means of understanding economic life, a study of laws and institutions and civilization as a whole, both past and present, especially with a view to finding out the laws by which through long periods society develops. They have done much valuable work in the investigation of industrial history past and present, and they have exercised an important influence as champions of measures designed to improve the condition of wage-earners, favoring especially (in contrast with the "classical" or "liberal" school) a free use for that purpose of the power and wealth of the state. The Historical School has had many representatives also in other countries as England and the United States.

A second anti-Ricardian movement inspired likewise by the idea of evolution, was the "national" or protectionist system represented chiefly by the German, Frederick List, who thought that the state ought to give aid to rising manufactures and facilitate the passage of the nation through the normal course of development to the final stage of diversified industry in which alone the highest civilization is possible. Another extreme and powerful opposition to the Ricardian economics is that of the Socialists. Karl Marx, their chief authority (whose important writings began about 1848), said that all history has been a history of struggles between economic classes and of revolutionary changes resulting from these struggles; that now the capitalist class has prevailed, overpowering all earlier influential classes so that there remain, confronting each other, only the capitalists and the wage-earners, or "proletariat," who are destined to overpower their capitalist oppressors. Then class struggles will forever cease. The employing capitalists are, under the present system, enabled to rob the wage-earners, it is said, because the product of the laborer's work per day has a value fixed, as Ricardo had said, by the amount of labor expended (say 12 hours per day); the employer pays in wages only the subsistence of the laborer, which can be produced in much less than 12 hours per day — say 6 hours. The capitalist's profits are the difference between the wages and the value of the goods produced.

Meantime the attempt, begun by earlier economists like Ricardo, to develop the science by deductive argument from a few principles, had

been by no means abandoned. The most important work of the kind has been a study of consumption (usually neglected by earlier writers) resulting in the "marginal utility" theory of value, also called, from some of its authors, the "Austrian" theory. This theory begins by noticing that a satisfaction if continuously repeated ordinarily grows less intense. Thus, if a hungry man eats in succession several pieces of bread, the first satisfies an extremely urgent need, but each later unit yields a less utility than its predecessors until desire ceases and further units if consumed would cause discomfort. In any specified supply of a commodity, as bread, one's estimate of a single unit is fixed by the least urgent want which this supply would satisfy, that is, by the utility of the "final" or "marginal" unit. If the supply is increased the utility of the single unit obviously decreases, as the want last satisfied by the added units is less urgent than any satisfied by the previous smaller supply. The reverse effect follows a decrease of supply. An economical person will seek to spend his money in such a way as to gain the greatest total utility, and will therefore stop buying one commodity and begin buying another when, with an increase in the amount of the first, its utility per unit sinks below the utility of a unit of the second. It has sometimes been assumed that persons ordinarily regulate their expenditure by this calculation and that a price offered for an article is determined by its marginal utility to the purchaser; but the assumption is questionable, as whim, habit and imitation influence offers very strongly. Marshall in England, Clark in the United States, and various other writers have made extensive use of this theory.

*The Fundamental Principles of Economics — Value and Price.*—The whole subject of economics has been commonly divided into four parts, production, distribution, exchange and consumption. As wealth and services are exchanged the amount of other things which any commodity or service will procure is known as its value; value expressed in money is called price. The actual price paid for goods at any time is called market price and is determined as follows by the demand for such articles relatively to the supply of them: It is assumed that each buyer has definitely in mind the highest price which he will pay while each seller refuses to sell for less than a certain price. For example in a wheat market the demand and supply might be conditioned thus (using small numbers for simplicity):

Buyer number	Bushels desired	Price, not above	Seller number	Bushels offered	Price, not below
1	100	\$ .80	1	60	\$ .70
2	30	.78	2	50	.72
3	15	.76	3	35	.73
4	80	.75	4	80	.74
5	10	.74	5	9	.76
6	70	.68	6	80	.78
7	40	.65			

Evidently the buyers will prefer in their trading to buy of the low-priced sellers and the sellers to sell to the high-priced buyers. The liberal buyers and the cheap sellers will, therefore, transact the business. The demand of the first, second, third and fourth buyers above (in all 225 bushels at a price not above 75 cents) will absorb the supply of the first four sellers (225 bushels at not less than 74 cents). The remain-



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ing buyers and sellers are left out of the bargaining as they cannot make terms at the prices on which they severally insist. The price of wheat will be fixed near the "marginal pair" — the buyer and seller last in the order of "liberality," who are yet able to conclude a bargain. The price will be fixed, then, between 75 cents and 74 cents, nearer one or other of these points according to the relative success of the two parties in bargaining. The price cannot rise above 75 cents (to 76 cents for example) because if it did rise momentarily the fourth buyer would refuse to buy and the sellers, in competing for his custom, would lower the price. Likewise the price could not fall below 74 cents and exclude the fourth seller; because of competition by the buyers ready to buy at his price.

It is well known that changes in demand and supply result in changes of price. Suppose that in the case above, demand increases, that is, new buyers enter the market, or the previous buyers make higher offers. If new buyers make only low offers (like those of the fifth, sixth and seventh buyer above) they cannot transact any business, but if the liberal offers, like those of the first and second buyers, increase, the fourth buyer, perhaps the third, will be out-bidden, and the price will rise. Suppose that demand diminishes, that is, some buyers drop out of the market. If they are all "low priced" buyers like the fifth or sixth, their withdrawal will not affect the prices; but if some of the liberal buyers, as the first or second, drop out, the disappearance of their competition will permit buyers before excluded to purchase, and the sellers will have to content themselves with the demands of less eager buyers. Likewise a change in the supply will affect prices if it augments or diminishes the number of "liberal" offers by sellers competing for opportunity to sell.

"Market price" is the price determined as above, by demand and supply; "Normal price" is the price which corresponds to the cost of production, understanding by cost of production not money, but the amount of labor and use of capital employed in producing the commodity. Cost, thus understood, regulates price only in the sense that when labor or capital employed in producing a commodity receives (in the market price of that article) a return less than that afforded by the market price of some other article, there is a tendency to withdraw labor and capital from the poorly rewarded to the well rewarded employments. This lessens the supply of goods in the ill-paid production with a tendency to raise prices there and increases the supply in the highly paid production, lowering prices there. So far as people have the ability to shift from one employment to another, prices must thus in the long run tend to be in proportion to the cost of production, but the process is hampered in various ways by the lack of knowledge on the part of those in the ill-paid employments, or lack of skill or natural ability to do the highly-rewarded labor, or by the fact that capital once invested (in machinery for instance) cannot be changed to another use. Monopoly (legal or other) prevents capital and labor from coming into the monopolized industry and so lowering the excessive prices. It should be added that many writers prefer to define cost of production from the employer's point of view as his expenses for labor and for the use of cap-

ital, plus the profit necessary to induce him to continue in business. Prices must tend to equal cost of production, in this sense, because if the price of any commodity exceeds this point production will be increased, and, with the added supply, prices fall; but if prices are below the expenses of production, plus profit, production will diminish and prices rise.

*Wages.*—The demand and supply of labor determines wages, somewhat as it determines the prices of other commodities; but labor differs importantly from other things bought and sold. First, it is inseparable from the laborer who sells it, so that the circumstances of its use are important to him. Second, the laborer is compelled to sell without great delay because ordinarily (unlike many other sellers of commodities) he has no resource on which to live if he wishes to wait for better terms.

*Interest.*—Interest on loans is partly a compensation to the lender for the risk of failure by the borrower to repay; but "pure interest," omitting this insurance payment, is paid by borrowers because capital (in the form of machinery for example) is useful in production; sometimes also because the borrower has some exceptional present need or is a spendthrift. Lenders will refuse to lend without demanding interest because, to many of them, a present enjoyment seems at present of greater magnitude than a like future enjoyment, and an additional payment is required to induce them to defer the use of their wealth. Interest is thus sometimes said to be a recompense for "abstinence" or "waiting." The rate of interest on capital loaned is determined like the price of a commodity by demand and supply. The borrowers who will pay the highest rate and the lenders accepting the lowest rate are the ones who respectively borrow and lend, and the rate is fixed (as in the price table above) near the "marginal" borrower and "marginal" lender.

*Rent.*—Payment for the use of natural agencies of production, especially land, is called rent. Improvements on land (as farm buildings) are classed as capital, and income from them as interest, although in practice it is evidently often impossible to distinguish between the land and the improvements.

Different pieces of land differ in their desirability because they are unequally fertile, unequally accessible to the market, etc. The demand for any agricultural product determines what land will be cultivated and what will seem too poor for cultivation. Thus if the price of wheat per bushel is one dollar, the poorest land fit for cultivation will be that on which it costs one dollar to raise a bushel of wheat and bring it to the market. In this the price of the product is assumed always to equal the expense of production on the poorest land in cultivation, because if the price falls below that point some land must be abandoned; if it rises, poorer land will be taken into cultivation. In the case supposed, better pieces of land, on which a bushel of wheat can be raised for less than one dollar (say 90, 85, 80 cents respectively) will yield a surplus over the expense of 10 cents, 15 cents, and 20 cents. This differential gain from better land is called a rent. The same principle may be expressed in another way: If a certain unit of land, cultivated at an expense of ten dollars, yields ten bushels of wheat worth a



dollar per bushel, it barely repays cultivation, and yields no rent. If another unit of land, cultivated in the same manner, yields 12 bushels, the surplus of product over expense (the rent from that land) is two dollars. When population grows, and the demand for agricultural products increases, and prices therefore rise, land previously not worth cultivating comes into use, while at the higher prices, land which had before just repaid cultivation now yields a surplus, or rent; and land which had before yielded a rent yields a higher rent. Thus growth of population tends to raise rent. A decline in population or a fall in agricultural prices for any other reason lessens the surplus value of the crop over the expense of producing it—that is, lessens rent. The income from land has long been regarded by most writers as entirely different from other kinds of income in the manner in which it arises and is measured. But recently there has appeared a growing tendency to regard as less important the differences between land and other sources of income, especially to notice that a large part (some would say all) of wages and profits are, like rent, a differential gain resulting from superiority like superior excellence of land.

*Profits.*—Probably no term in Economics has been employed with more confusion and difference of opinion than this. Many writers have adopted the popular usage, which includes under profits both the earnings of the employer, by his service as manager, and the return for the use of capital which he uses. This is objectionable, as no scientific term should be made to cover two distinct ideas. It seems here preferable to speak of the return for the use of capital as “interest,” and to understand by profits only wages of management, received by the employer or *entrepreneur*, as a return for his service in combining and directing the other agencies of production, capital, labor and land. Profits are thus the difference between the value of the gross product and the expenses of the enterprise. The employer may merely direct the business, borrowing capital, hiring labor, and renting land; in that case his income, after deducting wages, interest and rent, is the reward only of his skill or good fortune in management. But often the employer contributes also his own capital (buildings, machinery, etc.) or his own land or labor other than the labor of management, and the resulting income is a conglomerate of profits with interest or rent or mere wages. Profits must ordinarily be or seem likely to be, at least about as great as the wages which the same men could earn by doing something else, otherwise they would not consent to incur the risks and labor of responsible management. Above this point of necessary profits the amount of profits is determined by all the factors which affect either the gross receipts of the business or the expenses. These factors include especially ability in buying and selling and in choosing or handling the various agencies of production. Mere good or ill fortune also plays its part in this determination.

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**Political Offenses** are those offenses considered injurious to the safety of the state, or such crimes as form a violation of the allegiance due by a citizen to the recognized supreme authority of his country. In the ancient times of the Roman republic offenses of this nature were comprehended under the name *perduellio*, and were considered equivalent to making war upon the state. In modern times the crimes considered political offenses have varied at different periods and in different states. In England the most serious political offenses are termed treason and those of a lighter nature, which do not aim at direct and open violence against the laws or the sovereign, but which excite a turbulent and discontented spirit which would likely produce violence, are termed sedition. (See SEDITION.) Political offenders of foreign countries are by English law not included in extradition treaties, and the secretary of state may order at any time a fugitive criminal accused or convicted of such crimes to be discharged from custody. In the United States also, and in most of the countries of Europe, the extradition treaties do not include the giving up of political offenders.

**Political Parties** are divisions or classes of the people of a state or nation marked off by the particular views they hold as to the public policy to be pursued in the best interests of the people at large. In the United States the chief political parties are the Democratic and Republican, which take opposite views on the tariff question. (See FREE TRADE; PROTECTION.) Former prominent political parties in the United States were the Whigs and Know Nothings. (See WHIGS.) In Great Britain the two great parties are the Liberals and Conservatives. (See GREAT BRITAIN.) See also DEMOCRATIC PARTY; PEOPLE’S PARTY; PROHIBITION PARTY; REPUBLICAN PARTY.

**Political Science**, the science which treats of the nature and organization of states with particular reference to their forms of government (q.v.). The late Sir John Seeley, one of the most profound students of political science, declared that “the state in the largest acceptance of the word, distinct from the family, though not unconnected with it, distinct also from the nation, though sometimes roughly coinciding with it, is the subject of political science; or, since the distinctive character of the state wherever it appears, is that it makes use of a contrivance called government, we may say that it deals with government as political economy deals with wealth, as biology deals with life, as algebra deals with numbers, and as geometry deals with space and magnitude.” It is the province of political science to discover



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proper tests for the classification of governments as well as correct principles for the organization or administration of government. Whether political power shall be vested in the few or the many, what shall be the qualification of those who choose and those who hold government offices and mandates, whether a written constitution is preferable to an unwritten one, whether legislative, executive and judicial functions should be exercised by the same or different organs, whether the bicameral form of legislature has advantages over the single-chambered body, the relation between government and liberty, the proper sphere of government activity, the conception and organization of sovereignty, the principles governing the organization and powers of the executive, the legislature and the judiciary are some of the problems of general political science. In its nature political science may be descriptive or historical. Descriptive political science deals with existing constitutions and treats of principles which are applied in practice. Historical political science treats of constitutions which have obtained in the past and of the growth and development of political ideas. Political science is sometimes said to differ from politics in that the latter has to do rather with the practical administration of government and from political philosophy in that the latter is concerned with a theoretical examination of the concepts which underlie political science. According to this distinction political science has to do only with those political ideas which are scientific. It is closely allied to history and political economy. Its relation to history is ingeniously described by the eminent authority referred to above. He says that history is the *residuum* left when one group of facts after another has been taken possession of by some science. As this process of appropriation goes on, the *residuum* will eventually become the property of a single science — political science, a science which has for a long time been insensibly growing up by the side of history and in close connection with it. Political science draws many if not most of its materials from history, and the principles which underlie it are for the most part based on historical facts. Its relation to economics arises from the great part which economic influences play in determining the functions and scope of government. Thus the principles underlying the proper relation of government to industry, as for example whether certain industries should be encouraged by bounties, subsidies or tariffs, are affected largely by economic considerations. The method of the political scientist is inductive and by observation rather than by experiment, since it is physically impossible for him to experiment with materials which form the basis of his study as in the case of those who study the natural sciences. He may, however, study existing and historical constitutions as did Aristotle and in this sense his method is experimental.

Historically political science began with the ancient Greeks. Other primitive races lacked political consciousness. They had the consciousness of family and of class, but not of the state in the aggregate. By the common voice of posterity Aristotle (q.v.) is recognized as the founder of political science and his commentaries still occupy an important place in the

literature of the subject. He it was who first gave to politics the character of an independent science. He mastered in the concrete a large number of constitutions, mostly Greek, and from the mass of facts thus gathered he laid down the body of general principles which constitute his system of politics. He was the first to classify governments into monarchies, aristocracies and democracies and although many of his other theories have long since been rejected this classification is still accepted as the most scientific and convenient. The corresponding perversions he designated as tyrannies, oligarchies, and democracies. He laid down the important maxim that man is by nature a political animal and that therefore the state is necessary to a complete and all-sufficing life; he drew a distinction between ethics and politics; taught that the state was not an affair of mere convention but the result of growth and evolution; and discussed with scientific method the various types and forms of government, the theory of sovereignty, the institution of slavery and private property. Three elements, he said, were essential to every government. They were: a deliberative organization, a system of magistrates, and a judicial organization. He asserted that the best constitution is one framed and administered for the common good, but that the best for one people was not necessarily good for all; that some are born to command and others to obey; he emphasized the principle of the responsibility of power and expressed the opinion that government by the middle classes was the most desirable. The chief merit of Aristotle's work was that he studied exhaustively the materials at hand and reduced to a clean-cut systematic form the general principles which he was able to gather from his studies. In other words he created a science of politics. Among his countrymen Plato (q.v.) was the only other scholar who contributed anything worth mentioning to political science, and his treatment of politics was largely incidental to his ethical philosophy, it scarcely ever rising to the dignity of a science. In the 'Republic,' which was the greatest of his works, he formulated the conception of a state in which absolute justice prevails — an ideal commonwealth such as has never existed, in fact, nor probably ever will. Three classes, he affirmed, were necessary to every state. They were producers, warriors and magistrates, and every member must be assigned to the class for which he is best fitted. He did not recognize the right of private property, but insisted upon a uniform system of public education. In fact he believed that the only true way to the perfect state was through education. The function of the magistrates was to be limited — practically to the training of children, every detail of their early life being prescribed by the state. His idea of government was that of the aristocratic form; but he believed in an aristocracy of merit rather than of wealth. He proposed that philosophers should constitute the governing class, to exclude poetry from the state, to place women on an equality with man so far as political and military obligations were concerned. Some of his teachings, however, were not purely utopian; such for example as the opinion that the strength of the state was virtue and education, and that the guaranty of civil liberty could only be had in a well balanced



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constitution. His classification of governments was the same as that of Aristotle except that he added two other types, namely, tyranny and oligarchy, which is his last and most extensive treatise. In the 'Laws' he abandons somewhat his utopianism and seeks to present a practical code for the government of men. It proposed regulations for the minutest details of domestic life and recognized the institutions of marriage and private property, which had no place in his earlier treatises. It was he, as Sir Frederick Pollock shows, who first worked out the theory that government is a special art and can be exercised only by competent persons. His idea of government by philosophers, however, would now be ridiculed. Strictly speaking he had no theory of the state, and his political ideas generally have had little permanent influence upon the history of politics. The same may be said of the post-Aristotelian Greek scholars, although it may be said that the Stoics contributed the idea of the law of nature and the idea of citizenship. In the domain of political science the Romans were servile imitators of the Greeks and therefore contributed little of permanent influence. They were successful rulers and administrators, were skilful in the formulation of rights and accomplished wonders in the domain of jurisprudence, but when Rome became a world state, carrying with it the destruction of all independent political life, there was no place for theoretical politics. The Latin mind, in fact, was not given to speculation. Polybius and Cicero are almost the only names among the Roman theorizers, and their investigations were confined entirely to the Roman state. Polybius produced a remarkable treatise on the constitution of Rome which had an important influence upon later Roman politics. His discussion of the forms of government is also worthy of note. In Cicero's political writings of which the 'Laws' and the 'Republic' were the most notable, we find developed the idea of a mixed government, containing royal, aristocratic and popular elements—a type which Cicero believed would prove to be most stable because of its triune basis. His classification of government was the same as that of Aristotle. Cicero's most important contribution to political science was the presentation of a clear and definite conception of natural law, which he defined as the supreme principle common to all nations.

During the Middle Ages few or no important contributions were made to political science. As James Bryce points out the Mediæval period was essentially unpolitical. The decisive spiritual force was religion. Political self-consciousness was lacking. One and only one great question dominated the political and intellectual life of the time and that was the long controversy between the temporal and spiritual powers. It involved the relation of church and state and incidentally the nature of the civil power, the principle of the divine right of kings and the sovereignty of the people. A number of scholars, mostly theologians, arose to defend the claims of the Church to supremacy over the civil power. Of these, John of Salisbury and Saint Thomas Aquinas were probably the most notable. In the 'Polycraticus' the former discusses monarchy as a form of government and justifies the crime of tyrannicide; in the 'Summa Theologia,' one of the greatest treatises of the

Middle Ages, the latter discusses the various kinds of law, natural justice, the nature and forms of political authority and the functions of government. On the other hand, Dante, Occam, Marsiglio of Padua, and other jurists defended the claims of the civil power. To mention the most important of the numerous treatises that followed, Dante's 'De Monarchia' discussed the monarchical form of government as the best of all forms and asserted that a universal monarchy on the old imperial lines was necessary for the highest development of mankind. A universal monarch he said, having no rival to fear and no further ambition to satisfy, could have no motive for ruling unjustly, Occam's and Marsiglio's discussions of sovereignty and representation are of interest only to the student of political theory. Modern political science really begins with Machiavelli, an Italian who wrote during the latter part of the 15th century. He was devoted to the study of political science and like Aristotle regarded the state as the highest good. His chief works were the 'Discourse on Livius' and the 'Prince,' the latter a treatise which was designed to furnish advice to princes as to how they might best obtain their ends. The treatise is chiefly notable for its details of statecraft rather than for any theory of the state. It makes a complete separation of ethics and politics, in fact takes no account of morality. Into politics he introduces cruelty and bad faith, and teaches that a prince is justified in resorting to deceit, treachery, treason, cruelty and even murder in order to accomplish his ends. For this purpose such conduct seemed to him to be perfectly innocent and he recommended it without scruple. In the following century an important contribution to the literature of political science was Languet's 'Vindiciæ contra Tyrannos,' the first treatise which defined the relationship existing between rulers and subjects as one of contract. This is not to be confused with the principle of contract as a theory of the origin of the state. The work was also notable for its strong plea for resistance to rulers who violate the contract existing between them and the people. A monumental contribution to political science was Jean Bodin's 'De Republica,' published in 1577. It is a polemical treatise conceived on the plan of Aristotle's 'Politics' and is notable for containing the first definite enunciation of the modern political doctrine concerning the nature and location of sovereignty. He shows that in every independent state there must be some authority, whether single or collective, whereby the laws are enacted. This authority is the sovereign and being the source of law must be supreme over the law. "He is sovereign," said Bodin, "who sees no one greater than himself except God." He defines sovereignty as a "power supreme over citizens and subjects, itself not bound by the laws," and asserted that it was a unit and hence indivisible. This view of sovereignty was in the following century adopted by Hobbes and ultimately came to be the generally accepted view of the publicists. He is entitled, says Sir Frederick Pollock, to share with Hobbes the renown of having founded the modern theory of the state. In the 17th century the two most distinguished names in the annals of political science are those of Thomas Hobbes and John Locke, both Englishmen, one a defender of



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the absolutism of the Stuarts, the other a defender of the revolution and a champion of the sovereignty of the people. Hobbes' most famous treatise was the 'Leviathan or De Cive' and the two most important principles which he there lays down relate to sovereignty and the origin of society through contract. Like Bodin he taught that sovereignty was legally unlimited and subject to no higher powers. The sovereign, he said, was a public personage vested with absolute power, it might be arbitrary, it might be benevolent. No subject had a right to resist the sovereign, for that would be violation of his contract with all the other members of the state. His political science made no place for popular sovereignty, but it was Hobbes' doctrine of the state of nature and the contract theory of the origin of the state that made his work most famous. His view of a state of nature was that of a pre-social condition in which men were in a state of perpetual war with one another, each appropriating what he could get and hold by physical force. To escape from this intolerable condition and provide for the security of all, each was induced to resign certain of his so-called rights over all things and surrender them to some common authority, thus forming a mutual covenant for the protection of other rights. Each entered into a contract with all by which he agreed to divest himself of the natural liberty of hindering his fellow men in their efforts to obtain the same right. Hobbes' doctrine thus differed from that of the 'Vindiciæ contra Tyrannos' of Languet in holding that the sovereign is no party to the contract but only an authority set up as a result of contract among the subjects of the state. He, therefore, surrenders nothing, but retains his natural rights as though he were in a state of nature. Nor can he be accused of breach of contract, because he has promised nothing. The idea of justice had no place in such a state nor had the conception of private property yet arisen. Locke wrote as a defender of the principles of the revolution of 1688 and his 'Essay on Civil Government' is one of the most notable treatises on political science published before the 19th century. Like Hobbes he accepts the contract theory of the origin of society as well as the idea of the state of nature. He differed from Hobbes, however, in his view of the state of nature, holding that it was not a state of license or anarchy or a condition of perpetual warfare, but merely a condition in which men have no common superior. Each individual is limited in his action by the law of reason or natural justice, while the institution of private property, the right to labor, and the right of liberty, occupied an important place in the pre-social state as he understood it. Hobbes' doctrine of the renunciation of rights to an absolute ruler he also rejects. Locke's doctrines had more influence perhaps on American political philosophy than those of any other man. Passing over minor writers of the period we are brought to Montesquieu, who about the middle of the 18th century made several monumental contributions to the literature of political science, the most notable being his 'Esprit de Lois,' published in 1748, a work which was the result of great study and research. It has been said that his two main ideas were: (1) the construction of a comparative theory of legislation and institutions adapted

to the political needs of different forms of government; and (2) a comparative theory of politics and law based on wide observation of the actual systems of different lands and ages. He discussed intelligently the various forms of government, the corruption of democracies, the influence upon politics of the elements of air, sun, geography, climate, race, etc. Perhaps the best known and the most permanent in its effects of Montesquieu's political doctrines was his theory of the separation of powers and of checks and balances in government. The idea of the three-fold character of governmental powers (legislative, executive and judicial) was as old as Aristotle, but it remained for Montesquieu to show that the exercise of each group of these functions by separate and distinct organs was an essential condition of liberty. If all these functions are exercised by one and the same organ, that is, if the same organ legislates, interprets and executes, its legal sanction is that of a tyrant. This principle was destined to have a large influence upon the political development of the United States and was in the course of time adopted by all the States and by the national government.

The last contribution of note in the field of political science in the 18th century was that of Jean Jacques Rousseau. This contribution consisted (1) of his theory of sovereignty and (2) of his theory of the social contract. As opposed to the doctrine of the jurists who held that the will of the prince was law, Rousseau asserted the omnipotence of the people. In the 'Contrat Social,' his most notable work, the theory of the origin of the state as enunciated by Hobbes and Locke was elaborated. Like Locke, Rousseau maintained that pre-social men were not in a state of perpetual warfare nor in a condition of unrestricted license. During the 19th century the names of De Tocqueville in France, Bluntschli in Germany, and Herbert Spencer in England, are perhaps the best known. De Tocqueville's 'Democracy in America' was a philosophical examination of political institutions in the United States based to some extent on personal observation. Herbert Spencer's 'Political Institutions,' his 'Principles of Sociology' and his 'Man vs. the State' are substantial contributions to the literature of political science. The individualistic conception of government activity which he sets forth is perhaps the most notable plea for the *laissez-faire* principles to be found anywhere. Bluntschli's 'Theory of the State' is a profound treatise on the nature and attributes of the state.

In the United States the contributions to political science have, for the most part, been of little consequence. The American mind is practical rather than speculative, and while the Americans have shown great skill in the preparation of constitutions and the formulation of rights, they have given little attention to the scientific discussion of the state. Most of the principles of our political science were inherited from England. The ideas of natural rights, popular sovereignty, representation, etc., were the familiar doctrines of the Puritan revolution, while the idea of the separation of powers came from Montesquieu. The first and one of the greatest American treatises on political science was the 'Federalist,' written by Hamilton, Madison, and Jay in 1788 to secure the adoption of



the Constitution. But being a lawyer's brief, it lacks the element of an unbiased philosophical discussion. Thomas Jefferson contributed various ideas of a speculative character, but they never took the form of a systematic treatise and scarcely rose to the dignity of a scientific examination of the subjects treated. John C. Calhoun's 'Disquisition on Government,' written in 1850, is an original and profound essay on the nature of government, and has scarcely been surpassed by any other American contribution in this respect. Two other works deserving of mention are Francis Lieber's 'Political Ethics' and Theodore Woolsey's 'Political Science.' Lieber's work was the first approach to a systematic treatise on political science ever published in America and has had great influence upon the political thought of the nation. His 'Civil Liberty and Self-Government' also occupies a distinct place in the literature of the subject. A more valuable treatise still is Woolsey's work first published in 1877 and is without doubt the most scholarly and systematic presentation of the principles of political science which has appeared from the pen of an American. The most recent contribution is Burgess' 'Political Science and Constitutional Law,' which discusses in a profound way the nature and origin of the state, the conception of sovereignty, and the relation of government to liberty. Probably no contribution has had such influence in clarifying American conceptions on these phases of political science.

(See also articles STATE; SOVEREIGNTY; and the Sections on *Government* of the various countries.) In addition to the works cited consult Pollock, 'History of the Science of Politics'; Seeley, 'Introduction to Political Science'; Dunning, 'Political Theory of the Ancient or Mediæval World'; Willoughby, 'The Nature of the State'; also 'Political Theories of the Ancients.' JAMES WILFORD GARNER, *Professor of Political Science, University of Illinois.*

**Politics.** See ELECTION; POLITICAL SCIENCE.

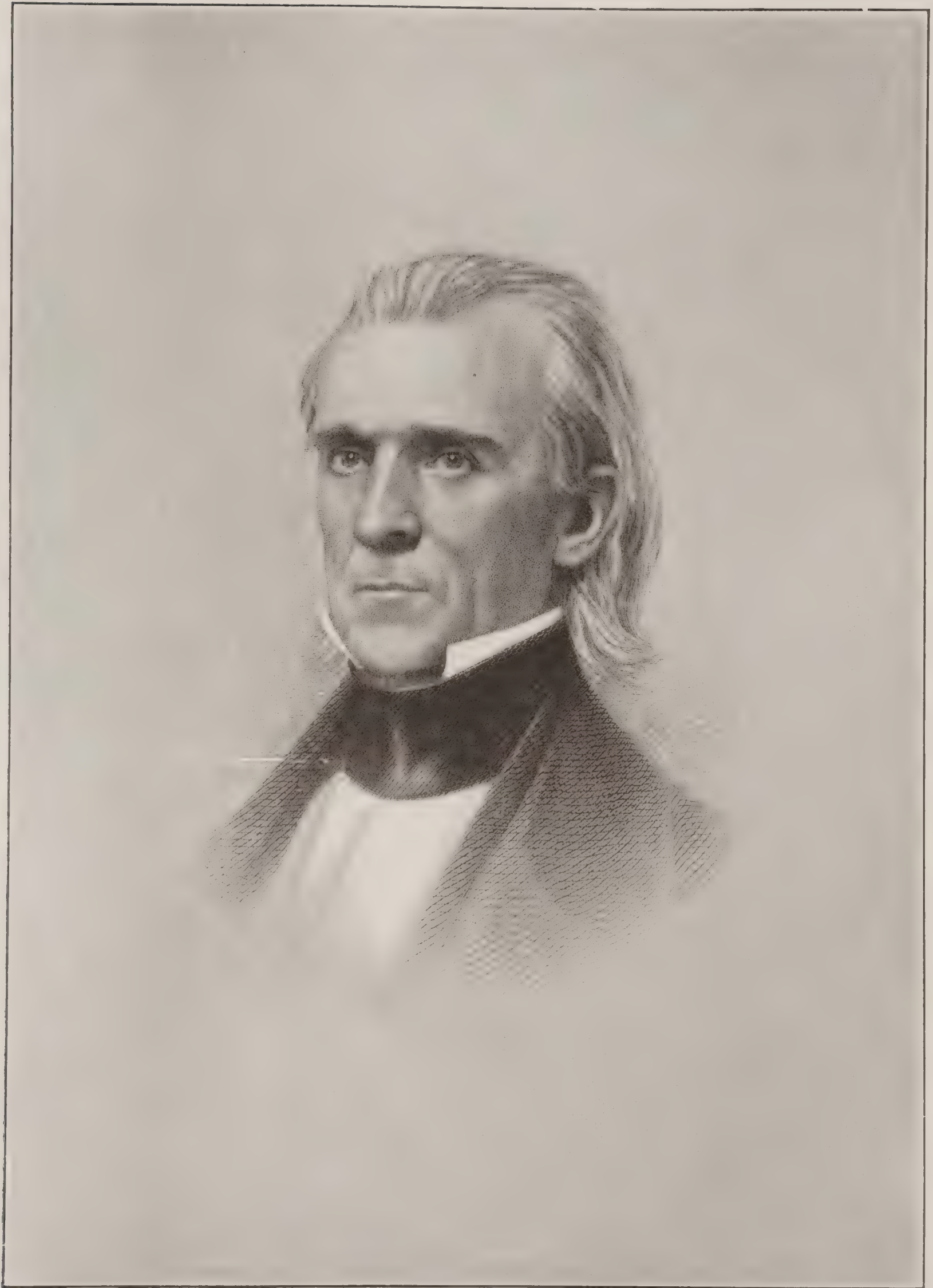
**Poliziano,** pō-lēt-sē-ä'nō, **Angelo.** See POLITIANUS, ANGELUS.

**Polk,** pōk, **James Knox,** 11th president of the United States: b. Mecklenburg County, N. C., 2 Nov. 1795; d. Nashville, Tenn., 15 June 1849. His ancestors bore the name of Pollock and came to America from the north of Ireland early in the 18th century. He was graduated from the University of North Carolina in 1818, studied law with Felix Grundy (q.v.) of Tennessee, in 1820 was admitted to the bar, and established a law practice in Columbia, Tenn. In 1823 he entered political life as a member of the Tennessee legislature, and in 1825 was elected to Congress where he served seven terms in succession. He was Speaker of the 24th and 25th Congresses and maintained throughout his 14 years' service a reputation as a consistent Democrat, a ready and able debater, and as Speaker presided at a time when party feeling was particularly bitter, in so just and impartial a manner as to win the praise of even his political opponents, and his rulings though frequently appealed from were almost invariably sustained by the House, irrespective of party. He was a loyal supporter of Jackson and Van Buren, but an opponent of Adams. In 1839 he was elected

governor of Tennessee, but was defeated for re-election both in 1841 and 1843. His popularity with his party, however, did not wane and he now became candidate for the vice-presidency. Party opposition to Van Buren rendered his renomination in 1844 impracticable and Polk as a compromise candidate received a unanimous nomination on the ninth ballot. The contest for election was a memorable one. Henry Clay, the Whig candidate, was the most distinguished man in his party, but his attitude in regard to the annexation of Texas had won disfavor in certain portions of the country, and the Democratic platform, favoring the "reoccupation of Oregon and the reannexation of Texas," proved strong enough to win support in both the North and the South and resulted in Polk's election. The majorities were small, and unfairness has sometimes, though unjustly, been charged against the Democratic party; but in the electoral college Polk received 170 votes as against 105 for Clay. His administration, with George M. Dallas as Vice-President, was eventful and successful though not brilliant. He secured a settlement of the Oregon boundary dispute with England, accepting in behalf of the United States the parallel of 49° as the northern boundary line, though much opposition to this course was evinced, since one of the party cries in the election had been the claim for 54° 40' N. as the northern limit. A second boundary dispute arose with Mexico, resulting in 1846 in the declaration of war with that country which terminated in the acquisition by the United States of the vast territory of California and New Mexico. Further important events of his administration were the passage in 1846 of a tariff law based on the principle of tariff for revenue only, and of a bill designated to establish an independent United States treasury. He vetoed the river and harbor bill as being an unjustifiable expenditure, and with the exception of the debate over the Wilmot Proviso and that of the bill organizing the Territory of Oregon there was little of moment concerning the slavery question. He was a man of ability, though far from brilliant, of character above reproach, quiet in habits, consistent in principles, and on the whole a successful statesman. Several biographies of Polk exist, a collection of his papers is the property of the Chicago Historical Society, and his manuscript diary is in the Lenox Library, New York.

**Polk, Leonidas,** American general and Protestant Episcopal bishop: b. Raleigh, N. C., 10 April 1806; d. Pine Mountain, Ga., 14 June 1864. He was a cousin of President Polk (q.v.). Educated at the United States Military Academy he subsequently studied for the ministry, and in 1831 took priest's orders in the Episcopal Church. In 1838 he was consecrated missionary bishop of the Southwest Indian Territory, Alabama, Mississippi, and Louisiana. In 1841 he was appointed bishop of Louisiana, and his plan for a system of higher education in the South had its outcome in Sewanee University and the University of the South, established in 1858. He was an ardent lover of the South and soon after the outbreak of the Civil War was offered a major-generalship in the Confederate army and, accepting it, proceeded to fortify strongly strategic points on the Mississippi. At Shiloh and at Corinth he commanded the First corps; in October 1862 he was promoted to lieutenant-





JAMES K. POLK,  
ELEVENTH PRESIDENT OF THE UNITED STATES.







## POLKA — POLLARD

general, and in November conducted the retreat from Kentucky. In December 1863 he was promoted to the Department of Alabama, Mississippi, and eastern Louisiana, and afterward joined Johnston in opposing Sherman's march to Atlanta. He was killed by a cannon ball while reconnoitering on Pine Mountain. Consult 'Life' by his son, W. M. Polk (1893).

**Pol'ka**, a dance of Bohemian or Polish origin, the name being derived from the Bohemian *pulka*, half, from the half-step that characterizes the dance, or from *Polka*, a Polish woman. It was introduced at Prague about 1835, and in 1839 was brought by a part of the musical band of the Prague sharpshooters, under the management of Pergler, to Vienna, where both the music and dance met with extraordinary acceptance. In 1840 it was received with the greatest applause at the Odéon Theatre in Paris, and was soon the favorite dance at all the public and private balls of that capital. It spread rapidly into every country of Europe, and is now common in every part of the civilized world. The music is written in  $\frac{2}{4}$  time, the first three quavers being generally strongly accentuated.

**Polko**, pōl'kō, **Elise Vogel**, German novelist: b. Leipsic, Germany, 31 Jan. 1823; d. Munich 15 May 1899. She was a sister of Eduard Vogel, the African explorer, and attained considerable fame as a public singer, but retired from the stage after her marriage to Polko, a scientist, and thenceforth devoted herself to literature, in which field she won much notice. Her 'Musikalische Märchen' (1852) was translated into English, as were others of her books. She published: 'Ein Frauenleben' (1854); 'Erinnerungen an Felix Mendelssohn Bartholdy' (1868); 'Aus dem Jahre 1870'; 'Neues Märchenbuch' (1884); etc.

**Poll-evil**, a swelling followed by severe ulceration, on the neck or head of a horse, which often results from a bruise, undue pressure of halter or similar injury to the flesh. As soon as it becomes evident that pus is forming warm poultices should be applied to hasten the process. When ripe the swelling should be lanced and kept open by a seton until thoroughly drained and clean and in proper condition to heal properly. Careful treatment is necessary to prevent serious injury to an animal so afflicted.

**Poll-tax**. See CAPITATION; TAXATION.

**Pol'lack**, or **Coalfish**, a dark green fish (*Pollachius virens*) of the cod family, which is common throughout the North Atlantic, and differs from the cod in seeking its food in shoals at the surface as well as near the bottom. In such surface excursions they pour out their spawn, which floats and quickly hatches. The flesh is highly esteemed on the British and Canadian coasts, but is not commonly known in the United States. Very similar fishes occur in the North Pacific, one of which is highly important to the Alaskan coast natives who call it beshow. All of these fishes yield a valuable liver-oil; and the eastern ones, at least, afford good sport with hook and line.

**Pollaiuolo**, pōl-lā-yoo-ō'lō, **Antonio**, Italian painter, sculptor, and goldsmith: b. Florence 1429; d. Rome 1498. He was a pupil of Donatello and Paolo Ucello, sculptor. Chiefly known as a sculptor, his paintings, however, have a distinct place in the development of Italian art from

their power in the expression of action, this quality best exhibited in his 'Hercules Strangling Antæus' in the Uffizi, and the 'David' at Berlin. His other occupations lend a certain character of hardness to his painting, which also exhibits his superior knowledge of anatomy, he being the first to study from dissection. His brother PIETRO: b. Florence 1443; d. there 1496, was associated with him in all his works, and did much independent painting. Pictures assigned to him are the 'Annunciation' in Berlin, and a fresco of Saint Christopher in the Metropolitan Museum, New York.

**Pollaiuolo, Simone del** ("IL CRONACA"), Italian architect: b. Florence 1457; d. 1508. He studied the architectural remains of antiquity at Rome for a number of years before undertaking any original work; and his constant habit of describing them to his friends, after his return to Florence, won for him the title "Il Cronaca," ("the Chronicler"). His masterpiece is the cornice added to the façade of the Palazzo Strozzi, of which he had been appointed architect. He built at Florence the Palazzo Guadagni and the Church of San Salvador al Monte, also the Sacristy of San Spirito, the court of the Palazzo Strozzi, and the great hall of the Palazzo Vecchio. He must be looked upon as one of the leading architects of the original Renaissance style in Italy. Consult Geymüller-Stegmann, 'Die Architektur der Renaissance in Toscana' (1885-96).

**Pollak**, pōl'ak, **Gustav**, American editor: b. Vienna 4 May 1849. After a course of study in the schools of his native city, he came to the United States in 1866, where he has devoted himself largely to editorial work. A contributor to 'The Nation' from 1874, he has written chiefly on foreign politics and literary subjects. He was cashier of *The Evening Post* 1881-93. In addition to copious work on leading encyclopædias, he has published: 'On Success in Child Training'; 'The Century Book for Mothers,' in which he was joint-editor.

**Pol''lanarru'a**, Ceylon, a ruined city and formerly capital of Ceylon, situated about 60 miles northeast of Candy. There are numerous large stone figures of Buddha, and remains of temples and other buildings. It flourished from the 8th to the beginning of the 13th century. It is now called Topare.

**Pollard**, pōl'ard, **Edward Albert**, American journalist and author: b. Nelson County, Va., 27 Feb. 1828; d. Lynchburg, Va., 12 Dec. 1872. He was graduated from the University of Virginia in 1849, removed to California where he engaged in journalism, and was preparing for the Episcopal ministry at the outbreak of the Civil War, throughout which he was editor of the Richmond *Examiner*. An ardent supporter of the Confederacy he was nevertheless a bitter and active opponent of Jefferson Davis. While endeavoring to run the blockade in 1865 on his way to England he was captured and imprisoned in Fort Monroe for eight months, when he was released by General Butler. He was an able writer, but bitterly opinionated and unfair where his prejudices were concerned. Among his numerous works are: 'Black Diamonds' (1859); 'Southern History of the War' (1862); 'The Lost Cause' (1866); 'The Life of Jefferson Davis' (1869).



**Pollard, Josephine**, American writer: b. New York 1842; d. there 15 Aug. 1892. She was an editorial writer on the 'Sunday School Times' from the time of its establishment in 1876, and for 20 years was connected with the Methodist Book Concern. Her books are chiefly religious works and juvenile stories. Among them are: 'The Gypsy Books' (1873-4); 'Elfin Land' (1882), poems; 'Gellivor, a Christmas Legend' (1882); 'The Boston Tea Party' (1882); 'Favorite Birds and What Poets Sing of Them' (1888); etc.

**Pollard, Percival**, American author: b. Pomerania, Prussia, 1869. He came to the United States in 1885, engaged in journalism in 1891, and has since been engaged in editorial and literary work in Chicago and New York. Among his published works are 'The Cape of Storms' (1895); 'Posters in Miniature' (1896); 'Dreams of To-day' (1897); 'The Imitator' (1902); 'Lingo Dan' (1903).

**Pol'larding**, the practice of cutting off the limbs of trees at a given height in order to make the stubs throw out numerous adventitious limbs. These latter, after being allowed to grow for three or four years, are cut for fuel and the process continued. In Holland and other parts of Europe where fuel is high-priced or scarce, the practice is very popular; but in the United States it has not come into vogue. It is also employed, like copses, for furnishing bark for tanning, and withes for baskets, barrel hoops, and wickerwork. Though the pollards, as they are called, are unsightly and are seemingly injured by the operation, they often become picturesque with age, and specimens still apparently thrifty are considered among the patriarchal trees of Europe. The species most used are willows, poplars, lindens, alders and certain elms and oaks.

**Pollice Verso**, pŏl'li-sē vēr'sō, the title of a famous picture by the French painter Gérôme. The words mean "with turned thumb," and the artist represents the spectators in the gladiatorial games turning their thumbs down as the victorious swordsman sets his foot upon the body of his vanquished antagonist. When the thumb was turned up it meant that the vanquished swordsman was to be despatched by the victor; it is not so plain that the down-turned thumb meant mercy.

**Pollio**, pŏl'i-ō, **Caius Asinius**, Roman poet, historian and orator: b. 76 B.C.; d. 4 A.D. He is known from the part he took in the political events of his time, but still more by his writings and love of literature. In the civil war, he (49 B.C.) adhered to Julius Cæsar, whom (after defeating Gaius Curius in Africa) he accompanied to Pharsalia, and then to the African and Spanish wars. He was afterward appointed prætor, and held the government of Further Spain, where he fought, without success, against Sextus Pompeius. When Lepidus and Antony were reconciled, in 43 B.C., he joined them with three legions, and was made administrator of Transpadane Gaul. At this time he became the friend of Virgil, whose property he saved from confiscation. After obtaining the consulship he commanded in Illyria and Dalmatia, and for his victories was honored with a triumph 39 B.C. He afterward devoted his time to literary pursuits. He wrote speeches, tragedies, and a his-

tory of the civil wars, but hardly anything of his is extant. He was a great patron of literary men, and introduced the custom (Recitatio) of reading aloud works, before publication, to a group of expert critics. Virgil addressed two Eclogues, and Horace an ode, to him. He founded the first public library at Rome. Three of his letters to Cicero are in the Ciceronian collection, and there are some extant fragments of his history of the civil wars. Wolfflin has on very inadequate grounds attributed to him the history of Cæsar's African campaign ('Bellum Africanum'). Consult Aulard, 'De Asini Polionis Vita et Scriptis' (1877).

**Pöllnitz**, pël'nīts, **Karl Ludwig**, BARON, German author: b. Issomin, Prussia, 25 Feb. 1692; d. Berlin 23 June 1775. He belonged to a noble family but became a soldier of fortune, serving at different times in the Austrian, Papal, and Spanish armies. He later gained the favor of Frederick the Great who appointed him his reader, and he subsequently became director of the theatre at Berlin. During his career he twice professed the Calvinist faith from interested motives, but before his death returned to the Roman Catholic Church. His works are witty and amusing and include: 'Etat abrégé de la Cour de Saxe' (1734); 'Lettres et Mémoires' (1738-40); etc.

**Pollock**, pŏl'ök, **Sir Charles Edward**, English judge and writer on law: b. 31 Oct. 1823; d. Putney 21 Nov. 1897. He was called to the bar in 1847, was elected bencher of the Inner Temple in 1866, acquired large practice, took silk (that is, became Queen's counsel) in 1866, and was knighted in 1873. In the last-named year he was raised to the exchequer bench, and through the judicature acts received in 1875 the status of justice of the high court. Among his works were 'The Practice of the County Courts' (1851; subseq. eds., with supplements); and 'A Treatise on the Power of the Courts of Common Law to Compel the Production of Documents for Inspection' (1851).

**Pollock**, **Sir Frederick**, English jurist: b. London 10 Dec. 1845. He was educated at Eton and Cambridge; in 1871 was called to the bar of Lincoln's Inn; and in 1882-3 was professor of jurisprudence in University College, London. Since 1883 he has occupied the chair of jurisprudence at Oxford, and during 1884-90 was professor of common law in the Inns of Court. Since 1895 he has been editor of the Law Reports. In 1888 he succeeded his father in the baronetcy. He has several times visited the United States and in the winter of 1903-4 delivered a course of lectures at the Lowell Institute, Boston. Among his published works are: 'Principles of Contract' (1876; 6th ed., 1895); 'Digest of the Law of Partnership' (1877; 7th ed., 1900); 'Spinoza, his Life and Philosophy' (1880); 'The Law of Torts' (1883; 5th ed., 1897); 'The Land Laws' (3d ed., 1895); 'Introduction to the History of the Science of Politics' (1890; 3d ed., 1900); 'Oxford Lectures and other Discourses' (1890); 'Leading Cases done into English, and other Diversions,' a series of parodies of English poets as well as of typical cases at law (1892); 'The Law of Fraud'; etc., in British India (1894); 'A First Book of Jurisprudence' (1896); 'The Etchingam Letters,' a novel in



## POLLOCK—POLO

epistolary form (1899; with E. F. Maitland); etc. With F. W. Maitland he wrote a 'History of English Law before Edward I.' (1895; 2d ed., 1899).

**Pollock, Sir George**, English soldier: b. London 4 June 1786; d. Walmer 6 Oct. 1872. He was educated at Woolwich, entered the East Indian service as lieutenant of Bengal artillery, in 1835 became colonel commandant, and until his death retained this post. He commanded the Bengal artillery in the Burmese war of 1824, in 1842 was made commander of the armies west of the Indus, 5 April forced the Kyber pass, 16 September entered Cabul. He was military member of the supreme council of India in 1844-5, a director of the East India Company in 1854-6, and held other offices. In 1859 he was made general, in 1870 field-marshal.

**Pollock, Walter Herries**, English journalist and author: b. 21 Feb. 1850. He is a brother of Sir F. Pollock (q.v.) and was educated at Eton and Cambridge. He was called to the bar at the Inner Temple in 1874, and from 1884 to 1894 was editor of the 'Saturday Review.' He has published 'Lectures on French Poets' (1879); 'The Picture's Secret,' a novel (1883); 'Verse of Two Tongues' (1884); 'A Nine Men's Morrice' (1889); 'Old and New,' verse (1890); 'Jane Austen: Her Contemporaries and Herself' (1899); etc.

**Pollock, Robert**, Scottish poet: b. North Muirhouse, Renfrewshire, 1799; d. Southampton, England, 18 Sept. 1827. He was educated at Glasgow University, studied divinity, and was licensed as a preacher by the Associate Presbytery of Edinburgh in the spring of 1827. He is the author of a series of 'Tales of the Covenanters,' published anonymously when very young, and a blank verse poem, 'The Course of Time,' which in spite of many faults of execution enjoyed a wonderful popularity both in Great Britain and the United States.

**Pollucite**, the only mineral in which the rare element cæsium occurs as an essential constituent, and, therefore, its most important ore. It occurs in cubes, but usually in small crystalline, deeply etched masses, colorless, transparent and much resembling quartz. It is a silicate of cæsium, aluminum and sodium. It is found only in Maine, and in the island of Elba.

**Pollux, pōl'ŭks, Julius**, Greek sophist and grammarian: b. Naucratis, Egypt. He flourished about 180-192 A.D. He went to Rome during the reign of Marcus Aurelius, and rapidly acquired a considerable reputation. He wrote several works, all of which have perished except his 'Onomasticon,' or Greek vocabulary, dedicated to Commodus, whose preceptor he was. Each of its ten books forms a separate treatise by itself, and contains the most important words relating to certain subjects, with short explanations of their meaning. The words are not arranged alphabetically, but are given with little regard to rigorous system of any kind, according to the subjects treated of in each book. It has been found an aid of much value in the study of Greek art and literature. The best editions are those of Lederlin and Hemsterhuis (1706), Dindorf (1824), and Bekker (1846).

**Pollux.** See CASTOR AND POLLUX.

**Polo, pō'lō, Gaspar Gil**, Spanish poet: b. Valencia, Spain, about 1530; d. Barcelona, Spain, 1591. Details concerning his life are few and contradictory. He studied law, and is doubtless identical with the Gaspar Gil Polo who was professor of Greek in the University of Valencia 1566-74. He occupied the office of town clerk at Valencia and in 1572 received an appointment under the government from Philip II., who apparently sent him to Barcelona in 1580. He wrote 'Canto de Turia,' in which he sung the praises of his native city, but his fame rests upon the pastoral romance 'Primera parte de Diana enamorada, cinco libros que prosiguen los siete de Jorge Montemayor' (1564), a continuation of Montemayor's 'Diana.' Its originality is questioned among critics, but his work is clear in delineation of plot and possesses beauties of diction and rhythm far surpassing that of the first 'Diana.' It ran through many editions in Spain, of which the best is Cerda's (1778) and has been translated into English, French, and Latin. Cervantes excepts it from the list of books condemned to the flames, his somewhat puzzling statement that it should be guarded "as though Apollo had written it" being evidently a pun on the author's name.

**Polo, Marco**, Italian mediæval traveler: b. Venice about 1250; d. there 1324. His father, a man of noble rank, in 1271 took young Marco with him on a trading expedition to China and the East. The youth of 20 entered the service of the Great Khan, and traveled extensively through China and the neighboring regions. The travelers were finally desirous of return, and were allowed to accompany an embassy to Persia. Thence they made their way to Venice, which they reached in 1295. Later Marco commanded a fleet in a war with Genoa, in 1296 was taken prisoner, and did not secure his release until 1298. At this time he dictated to Rustigielo di Pisa the work of travel known as 'The Book of Marco Polo,' published in French. Though his narrative made a great sensation, it was for many years regarded as a mass of fabrications and exaggerations. It had an undoubted effect, however, upon exploration; and later researches have confirmed the truth of many of the author's descriptions. It was long the sole authority possessed by Europe on the peoples of the Far East. The best edition is that of Yule (1875, revised 1904). An English version appeared in 1818.

**Polo** is an equestrian game, the object of the players being to strike the ball through the opponent's goal; all are mounted on ponies not exceeding 14½ hands and carry mallets about 4 feet long with which to strike the ball, made of light wood. The grounds are usually 900 feet long by 450 feet wide, level turf, at each end of which are located goal posts 24 feet apart. The proper number of players is four on a side, but a less number can play; combination and interference are important elements of success. But little is authentically known of the exact origin of the game, yet legends of the Orient give proof of its antiquity, and it is generally accepted that the game was played in Persia before the beginning of the Christian era, and had its origin in northern India. In 1870 polo was introduced in England by army officers who had been stationed there, and about 1885



it was introduced into the United States. The rules of the game in England and America differ materially, especially in the tendency of the English game to lessen the freedom of the player in order to increase safety; the game has always been popular with the British army officers, who have produced many of the leading experts. In America there exists a system of handicapping the players, thus giving the less experienced an equal chance. The demand for suitable ponies has developed the industry in the United States of breeding them through crossing the thoroughbred with the hardy Western ponies. In addition to horsemanship the game requires control of temper, quickness of observation, judgment, nerve, and endurance; the United States army has done much to encourage the game at the various army posts, and introduced it at the West Point Military Academy. The central authority on the game in the United States is the Polo Association, composed of 34 clubs located throughout the country; it forms the rules, regulates the handicapping, and arranges the tournaments, championships, and other matches.

HENRY M. EARLE.

**Pol'ock, Moses**, American publisher and bookseller: b. Philadelphia 14 May 1817; d. there 16 Aug. 1903. In his 14th year he began the book business, in which he continued until his death. He issued many books in fiction, the drama, and general literature, and in addition dealt in old and rare books, becoming an authority in Americana. His shop for half a century was frequented by book lovers, and his collections of Washingtoniana and books printed by Benjamin Franklin were particularly notable. He had a profound knowledge of early Pennsylvanian history.

**Polonium**, an element the existence of which in 1904 was still a question of great uncertainty. It was discovered by Mme. Skłodowska Curie (1898) while examining some samples containing uranium obtained from the complex mineral pitch-blende. Mme. Curie named it polonium in memory of her native land, Poland. Pitch-blende is a peculiar and very complex mineral found principally in Joachimsthal, Bohemia, Cornwall, England, and in some parts of this country, notably Colorado. It contains a large amount of the element uranium and is mined and worked over to obtain that element. It was from the refuse or waste left after the extraction of the uranium that Mme. Curie obtained polonium and afterward the far more important element radium. Polonium closely resembles bismuth in its chemical properties, so is found in company with that element when it is separated from the rest of the above refuse during the process of analysis. To separate the polonium from the bismuth is a matter of great difficulty and no sample of polonium has yet been obtained that is free or even approximately free of bismuth. The method usually used is that of fractional precipitation of the basic nitrates. A solution of the mixed nitrates of bismuth and polonium is made in concentrated nitric acid. Water is added until the liquid becomes cloudy. The white solid basic nitrates that separate at first contain a larger percentage of polonium than the original mixture dissolved in the acid. This process, repeated many times, gives a solid rich in polonium. The most important property of

polonium is its radio-activity (see RADIUM). While radium gives off three kinds of rays or radiations called  $\alpha$ ,  $\beta$  and  $\gamma$ , polonium appears to give only one variety, the  $\alpha$  rays. Polonium loses its radio-activity slowly, thereby differing from radium. It should be noted that some noted investigators in this field of radio-active substances deny the existence of polonium, claiming it to be merely a radio-active form of bismuth, its radio-activity having been induced by its association with radium in the pitch-blende.

**Poltava**, pŏl'tä-vä. See POLTOWA, RUSSIA.

**Polyænus**, pŏl-ĭ-ē'nūs, Greek writer: b. Macedonia about 85 d. Rome, Italy, about 170. He wrote a historical collection of instances of military ruses employed by Greeks, Romans, and barbarians. It was entitled 'Strategics,' or 'Stratagems,' and was inscribed to the emperors Marcus Antoninus and Lucius Verus. Two of its original eight books are lost, but the remainder contains much valuable information not found elsewhere. Two excellent editions have been published, Casaubon's (1854) and Wölfflin's (1887).

**Polyandry** (Gr. *polys*, many, *andres*, men, husbands), a marital relation subsisting between one woman and several men. Polyandry is found to exist in primitive and barbarous peoples in every age and everywhere. In antiquity we have the testimony of Herodotus for the prevalence of this custom among the Scythian peoples Agathyrsi and Massagetæ and the Nasamones, a people of northern Africa near the Greater Syrtis. A like report is made regarding the people of Libya by Aristotle, by Diodorus Siculus regarding the Trogloditæ and the Ichthyophagi on the coast of the Red Sea, by Cæsar regarding the inhabitants of Britain; Polybius finds unmistakable traces of the institution even among the Spartans. Till but a little while ago these reports of ancient authors were held to be abnormal and exceptional, for it was assumed that the primordial family had everywhere its origin in the marital relation of one man with one woman (monogamy) or of one man with several women (polygyny or polygamy). But the reports of modern travelers concerning the marriage customs of barbarous and uncultured peoples prove that among them polyandry is universal or at least usual; it is found in Malabar, the Marquesas, in New Zealand and throughout all the Pacific isles, in North and South America—in short, wherever mankind has not risen above a certain stage of social culture; nor is it confined to totally uncultivated peoples; to cite one example only, it is a legitimate custom among the Tibetans. Usually, but not always, in the Tibetan polyandric family the joint husbands of a woman are brothers, and the elder brother is credited with the paternity of the children, while the other brothers are uncles. It is the report of travelers that the female head of a polyandric family enjoys a measure of consideration and authority very unusual among barbarians; in some tribes it has grown into a real sovereignty. The universality of the custom is proof at least that over against the patriarchal family and descent through the male head of a monogamous family must be set the matriarchal family in which descent is traced to the mother; and that gynæocracy is of equal antiquity with patriarchy.



## POLYANTHUS — POLYCHÆTA

**Polyanthus**, a name popularly applied to several unrelated plants, as a narcissus (*Narcissus tazetta*), and the tuberose (*Polianthes tuberosa*); but most commonly a certain primrose thought to be derived from *Primula elatior* as a principal parent; but perhaps a hybrid between *P. officinalis* and *P. vulgaris*, or a race developed from the last species. It is one of the most popular of its genus in American gardens. It is a hardy perennial herb with entire, simple leaves, leafless scapes terminated by an umbel of several to many early spring flowers mostly red, yellow or both these colors together. Some of the numerous varieties have two corollas one within the other and are called hose-in-hose or duplex. The plants may be grown from seeds, but individual varieties are usually propagated by division. They delight in cool, moist, shady places and rich, loamy soil.

**Polyba'sic Acids**, in chemistry, acids which possess more than one hydrogen atom capable of being replaced by a metal equivalent.

**Polybasite**, a black, metallic mineral, occurring in hexagonal, tabular crystals of orthorhombic symmetry. It is a sulph-antimonite of silver and copper, containing 75.6 per cent of silver, of which it is, therefore, an important ore. It occurs in many silver mines of Saxony, Mexico and the western United States.

**Polybius**, pŏ-līb'ī-ūs, Greek historian: b. Megalopolis, Arcadia, about 205 B.C.; d. about 120 B.C. He was educated for arms and political life, and when about 169 B.C. the design of the Romans to make all the free states of Greece dependent became evident, Polybius took part in all the measures for the preservation of their independence. When, therefore, after the subjugation of Perseus (168), the Romans used less disguise, Polybius found himself among the 1,000 hostages whom the Achæans were obliged to deliver up to the Romans. His learning, virtues, and talents soon gained him the favor of some of the most distinguished senators, especially Fabius and Scipio, the two sons of Paulus Æmilius. The hostages were not dismissed until 17 years had elapsed, when Polybius, who did not wish to see again his degraded country, remained in Rome, and entered into the service of Scipio Æmilianus. He accompanied him on his expedition to Africa, and was a witness of the destruction of Carthage in 146. He then went to Greece, where the Achæans had become involved in a war with the Romans. After the Achæan defeat he did much to obtain favorable terms of peace. His services were gratefully recognized by the erection of his statue in many towns. Polybius is the author of a historical work from the 140th Olympiad (220 B.C.) to the overthrow of Grecian independence (146 B.C.). It consisted of 38 books, besides two introductory books, containing a sketch of the Roman history from the taking of Rome by the Gauls. Although the affairs of Rome are the chief subject, contemporary occurrences in other countries are also related. We have of this great work only the first five books entire, and valuable fragments of the remaining books. Some of these fragments, as that containing an account of the Roman army, are of considerable length. In extent of political and military knowledge, Polybius is surpassed by no historian of antiquity.

To him is also attributed the introduction of didactic politics into history—that is, of that manner of writing history which, by intermingling views of the causes, occasions, and effects of events, is a useful introduction to politics. On the other hand, his style is destitute of beauty, and the narrative interrupted by lengthy digressions, which weaken the artistic effect. Livy was much indebted to Polybius after he came to the second Punic war. Cicero mentions a particular work of his on the Numantian war. The most valuable editions of Polybius are those of Schweighauser (1789), Bekker (1844), L. Dindorf (1866-8), and Hultsch (1867-71). The history of Polybius has been well translated into English by Shuckburgh (1889).

**Polycarp**, pŏl'ī-kārp, one of the apostolic Fathers of the Church, and styled by his disciple Irenæus a pupil of the apostle John: b. Smyrna probably about 69 A.D.; d. there 155. According to legend he was brought up by a noble Christian lady named Callisto, and was consecrated by Saint John as bishop of his native city. When the controversy about the time of Easter arose, he went to Rome to confer with Anacletus, who then occupied that see; and though he did not succeed in reconciling the differences between the Eastern and Western usages, the questions were discussed in the most friendly manner. During the persecution under Marcus Aurelius Antoninus he was brought before the Roman proconsul at Smyrna and urged to revile Christ, but he replied, "Eighty and six years have I served him, and he has done me naught but good, and how could I then revile my Lord and Saviour?" The people desired that he should be flung to the wild beasts, but he was sentenced to death by fire. The flames, however, according to the legend, played harmlessly around him like a swelling sail, emitting a sweet fragrance. When the judges ordered one of the executioners to run him through with a sword, the flames were extinguished by the blood that flowed from the wound. Polycarp is one of the saints in the calendar of the Church, and the 26th of January has been consecrated to his memory. He wrote several epistles, which were current in the early church, but have all perished except one addressed to the Philippians. Consult: Lightfoot, 'Apostolic Fathers' (1891).

**Polychæta**, pŏl'ī-kē'ta, one of the two subclasses (the other being *Oligochæta*) of annelid worms composed of a large number of marine species, but only a few from fresh water, whose most striking characteristic is the presence of fleshy outgrowths (parapodia) on either side of each somite of the body, each strengthened by a number of bristles. The group is separable into *Errantia* and *Sedentaria*. The *Errantia* are wandering forms which, while they burrow, can swim readily. They have a well developed head provided with eyes, sensory tentacles and usually the mouth is armed with strong jaws. The parapodia are well developed and form the organs of swimming and usually serve also as gills. They are carnivorous, feeding upon other worms, etc. The *Sedentaria* live exclusively in burrows, and in some cases have the power to secrete tubes of horny matter, or even of lime, in which they dwell. Living in this way and not using the parapodia these structures have been reduced; while the head not infrequently bears



## POLYCHROME BIBLE — POLYCHROMY

gills and numerous long retractile tentacles which are used in obtaining food. These feed largely upon the microscopic life in the water and are without jaws. In the life-history of the Polychætes a larval form known as the trochophore is very common.

**Pol'ychrome Bible** (Greek, *πολύχρωμος*, many-colored), an edition of the Old Testament scriptures printed in different colored type so as to show the various literary elements out of which, according to modern Orientalists, the several books were compiled. The editor is Professor Paul Haupt of Johns Hopkins University, Baltimore, Md.

**Pol'ychromy**, literally the use of many colors and generally used in the sense of decorative work by means of brilliant coloring or that which is brilliant in comparison with other work of the same class and character. Thus a fitting together of building-stones in patterns is polychromy, although the hues of the sandstone or limestone or marble are not positive nor strongly contrasted with one another. In French Romanesque architecture, as also in modern imitations of it, like Trinity Church, Boston, Mass., the sandstones are of two or three different shades of reddish brown, and an additional hue approaching buff; and yet this very moderate degree of contrast, when used deliberately in pattern, is called polychromy. On the other hand, polychromatic painting is always assumed to be in primary colors, or those which nearly approach them in brilliancy. Thus the painting of a Grecian Doric temple in the 5th century A.D. is known to have been in great measure carried out in the unmixed natural pigments as strong and pure as they could be procured; red and deep blue, with a free use of metallic gold in the form of gilt, bronze or the like, and the rather frequent introduction of such secondary colors as green and purple.

Color effects in architecture are as ancient as architecture itself. It never seems to have occurred to an Egyptian builder to leave his limestone walls unadorned with polychromatic effects, nor to the sculptor engaged in carving reliefs on those walls or statues to set up against them, that such human and animal forms could ever be left in the natural color of the stone. Sculpture was always completed by the paint-brush except in those cases where, chiefly for display or in the spirit of sacrifice, there was used a very costly and very hard material of some importance in its own surface and color. Thus an Egyptian statue of diorite or basalt, or a Roman statue of the imperial epoch wrought in black marble, or a portrait bust with the head and neck of white marble inserted into the draped shoulders and torso wrought in the most precious Oriental alabaster or beautiful veined marble from Greece or Numidia, would not be painted; and any polychromy that would be added by hand would be in the nature of gilding applied to the hair or the ornaments. So the bronze statue, highly esteemed for its material, which was always accepted as superior to marble or other natural stone, would receive eyes of hard natural stone or of glass, and perhaps gilding as mentioned above, but nothing more. On the other hand, some modern work in experimental polychromy has been carried farther;

thus the statues and busts of Charles Henri Cordier have been adorned with enamel applied freely to articles of costume, to the harp of an Egyptian harp-player, in addition to the approximation of the natural color of skin and of drapery. In the Paris Exposition of 1900 there were exquisite statuettes wrought in the precious materials, onyx, agate, alabaster and the like, with bronze of many colors or in other cases in carved and stained ivory. The most impressive piece of work of this kind was the statue by Ernest Barrias, 'Nature Unveiling Herself,' a statue somewhat larger than life, of which the whole lower part representing the body from the breast downward with its drapery, is wrought of a single block of marble of unusual beauty—a superb piece of red and purple veining—while the breast and shoulders, arms and head, are in white marble, the hair and eyes being stained, and the veil is of a natural stone of a delicate buff or perhaps greenish yellow tinge.

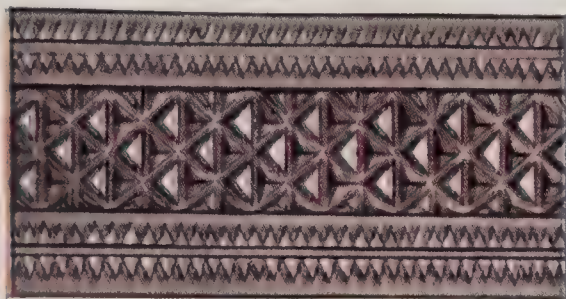
Polychromy in painting has not been so commonly used in modern times. For some reason painting, when applied in merely flat and unchanging masses, is looked on with some contempt by modern decorators; and the artist who controls a more complete skill, whose painted work is characterized by all the art of gradation and harmony known to the modern world, abstains from doing such purely decorative work. It was not so in antiquity, for while no fragment remains to us of the highest development of chromatic effect in sculpture, on the other hand there were no texts more intelligible than those which set forth the practice of employing painters of name and fame to adorn with color the works of the sculptors. An early but most interesting example of what this work must have been is seen in the draped statues discovered on the Acropolis in 1883 and 1886. The color is disappearing rapidly; but when it was taken from the ground it was brilliant. The outer garment (himation or peplos) has in every case a rich border of two or three contrasting hues; the larger surfaces of the stuff are shown as covered with a pattern in spots or small foliated figures; and the under garment (chiton), where visible, is often painted in a strong, deep green, which was probably in the first place more nearly blue. Hair, eyes, lips, and all the jewelry shown, such as ear-rings, are treated separately and with what seems to have been a free use of gilding.

The great masters of polychromy are, however, the Persians and the civilized races of Asia generally. Beauty of pattern is especially the Persian gift; but this merit is shared by the people of the Indian Peninsula and by the Chinese and the Japanese, and in a lesser degree by the Malays and the inhabitants of Farther India. Even the peoples of very low civilization in the north, the original inhabitants of Siberia, showed a marked gift in the arranging of decorative patterns. Both the Japanese and Chinese use polychromy in their larger works, temples and the like, with great freedom and with perfect success; the Japanese limiting brilliant effects rather to the interior and to special details of the exterior, while the Chinese had at one time the great art of polychromatic building, using their enameled potteries with perfect freedom.

RUSSELL STURGIS.



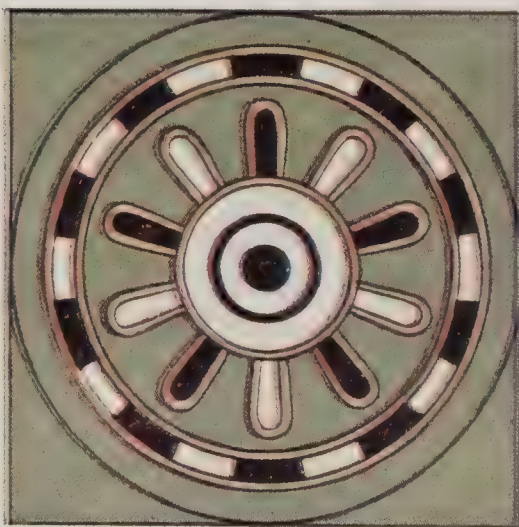
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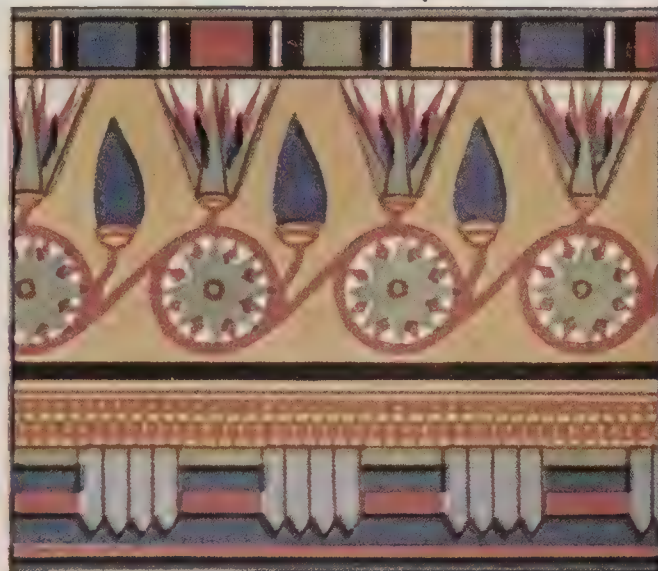
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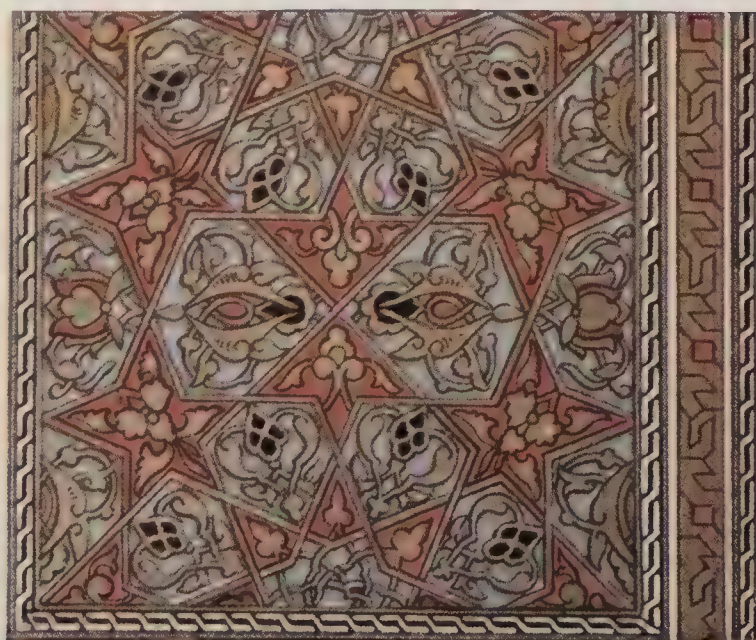
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1. Scallop Ornament from New Zealand. 2. Greek Meander. 3. Assyrian Ornament. 4. Scalloped Ornament from Nineveh. 5. Grecian Plant Ornament. 6. Palmetto, conventionalized. 7 and 8. Pompeian Ornament. 9. Egyptian Flower Ornament. 10. Animal Forms, 13th Century. 11. Geometrical Arabian Forms.







## POLYCLETUS OF SICYON—POLYGAMY

**Polyclitus** (pöl-ī-klī'tūs) of Sicyon, Greek sculptor and architect. He was a pupil of the Argive sculptor Ageladas, in whose studio he became fellow student of Phidias. He flourished 452-412 B.C. He stood at the head of the schools of Argos and Sicyon, and is held to rival Phidias, the head of the Athenian school. The latter was considered preeminent for his statues of the gods, and Polyclitus in those of men. He excelled particularly in representing the graceful attitudes of youthful athletes. One of his most celebrated statues was the Doryphorus (Spearbearer), a figure to which the name of canon, or standard of beauty, was given, as in it the artist had produced a perfect ideal of the human form. His statue of Hera, in the temple between Argos and Mycenæ, was thought by Strabo to be equal to Phidias' chryselephantine statues of Zeus and of Athena. The goddess was represented enthroned, wearing a garland on which were wrought the Graces and Hours; in one hand she held a pomegranate, and in the other a sceptre surmounted by a cuckoo. The head, breast, arms, and feet were of ivory, and the robe of gold. As an architect Polyclitus won special fame from the theatre and rotunda, which he designed for Epidaurus, which Pausanias pronounced to be the finest buildings of their kind ever erected. Polyclitus also wrote a treatise on the proportions of the human form.

**Polycrase**, a black, resinous mineral, occurring in prismatic crystals, chiefly in Norway and the Carolinas. It is of value for the rare earths which it contains, its composition being a mobate and titanate of yttrium, erbium, cerium, and uranium.

**Polycrates**, pŏ-lik'ra-tēz, Greek tyrant of Samos: d. 522 B.C. He was one of the most daring, successful, and treacherous of the Greek tyrants. Toward the end of the reign of Cyrus about 535 B.C., with the aid of his brothers Pantagnotus and Syloson, he conquered the island of Samos which had until then been free, and by banishing one brother and executing the other firmly established his power as sole ruler of the island. He raised a fleet of 100 vessels manned by 1,000 archers, seized several of the surrounding islands, conquered Miletus and defeated the Lesbians who came to assist the inhabitants of the latter city. Fired with the purpose of conquering the Ionian cities and the islands of the Ægean he formed an alliance with Amasis of Egypt. Herodotus informs us that Amasis, fearing the anger of the gods at the extraordinary good fortune of Polycrates in his many expeditions, persuaded him to make a sacrifice to the gods to avert misfortune. Polycrates thereupon threw into the sea a signet-ring of great value, which was found a few days later in the maw of a fish presented to him. Amasis considering his ally's doom certain, withdrew from the alliance. Grote, however, considers this story a fiction, and holds that it was Polycrates who broke off the alliance, perceiving it to be more to his interest to cultivate the friendship of Cambyses, who in 525 B.C. invaded Egypt. Polycrates sent to Cambyses 40 ships manned by the malcontents of his kingdom with the understanding that they were never to return. They escaped, however, returned to Samos and made war upon Polycrates, but were defeated,

whereupon they gained the assistance of the Spartans and Corinthians and laid siege to Samos for 40 days, then abandoning the war. Polycrates continued prosperous, becoming more and more powerful until Oroëtes, satrap of Sardis, nourishing a deadly hatred against him, treacherously contrived to lure him to his palace where he had him crucified.

**Polydip'sia**, excessive thirst such as usually accompanies diseases in which high temperatures occurs. In diabetes especially it is a characteristic symptom, and the name polydipsia was formerly often given to this disorder. See DIABETES INSIPIDUS; DIABETES MELLITUS.

**Polygala**, a genus of annual and perennial herbs and shrubs of the order *Polygalaceæ*. The species, of which about 200 have been described, are widely distributed in temperate climates; about 40 are North American. Some of the exotic species are cultivated in gardens and greenhouses; for example, *P. paucifolia*, common from Nova Scotia to Manitoba and south to Georgia; and *P. chamæbuxus*, a European species. The former is popularly known as gay-wings, fringed milkwort, flowering wintergreen, and fringed polygala; the latter as box-leaved milkwort. *P. lutea* is said to be the handsomest American species. The roots of *P. senega* and of *P. crotalarioides* have been reputed remedies for snake-bites; the former in America; the latter in the Himalayas. The American species is known as snake-root, seneca-root, senega-root and mountain flax. *P. polygama*, a native from Nova Scotia to Manitoba and southward to the Gulf States, has attractive flowers above ground and many flowers which are developed underground. In general the hardy species thrive best in moist soil in low situations. The seed is sown in early spring or in autumn. In greenhouses the plants succeed well in ordinary light soil which must never be allowed to dry out. The first mentioned species may be propagated by division.

**Polyg'amy**, the condition of a man having more than one wife at the same time. Etymologically considered, the word would signify plurality of husbands (polyandry) as well as plurality of wives (polygyny); it is employed here in the latter (the usual) sense. Polygamy among barbarous peoples is customary, though among them—as indeed wherever polygamy is allowed—plurality of wives is not usual except in the upper classes. The law of monogyny (one wife), we learn from Tacitus, was most strictly observed among the Germani; “almost alone among barbarians,” he says, “the Germani are content each with one wife”; yet he says that their chiefs had the right to marry several women at the same time. A custom of promiscuous marriage existed among the ancient Britons; any number of men would form a society and take an equal number of wives in common; the children born were the children of all; a like community of wives is, perhaps ironically, praised by Plato in his ‘Republic.’ Polygamy was allowed among the ancient Greeks, but seems to have been rarely practised. It was never customary among the ancient Romans, though no Roman law prohibited it: Mark Antony is reputed to have been the first Roman to have at once two wives; under the empire polygamous unions were not infrequent whether



## POLYGLOT—POLYHALITE

in the imperial house or in the class of the very rich. Laws to prohibit polygamy in the Roman state were first enacted under Theodosius and under his two sons, Honorius and Arcadius; they were abrogated by Valentinian I. The Merovingian kings of the Franks, we learn from Gregory of Tours, were polygamous, and the same author says that Charlemagne had a numerous harem of wives. Martin Luther formally approved the taking of a second wife, the first living, by the landgrave of Hesse. The Jewish laws permitted polygamy, but probably here again the practice was confined to the wealthy class. In all Christian countries polygamy is condemned by the law of the churches and prohibited by the laws of the state under penalties. In England, till the reign of James I., matrimonial questions were matters of ecclesiastical cognizance only; but under James a statute was enacted making death the penalty for polygamy. The Mormons in Utah openly professed and practised polygamy from their first settlement there till 1890 when Congress enacted drastic laws for its suppression; since then it has been notorious that the sect adheres still to its belief in the lawfulness and the meritoriousness of polygamous unions; and though they no longer openly practise it, polygamous unions among them—crypto-polygamous unions—are not rare, as is evident from the testimony before the Senate committee in March 1904.

**Pol'yglot** (Greek, *polys*, many, and *glotta*, language), a work which contains the same matter in several languages, especially a copy of the Holy Scriptures in two, three, or more languages. The most important of such works is the Complutensian polyglot, prepared under the direction of Cardinal Ximenes. It was printed (1514-17), in six folio volumes, at Alcalá de Henares, called in Latin *Complutum*, whence the name of the work. It contains the Hebrew text of the Old Testament, with the Vulgate, the Septuagint, a literal Latin translation, a Chaldee paraphrase (which is also accompanied by a Latin translation). Next is the polyglot of Antwerp, called the Royal Bible, because Philip II. of Spain bore part of the cost of publication. It was edited by the Spanish theologian Montanus, and appeared at Antwerp in eight folio volumes (1569-72), and, besides the Hebrew text, contains the Latin Vulgate, the Septuagint (with a literal Latin translation), several Chaldaic paraphrases (Targums), also accompanied by a Latin translation, and the New Testament in the original Greek, with the Latin Vulgate, and a Syriac translation in Hebrew and Syriac letters (also with a Latin translation). Still more celebrated is the Paris polyglot, executed principally under the direction of Gui Michel le Jay, who expended his whole fortune on the undertaking. It appeared in 1645, in ten folio volumes, and contains, in addition to the contents of the Antwerp polyglot, a Syriac and an Arabic translation (with Latin), and also the Samaritan Pentateuch (a Samaritan text, with a translation), and likewise an Arabic translation of the New Testament, with a Latin translation of the same. The London or Walton's polyglot, in ten languages, appeared in six volumes folio, with two supplementary volumes (London, 1654-7). It was conducted under the care of Bryan Walton, afterward

bishop of Chester, and contains all that is in the Paris polyglot, but with many additions and improvements, including the original text according to several copies, with an Ethiopic and a Persian translation, and the Latin versions of each. Cromwell patronized the undertaking. Bagster's Polyglot (folio, London, 1831, with later editions) gives eight versions of the Old Testament and nine of the New.

**Polygnotus**, pōl-īg-nō'tūs, Greek painter, flourished from 450 to 410 B.C. He was a native of the Island of Thasos, and with his brother Aristophon was instructed in their art by their father Aglaophon. Cimon, the commander, and rival of Pericles, brought him to Athens on the subjugation of Thasos, and employed him to decorate the Stoa Pœcile, or painted portico at Athens. Micon and Panæus assisted him in painting the Pœcile. His two principal pictures there represented 'The Capture of Troy' and 'The Battle of Marathon.' In the Lesche (hall) built by the Cnidians at Delphi he painted the 'Conquest of Troy' and 'Descent of Odysseus into Hades,' which are described by Pausanias. Polygnotus is represented as being the first who gave life, motion, character, and expression to the countenance, and skilful disposition to the drapery. His works are without perspective or shading, and consisted only of outlines against a colored background. Yet the nobility and fineness of his drawing, and the excellence of his composition, made them justly celebrated.

**Pol'ygon**, in geometry, a plane figure of many angles and sides, or at least of more than four sides. A polygon of five sides is termed a *pentagon*; one of six sides, a *hexagon*; one of seven sides, a *heptagon*; and similarly we have *octagon* (8), *nonagon* (9), *decagon* (10), *enneagon* (11), and *dodecagon* (12). Polygons of more than 12 sides do not usually receive single-worded names. *Similar polygons* are those which have their several angles equal each to each, and the sides about their equal angles proportionals. All similar polygons are to one another as the squares of their homologous sides. If the sides are all equal and the angles are likewise all equal, the polygon is said to be regular; otherwise, it is irregular. The angle of a regular polygon of a given number of sides is a definite quantity depending only on that number. Every regular polygon can be circumscribed by a circle, or have a circle inscribed in it. See GEOMETRY.

**Polygon of Forces**, a diagram used in graphic statics, depending upon the following theorem: "If any number of forces acting upon a point be represented in magnitude and direction by the sides of a polygon taken in order, they will be in equilibrium," or "any side of a polygon, taken in reverse order, will represent the magnitude and direction of the resultant of any number of forces acting upon a point, when these forces are represented in magnitude and direction by the remaining sides of the polygon taken in direct order."

**Polyhalite**, a brick-red or yellowish, fibrous or massive mineral. It is best known as one of the salts from Stassfurt, Germany, though it occurs in other salt mines in Central Europe. It is a hydrous sulphate of calcium, magnesium and potassium.



## POLYHEDRON — POLYNESIANS

**Polyhe'dron**, in geometry, a body or solid bounded by many faces or planes. When all the faces are regular polygons similar and equal to each other the solid becomes a regular body. Only five regular solids can exist, namely, the tetrahedron, the hexahedron (or cube), the octahedron, the dodecahedron, and the icosahedron, having respectively 4, 6, 8, 12, and 20 faces. In the first, third, and fifth the faces are equilateral triangles; in the dodecahedron they are regular pentagons; and in the cube they are squares.

**Polyhym'nia**, or **Polymnia** (Latin from Gr. *Πολύμνια* or *Πολύμνια*), according to the later Greek poets the Muse of lyric song and of eloquence, to whom is attributed the invention of the lyre and of mimes and pantomimes. The Greek artists represented her enveloped in a mantle, crowned with a wreath of flowers, and in a meditating posture. Her attributes are the lyre and the plectrum. She places the forefinger of her right hand on her mouth, or holds a scroll. See **MUSES**.

**Polymignite**, a highly complex, black mineral found in Norway in slender orthorhombic prisms. It is a niobate, titanate and zirconate of the cerium metals, iron and calcium.

**Polynesia**, pŏl-ĭ-nē'sĭ-a (Greek, *polys*, many; *nēsos*, island), a geographical name applied in its widest sense to the vast island dotted region extending from southeastern Asia across the Pacific, and from Bering Strait southward to the Antarctic Ocean, also called Oceania. It has neither physical, ethnographical, nor political unity, and is commonly divided into several sections. Australasia comprises Australia, Tasmania, and New Zealand, with other islands adjacent. The numerous islands extending from the Malay Peninsula to New Guinea are known collectively as Malaysia or the Malay Archipelago. The Philippine Islands are often associated with those of Malaysia proper. The name Micronesia (Gr. *mikros*, small, and *nēsos*) is in common use as a collective name for the numerous small islands in the northwestern Pacific, between New Guinea and Japan; and Melanesia (Gr. *melas*, black, and *nēsos*) includes New Guinea and a chain of islands extending southeastward to the Fiji Islands and New Caledonia, all chiefly inhabited by Papuan races. All the remaining islands, comprised for the most part within the parallels of 30° N. and 30° S. latitude, and between the meridians 180° and 120° W. longitude, constitute Polynesia in the narrower and more definite sense of the term. Practically all the Pacific islands are now in the possession of Britain, France, Germany, and the United States. At one time Spain had extensive possessions in the Pacific, and the Netherlands, which owns nearly the whole of Malaysia, holds the western half of New Guinea. The islands of Polynesia proper may all be classified as volcanic or coralline. The volcanic have an irregular surface and a higher elevation than the coralline islands. The coralline islands are low, never elevated much if any above 500 feet. The atoll formation is common. Some of the smaller islands are of value only for their deposits of guano. The indigenous fauna is remarkably deficient in terrestrial mammalia, the only kinds at all generally distributed being bats. The avifauna is large and interesting, and several species of

snakes are found in the western islands. The insects and mollusks are of special interest. The coco-palm is grown throughout all Polynesia, and the sago-palm in the west. Bread-fruit, yams, and the taro are staple articles of cultivation. Some of the islands, chiefly in the west, have an extensive and peculiar flora, but others, especially the more easterly, are poor in species. Though Polynesia is almost entirely within the tropics, its climate is generally temperate and very salubrious, owing to the influence of the ocean.

The races of Polynesia all belong either to the eastern section of the Ethiopic (Negro) division of mankind, or to an aberrant group of the Caucasian (White) division. The negro races of Melanesia are known collectively as Papuans, and include the Papuans proper of New Guinea and the Melanesians of the other islands. Physically they are characterized chiefly by the long head, moderately prognathous jaw, and frizzly hair; the nose in the Papuans is large, straight or arched with downward tip, in the Melanesians small and broad, with wide nostrils. They are or were cannibals, and are generally of a cruel and treacherous disposition. The Melanesians are more highly endowed mentally than the Papuans. The Samoans, Tahitians, Tongans, Marquesans, Union Islanders or Tokelau, Tuamotu, Hawaiians, and other Polynesians, as well as the Maoris of New Zealand, are now regarded as belonging to the Caucasian section of the human race. The New Zealand Maori is handsome, healthy, tall, and strong. In bodily vigor he is a rival of the Greek athlete. Prior to the arrival of the Europeans as a factor in forming the commercial, educational, and religious conditions, the chief occupation of the Polynesians was fishing, with as little of agriculture as possible. On some of the islands clothing and ornaments were made, and a method of cooking certain foods was almost a law, especially in the preparations for the great festivals. See **POLYNESIANS**.

**Polynesians**. The branch of ethnology which deals with the origin, migrations, physical features, languages, and traditions of the people of Polynesia, has for several years been receiving special attention. The mutual relations of the people are so intricate that the difficult linguistic and anthropological problems suggested by a comparative study of them are still unsolved. Many authorities hold that Polynesia has been occupied from prehistoric times by two distinct races, the dark Melanesians, who belong to the same stock as the Papuans of New Guinea and Malaysia, and the brown Polynesians, called also Mahori and Sawaiori, whose racial affinities have not been satisfactorily determined. By different writers they have been allied to the Mongoloid Malays, to the Aryans or Caucasians, to the American aborigines, and even to the Melanesians. But the difference between the Polynesians and Melanesians must be regarded as fundamental. The former are brachycephalous (round-headed, with high cephalic index, orthognathous, narrow-nosed, of a light-brown color, with round orbits and black straight hair, and next to the Patagonians the tallest people on the globe (mean height, 5 feet 10 inches). The Melanesians are dolichocephalous (long-headed, with the lowest cephalic index of any race), prognathous, broad-nosed, of a sooty black



## POLYNICES — POLYP

color, with low orbits, black frizzly hair, and low stature (mean height, 5 feet 5 inches).

The Melanesians appear to be the indigenous element in the Pacific, where they formerly occupied a much wider domain than at present, for traces of black blood are found in Samoa, New Zealand, and even as far east as the Marquesas (Whitmee). They are of a lower degree of culture, being undoubted cannibals, in many places head-hunters, extremely savage, blood-thirsty and treacherous, scarcely recognizing any hereditary chiefs, and often forming independent hostile groups at perpetual feud with their neighbors.

The Polynesians, who closely resemble the Indonesians of the Malay Archipelago seem to be later arrivals, almost certainly from Malaysia to Samoa, whence they gradually spread from island to island over all the eastern archipelagoes, more recently sending colonies westward to Melanesia and even to New Guinea. Hence Sawaiori settlements and mixed Sawaiori-Melanesian communities are now found in the eastern parts of Fiji, in the New Hebrides (Niuē, Futuna, Mel, and Fil), in the Loyalty group (Uvea), in British New Guinea (Motu), and generally in Micronesia. That Samoa was the centre of dispersion is shown by the recurrence of such geographical terms as Samoa and Savaii (originally Savaiki), the largest island of the archipelago, under diverse dialectic forms (Hamoā, Amoa, Hawaii, Havaiki, Hawaiki, Avaiki), either in the geographical nomenclature or in the traditions and mythologies of all the Polynesian islanders from New Zealand to Hawaii.

In Easter Island (Rapanui) and the Carolines (Ponapé, Lelé, Ualan) are found numerous cyclopean monuments, huge monolithic statues, paved avenues, ramparts or walls of basalt blocks over 30 feet long, brought from great distances. None of the present races could erect such structures as these, all memory of which has died out. They have been referred to the cultured peoples of America, and the features of the Easter Island statues are said to resemble the Bolivian Aymaras, though others have recognized a Papuan cast in the specimens preserved in the British Museum. Skulls of a Papuan type have also been found in Easter Island, but if the monuments were erected by these natives, it must have been under the direction of builders such as the Hindu missionaries who raised the stupendous temples of Java and Indo-China by training Malay and Cambodian craftsmen for the work.

Nearly all the Pacific languages appear to be members of the great Malayo-Polynesian family, which stretches across two oceans, from Madagascar to Rapanui. Phonetic variations are the basis of the dialects. They have a primitive poetry, a mythological and folk-lore literature which is rich in hero-stories, ancestor-myths, epics. The *harepo*, or professional poet, or one akin to the old family ballad singer of other races, is found among the Polynesians. Political orations, accounts of deeds of daring, and love songs were taught, sung, and recited. Christianity has been among many of the groups or on many of the islands. As civilization increases the original races seem to decrease on many of the islands. Allowance must be made for the uncertainty of the estimates made by the first discoverers regarding the original popu-

lation. Here and there the returns show an apparent increase, but only among the half-castes. Everywhere the pure Polynesian race seems to be rapidly disappearing, a phenomenon attributed partly to the introduction of alcoholic drinks, partly to the abrupt change of habits, dress, diet, etc., but mainly to the ravages of leprosy, smallpox, syphilis, measles, and especially pulmonary affections, by which whole communities have been decimated.

Formerly the political organization was based on a distinction between two classes, the nobles and the common people. The Maoris had developed a sort of democracy; but elsewhere the archipelagoes constituted one or more monarchies of a somewhat feudal character, with powerful hereditary rulers under a king, whose authority had been much reduced in Samoa, the Marquesas, and some other groups. Their subjects, were a gay, pleasure-loving people, engaged chiefly in fishing, agriculture, and navigation. Their diet was largely vegetarian (yams, taro, batatas, bananas, cocoanuts, etc.), varied with fish, pork, poultry, and, in some places, human flesh. Human victims were also offered on solemn occasions, and a prominent feature of the primitive religion was the so-called Tabu, in virtue of which certain persons and objects acquired a sacred character. But there was nowhere a distinct sacerdotal class, and most of the old beliefs had resolved themselves into a system of ancestor-worship. Other distinctive institutions were certain orders of knighthood, secret societies with peculiar semi-religious rites, and tattooing, which, especially in Micronesia, acquired the character of a fine art, rivaling the Burmese and Japanese systems in its elaborate designs and skilful execution. Few other arts were practised, and letters were unknown, although the national folk-lore, tolerably rich in historic legends and myths, was orally preserved, and has been mostly committed to writing by European scholars. Consult: Turner, 'Nineteen Years in Polynesia'; Gill, 'Historical Sketches of Savage Life in Polynesia'; 'Myths and Songs from the South Pacific'; Grey, 'Polynesian Mythology'; Fornander, 'An Account of the Polynesian Race'; Macdonald, 'Oceania, Linguistic, and Anthropological'; Ratzel, 'History of Mankind'; Reeves, 'Brown Men and Women'; De Quatrefages, 'Les Polynésiens et leurs Migrations'; Lesson, 'Les Polynésiens, leur Origine, leurs Migrations, Langue'; Edge-Partington, 'An Album of the Weapons, Tools, Ornaments, Articles of Dress of the Natives of the Pacific Islands'; Graf von Pfeil, 'Studien und Beobachtungen aus der Südsee'; Meinicke, 'Die Inseln des stillen Oceans'; Brandstetter, 'Malaio-Polynesische Forschungen'; Publications of Polynesian Society of Wellington, New Zealand.

**Polynices**, pōl-ī-nī'sēz, brother of Eteocles. See ETEOCLES AND POLYNICES.

**Polyol'bion, The**, a long descriptive poem by Michael Drayton (1613-22). It is in effect a topographical survey of Great Britain, containing, with much other matter, descriptions of shires, rivers, mountains, and forest tracts, and is not only of interest to the antiquarian but to others as well, its accuracy as an authority being generally conceded.

**Pol'yp**, a term variously and indiscriminately applied to different animal forms, but



## POLYPHEMUS — POLYTHEISM

properly designates a coelenterate of the class Actinozoa, represented by the sea anemones, corals, and the like; or any member (or zoöid) of a compound organism belonging to that class. The term *polypide* is also employed to designate each member or zoöid of the compound forms in the Polyzoa. The name *polypidom* applies to the entire outer framework or skin-system of a compound form, such as a hydrozoan, zoophyte or an individual polyzoön. The word *polypite* refers to each separate zoöid or member of a compound zoophyte or hydrozoön, and is thus used in opposition to the term *polypide* already explained. The *polypary* of a hydrozoön specially refers to the horny or chitinous skin secreted by the hydrozoa. See CŒLEENTERATA, HYDROZOA, MOLLUSCA, POLYZOA, etc.

**Polyphemus**, põl-ĩ-fē'mūs, one of the Sicilian Cyclopes. He was a son of Poseidon and the nymph Thoösa and lived in a cave in Mount Ætna. Ulysses and his companions, driven by the storm to take refuge on the island, found shelter in the cave of Polyphemus, and were found there on the return of the monster. He devoured two of the company and shut the remainder in the cave. Ulysses contrived to intoxicate Polyphemus with wine and when he fell asleep put out his single eye and then with his comrades escaped. The storms which followed Ulysses at sea were visited upon him by Poseidon in answer to the prayers of Polyphemus. Polyphemus was a suitor of the nymph Galatea and upon her accepting Acis the disdained lover killed his successful rival.

**Polyph'ony**, in musical composition, the harmonious combination of two or more parts, each of which forms an independent theme, but progress simultaneously according to the laws of counterpoint. A fugue is the best example of polyphonic compositions. See COUNTERPOINT.

**Polypodium**, a genus of ferns of the order *Polypodiaceæ*. The species, of which more than 350 have been described, are widely distributed throughout the world, mostly in dry situations such as banks, walls, logs and cliffs. Some tropical species are epiphytic. Many are popular as garden or greenhouse plants. Among the best known is the common wall-fern or polypody (*P. vulgare*), a widely distributed native of Europe and North America. It is one of the most satisfactory garden ferns. See FERN AND FERN ALLIES.

**Polyp'orus**, a genus of parasitical fungi, forming shelf-like growths on the trunks of trees, and contributing to the decay of timber. It is the typical genus of *Polyporaceæ*. See FUNGI.

**Polyp'terus**, a genus of ganoid fishes inhabiting the Nile, Senegal, and other rivers of Africa. See BICHR; ICHTHYOLOGY; MUD-FISH.

**Pol'ypus**, in pathology, any tumor which forms chiefly in a mucous membrane, and which is more or less pedunculated and rounded in form. See TUMOR.

**Polytech'nic College**, located at Fort Worth, Texas. It was founded under the control of the Methodist Episcopal Church, and opened in 1891. The work of the college is arranged in two general courses, classical and scientific, which lead respectively to the degrees

of A.B. and B.S. There is also a business course and a preparatory department. The college is co-educational. In 1902, the grounds and buildings were valued at \$40,000; the faculty numbered 13, and the students 220, of whom 90 were women.

**Polytechnic Institute of Brooklyn**, founded in 1854 under the name of the Brooklyn Collegiate and Polytechnic Institute. It conferred its first collegiate degree in 1871 by special authority of the State Board of Regents; and in 1890 was reorganized under its present name with larger corporate powers, and a full college charter. The Institute now offers five undergraduate courses of four years: (1) arts, leading to the degree of A. B.; (2) chemistry, leading to the degree of B. S.; (3) civil engineering, leading to the degree of C. E.; (4) electrical engineering, leading to the degree of E. E.; (5) mechanical engineering, leading to the degree of M. E.; also two graduate courses of one year: (1) arts, leading to the degree of A. M.; (2) science, in the department of chemistry, civil, electrical, and mechanical engineering, leading to the degree of M. S. The laboratories are well equipped, and there is an observatory with an equatorial telescope, and museum collections in geology, zoology, and palæontology; the library, a memorial to Uriah D. Spicer, numbers 12,000 volumes. The Preparatory School is closely affiliated with the Institute, and is specially designed to prepare students for the Institute, but also prepares for other colleges and scientific schools; it offers four courses: (1) the scientific course; (2) the classical course; (3) the Latin scientific course; (4) the commercial course. The students, including those in the Preparatory School, numbered 600 in 1904. The Institute is one of the oldest educational institutions of Brooklyn, and counts among its graduates many of the most influential men of the city.

**Polytechnic Schools.** See EDUCATION, SCIENTIFIC AND TECHNICAL.

**Polytechnique, The**, originally a French educational institution in which the technical sciences that rest in great part upon a mathematical basis, such as engineering, architecture, etc., are taught. The first school of the kind was established in Paris (1794) by the National Convention, under the name of School of Public Works. No students were admitted but those who intended to enter the public service, especially the corps of civil and military engineers and the artillery. The Polytechnic School, as it was called from 1795, has been repeatedly reorganized as the different political parties have succeeded to power. At the present time it is the institute in which France trains her artillery and engineer officers, her naval engineers, her directors of roads and bridges, and of mines, her telegraph officers, in short, all her officials who require to know something of the higher branches of technical science.

**Pol'ytheism** (Gk. *polys*, many; *theos*, god), belief in and worship of a plurality of gods. It appears to be a development of fetishism. Fetishism is founded on primitive man's view of all nature, animate and inanimate, as consisting of beings possessing attributes similar to his own — sensibility, will, feelings, passions, benevolence and malevolence; and as these beings or objects, like his fellow-men, were con-



## POLYXENA — POMADE

ceived by him to possess the power to help or hurt him, he would, to win their aid in his necessities, flatter or cajole them or venerate them, or, when they proved false to him, treat them with curses and outrage; or he would stand in terror of them if he had incurred their enmity. Since for the fetishist all nature is endowed with life and sense, the savage man apprehends even stones anthropomorphically: the Caaba at Mecca is doubtless a survival of primeval fetish worship. Other notable objects of fetish-worship are mountains: Mount Carmel would seem to have been an object of adoration: hence the *Deus Carmelus* of Suetonius (Vespasian); so wind and fire, so plants: sacred trees are common in nature-religions; of animals, the crocodile was worshipped by the Egyptians; and in all the ethnic religions of antiquity the sun, moon and stars, and the heavens were held to be gods and were objects of worship. From the lowest fetishism is but a step to the polytheism of the highest-cultured peoples of antiquity, in which the gods are demonstrably the very same natural objects—the sky (Zeus, Jupiter), the sea (Neptunus, Oceanus), the sun (Sol, Helios, Apollo), the moon (Selene, Artemis, Diana), which were worshipped by the fetishists of a ruder age, but which are now clothed with more august attributes. Very curious is the usage of ancient Greek and Latin writers in using *Theos*, *Deus* (God) and *Theoi*, *Dî* (gods) interchangeably. For example, in Cicero's dialogue 'De Natura Deorum' ('Of the Nature of the Gods') we read (iii. 37): "It is the belief of all mankind that good fortune is to be asked of God (*a Deo*), but wisdom of oneself . . . health, wealth, victory of the Gods" (*a Dis*). Though Cicero in that dialogue intends to discuss the different opinions of the philosophers upon the nature of the gods it never occurs to him to inquire whether Deity is one or manifold.

**Polyxena**, pŏ-lik'sě-nā, in Greek legend, the daughter of Priam and Hecuba. She was beloved by Achilles, who in order to obtain her for his wife promised to bring about peace between the Greeks and Trojans. While negotiating the marriage at the temple of the Thrymbræan Apollo, Achilles was treacherously slain. Afterward his shade appeared demanding Polyxena and she was therefore sacrificed to his Manes. Her sacrifice is represented in the Acropolis at Athens and forms a part of the 'Hecuba' of Euripides.

**Polyzo'a**, a group of animals, at first regarded as radiates, then as mollusks, and later as members of the heterogeneous group of worms. Its precise rank and position remain to be determined. All are small and all are aquatic, the great majority being marine. At the anterior end of the body is a circle of ciliated tentacles around the mouth. By means of these food is collected and brought to the alimentary canal. The intestine is flexed on itself and the vent is on the dorsal surface, either near the tentacles (*Ectoprocta*) or inside the circle (*Entoprocta*) while the central nervous system lies between the mouth and vent. In the *Entoprocta* the body-wall is solid, but in the *Ectoprocta* there is a spacious body cavity (cœlom). Besides reproduction by eggs all multiply by budding, the result being the formation of colonies, often of considerable extent. The *Entoprocta*, the characters of

which are included above, embrace only a few forms, each individual being raised on a slender stalk, the colony being connected by a running root-stalk on the support to which the animals are attached. *Urnatilla gracilis* occurs in the fresh waters of the United States. Most of the species are marine.

The *Ectoprocta* secrete a protective case, often rendered firmer by the deposition of lime around each individual, and into which the animal may quickly retreat, the opening in some cases being closed by a door or operculum. The great majority of the *Ectoprocta* belong to a group called *Gymnolamata*, in which the tentacles are in a more or less perfect circle. All but a few of them are marine, and are among the most abundant of animals along our whole coasts, some forming encrusting sheets on shells and stones, others forming bushy growths on rock and piles. The *Phylactolamata* are exclusively inhabitants of fresh water, and are characterized by having the tentacles folded into a horseshoe shape. In these, as in sponges, there is the formation of peculiar buds (statoblasts) enclosed in a hard shell which preserve the species through the winter or in times of drought.

The closest allies of the *Polyzoa* (which are also known as *Bryozoa*) are the *Brachiopoda*, the two groups having formerly been united as a class *Molluscoida*. The *Polyzoa* are also related to the *Phoronididæ*, which in turn show resemblances to the *Annulata*. Consequently the three groups have been united as classes in the phylum *Molluscoida* by Parker and Haswell, 'Text-book of Zoology' (1897).

**Pom-pom.** See ORDNANCE.

**Pom'ace Fly**, a small yellowish fly of the genus *Drosophila*, frequently a nuisance in cider factories and wine houses. The eggs are laid in the pomace in which the larvæ feed and from which the adults fly to the houses. They also visit dwellings in which decaying fruit is exposed. Sometimes they breed in other organic remains. Cleanliness and the prompt removal of fermenting or decaying matter are preventive measures.

**Pomade', Pommade, or Pomatum**, a term originally applied to a fragrant ointment prepared with lard and apples, but now wholly restricted to perfumed solid greasy substances used in dressing the hair. In the preparation of pomades the first object of consideration is to obtain their fatty basis in as pure and fresh a state as possible. Lard, beef and mutton suet, beef marrow, veal fat, and bear's grease are the materials commonly employed for this purpose, either singly or in mixtures of two or more of them. The fat, which should be that of a young and healthy animal, is pounded in a marble mortar in the cold, until all the membranes are completely torn asunder; it is then submitted to the heat of a steam-bath until its fatty portion has liquefied, and the albuminous and aqueous matter and other foreign substances have completely subsided. The liquid fat is then carefully skimmed and passed through a flannel filter. In this state it may be perfumed at will; after which, when it is intended that the pomade should be white, it must be constantly stirred with a glass or wooden spatula until it solidifies; should it be wished transparent or crystalline it is allowed to cool very slowly without being



POLYZOA.



1-5. *Cristatella mucedo* (1, a statoblast; 2, another, more advanced; 3, a young stock or cormidium; 4, fully formed stock or cormus; 5, cross-section of Fig. 4). 6-8. *Plumatella repens* (6, young individual; 7, young stock; 8, a portion of Fig. 7 enlarged). 10-12. *Lophopus crystallinus* (10, a young stock; 11, young bud not yet opened; 12, another bud, more advanced, but not open.)







## POMBAL — POMERANIA

disturbed. To prevent its becoming rancid a little benzoic acid, gum benzoin, or nitric ether may be added, and to increase its consistency a little wax or spermaceti. Pomade may be perfumed by enfleurage, maceration, or simply by adding the fragrant essences or essential oils in the required quantity. See PERFUMES AND PERFUMERY.

**Pombal, Sebastião José de Carvalho e Mello**, sã-bäs-tē-än'oo hō-sā' dā kār-väl'yoo ā mā'loo pôn-bäl', or pöm-bäl', MARQUIS OF, Portuguese statesman: b. Soura, near Coimbra, 13 May 1699; d. Pombal 8 May 1782. In 1739 he was appointed ambassador to London, but was recalled in 1745. He was then sent to Vienna to act as mediator between the Pope and the Empress Maria Theresa. Carvalho here gained general esteem, and married the youthful Countess of Daun. In 1750 Carvalho obtained from Joseph I. the post of secretary of state for foreign affairs, and soon rendered the feeble and sensual king entirely subject to his influence. Joseph I. fell in with the most daring projects of his minister; and the latter now proceeded to the accomplishment of his four favorite objects—the expulsion of the Jesuits, the humiliation of the greater nobles, the restoration of the prosperity of Portugal, and the absolute command of the state in the name of the monarch. After the earthquake of 1 Nov. 1755, which destroyed Lisbon, Carvalho displayed great vigor and resolution. He was now created Count of Oeyras, and in 1756 first minister. He then removed every one who ventured to obstruct his plans. The discontented vine-dressers committed excesses in Oporto, but Pombal vigorously suppressed the riots, and passed most comprehensive laws against treason. He also expelled the Jesuits from their flourishing missions in Paraguay. Carvalho finally determined to remove the Jesuits entirely from the person of the king and they were ordered (16 Sept. 1757) to retire to their colleges. A conspiracy against the life of the king, who was wounded on the night of 3 Sept. 1758, by assassins, he falsely laid to the charge of the Jesuits. Pombal denounced the Jesuits to the Pope as the contrivers of the scheme, and caused some of them to be executed in prison. Pombal had already banished the whole order from the kingdom by a royal decree of 3 Sept. 1759, and those who did not comply with the mandate were seized and transported to the States of the Church. A protracted dispute with the Pope followed; in 1760 Pombal transported the Papal nuncio beyond the frontiers, and was on the point of dissolving all connection with Rome when Clement XIII. died, and Clement XIV., his successor, abolished the order in 1773. Through Pombal the Portuguese army received an entirely new organization, and the fortifications on the frontiers were restored. He paid particular attention to the schools; he also rendered the censorship less strict. Joseph I. died 24 Feb. 1777, and was succeeded by his daughter, Maria I., who immediately deposed Pombal and deprived him of all his offices. The state-prisoners whom he had incarcerated, 9,800 in number, were released, and all his regulations abolished. All those who had been attainted with treason under Pombal's charges were rehabilitated, and he himself ordered to retire to his estates, where he died. His record is one of the bloodiest in Por-

tuguese history. Consult: Moore, 'Life of Pombal' (1819); Opperman, 'Pombal und die Jesuiten' (1845); Weld, 'The Suppression of the Society of Jesus in the Portuguese Dominions' (1877); Feval, 'The Jesuits' (1878).

**Pom'egranate**, a shrub or small tree (*Punica granatum*) of the order *Lythraceæ*. It is a native of Persia and adjacent countries, where it has been cultivated for centuries and whence it has been carried to nearly all tropical and subtropical countries of the world. It grows about 15 feet tall; bears shiny, oblong, entire leaves; showy, waxy, orange-red flowers, solitary or clustered in the axils; and thick-rinded red pome-like fruits of the size of an orange, filled with many seeds in several compartments. The tree is hardy as far north as Virginia, but is little cultivated except in the Gulf States and California in each of which sections it is, however, more a garden and a hedge-plant than a commercial fruit. In the South, as in eastern countries, cooling drinks are made from the seeds bruised with sugar and mixed with water. Typical varieties are rather acid, but there are sweet and subacid sorts also. An East Indian variety is seedless and in India is highly prized. Several double-flowered varieties with yellow, red, and variegated flowers are cultivated largely in the South and in northern greenhouses for ornament. They do not bear fruit as a rule. There are dwarf-fruited and non-fruited double and single-flowered varieties. The plants may be as easily propagated by cuttings as currants are, except that they usually require some artificial heat. Layers and grafts are also satisfactory. It will thrive upon a great variety of soils but seems to do best upon well drained light loams. The numerous shoots should be annually cut away from the centre of the plant as in the currant, except when new stems are desired to replace old ones. It will repay cultivation and fertilizing with potash and phosphoric acid; but usually is allowed to shift for itself.

**Pomegranate Melon.** See MELONS.

**Pom'elo, or Pumelo.** See SHADDOCK.

**Pomerania**, pöm-ē-rā'nĭ-a (German, *Pommern*), Prussia, a northern province and duchy, bounded north by the Baltic, west by the Duchy of Mecklenburg, south by the province of Brandenburg, and east by West Prussia; area, 11,628 square miles. It consists of a long and comparatively narrow tract of country, stretching longitudinally east to west. The coast is generally low and sandy, and is lined by a great number of lagoons, separated from the sea by narrow belts of land or low sandhills. Along the coast are a few islands, but none of them, except Rügen, Usedom, and Wollin, are of great extent. The principal rivers are the Oder, Persante, and Stolpe. The soil generally is sandy and indifferent; but there are many rich alluvial tracts, particularly along the banks of the rivers and lakes, producing a surplus of grain for export. Flax, hemp, and tobacco also are cultivated. The domestic animals, of which sheep and swine are the most important, are numerous, and of tolerably good breeds. The forests are of large extent, and well supplied with game. Fish also are abundant. The only minerals of any consequence are a little iron, salt, and alum. Manufactures early made considerable progress, in consequence of the influx



## POMEROY — POMONA COLLEGE

of French refugees on the revocation of the Edict of Nantes, who introduced the manufacture of woollens and other fabrics. Through the Oder the province carries on a considerable trade, both general and transit. The principal exports are corn, cattle, wood, wool, wax, amber, and fish; the principal imports are wine, cotton goods, coffee, sugar, and other articles of colonial produce. The centre of trade is Stettin, which ranks as one of the most important commercial cities of Prussia. Pomerania was originally inhabited by Goths, Vandals, and Slavs. The first mention of it in history is in 1140. It long remained an independent duchy, and was of much larger extent than at present. In 1637, on the extinction of the ducal family, the electoral house of Brandenburg claimed possession, but was obliged to give way to Sweden. On the death of Charles XII. the electoral house again claimed possession, and the whole was formally ceded to it except a part which received the name of Swedish Pomerania. This part having been ceded to Denmark, was by it given up in exchange for the Duchy of Lauenburg, to Prussia, to which the whole of Pomerania now belongs. For administrative purposes it is divided into three governments (Regierungsbezirke), Stettin, Köslin, and Stralsund. Pop. (1900) 1,636,659.

**Pomeroy**, pŏm'- or pŭm'ë-roï, **Marcus Mills** ("BRICK POMEROY"), American journalist and humorist: b. Elmira, N. Y., 25 Dec. 1833; d. Brooklyn, N. Y., 30 May 1896. He was apprenticed to the printer's trade when very young, established the *Corning* (N. Y.) 'Journal' and the 'Athens Gazette,' and in 1857 removed to Horicon, Wis., where he successfully conducted the 'Argus.' Later he went to Milwaukee where he edited the *Daily News* and subsequently secured an interest in the *La Crosse* (Wis.) 'Union and Democrat.' After the Civil War he founded the *Daily Democrat*, which in 1887 was merged in 'Pomeroy's Advanced Thought.' His chief publications are: 'Gold Dust' (1872); 'Brick Dust' (1872); 'Perpetual Money' (1878).

**Pomeroy, Seth**, American Revolutionary soldier: b. Northampton, Mass., 20 May 1706; d. Peekskill, N. Y., 19 Feb. 1777. He was by trade a gunsmith, and early spent much time in the colonial military service, attaining the rank of colonel. In 1774-5 he was delegate in the Provincial Congress, in October 1774 was made a general officer, and in February 1775 became brigadier-general of militia. After having participated as a private soldier in the battle of Bunker Hill, he was appointed 22 June 1775 senior brigadier-general of the Continental army. His appointment, however, was the occasion of some difficulty in the adjustment of matters of rank, and he resigned from the service, without having acted. When New Jersey was overrun by the enemy in 1776, he headed a volunteer force and marched for the Hudson, but died on the way.

**Pomeroy, Theodore Medad**, American jurist and statesman: b. in Cayuga, N. Y., 31 Dec. 1824; d. Auburn, N. Y., 23 March 1905. He received his early education at Monroe Academy and graduated from Hamilton College, taking his degree in 1842. He was admitted to the bar in 1846, practising until 1870. In 1851

he was elected district attorney of Cayuga County, holding that position until 1856, when he was elected to the Assembly. In 1861 he was elected to Congress, remaining there until 1869 and during the 40th Congress acting as Speaker of the House of Representatives. In 1875 he was elected mayor of Auburn, serving one year, and was elected to the State Senate in 1878-9.

**Pomeroy**, Ohio, city, county-seat of Meigs County; on the Ohio River and on the Columbus, H. V. & T. railroad; 85 miles southeast of Columbus. It was first settled in 1816 and incorporated as a city in 1846. It is built on a strip of land lying between the river on one side and hills on the other. It is in a region rich in bituminous coal and salt, and is the centre of an important mining industry. It also produces calcium and bromine, and has numerous manufacturing interests. Its industrial establishments include rolling mills, salt works, machine and engine works, furniture factories, planing and lumber mills, and flour mills. The city is governed by a mayor, who holds office for two years, and a city council. Pop. (1890) 4,726; (1900) 4,639.

**Pom'fret**, a name given in Europe to a species of *Stromateus*, allied to our butterfish (*Rhombus triacanthus*), found in the Mediterranean and Indian Ocean; and in the Bermudas to a large fish (*Brama raii*) of the family *Bramidae*. Both of these belong to the scomberoid series of percomorphous fishes. The latter is a fish of comparatively deep oceanic waters, and is quite cosmopolitan in its range. Occasionally it has been taken in our waters on both the Atlantic and Pacific sides. As a food-fish it is of excellent quality, but is nowhere sufficiently plentiful to be of importance. The family *Bramidae* is a small one, comprising only three genera and 10 or 12 species, which are remarkable for the changes which they undergo with growth. *Brama raii* reaches a length of four feet, and has a somewhat compressed form, with the dorsal and anal fins very long. The cycloid scales are peculiar in being provided with a deep perpendicular bony plate, one side of which is imbedded in the skin.

**Pommade'**. See POMADE.

**Pomona**, Cal., city in Los Angeles County; on the Atchison, T. & S. F. and the Southern Pacific R.R.'s. It was first settled in 1875 and incorporated as a city 12 years later. It is the commercial centre and shipping point for an agricultural and fruit-growing region, particularly noted for its oranges; and also manufactures wine, and has a planing mill and a canning factory. It is a well-built handsome city, with a fine park from which a wide view of the surrounding country may be obtained, and is a health resort. It has a high school and a public library, and Pomona College (q.v.) is located within a few miles at Claremont. The city is governed by a board of trustees; the city officials are mostly elected directly by the people. Pop. (1890) 3,634; (1900) 5,526.

**Pomona**. See ORKNEY ISLANDS.

**Pomona College**, located at Claremont, Cal. It is under the control of the Congregationalists, and was first opened to students in 1888. Women are admitted to all courses. The college offers three general courses, classical,





From "American Food and Game Fishes."

OLD WIFE.

This is a near cousin of the famous Pompano. Photographed from life at Key West, Florida.

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## POMPADOUR — POMPEII

scientific, and literary, for the completion of which the degrees of A.B., B.S. and B.L. are conferred. There is also provision for graduate work, a normal course, and a preparatory department. In 1904, the grounds and buildings were valued at about \$90,000; the amount of productive funds was \$182,000, and the annual income \$213,319. The library (1904) contains 6,000 volumes; the students number 310, and the faculty 20.

**Pompadour, Jeanne Antoinette Poisson,** zhän än-twän-ët pwä-sôn pôn-pä-door, MARQUISE DE, mistress of Louis XV.: b. 29 Dec. 1721; d. Versailles 15 April 1764. She was the daughter of François Poisson, equerry to the Duke of Orleans, and not butcher to the Invalides, as frequently stated. The paternity of the future favorite was, however, claimed by Lenormand de Tournehem, a rich fermier général, who spared no pains to give her a brilliant education, and at his death left her the half of his immense fortune. In 1741 she was married to her cousin Lenormand d'Étiolles. She succeeded in attracting the attention of the king, was formally presented to him, and soon entirely engrossed his favor, appearing at court under the title of Marquise de Pompadour. Here she enjoyed the highest consideration, but did not at first interfere in political affairs, satisfied with appearing as the patroness of learning and the arts. She collected books, pictures, and curiosities, and encouraged the institution of the military school of which Paris du Verney was the founder. But when she could only maintain her influence with the king by furnishing him other objects for favor, she turned her attention to state affairs. She filled the most important offices with her favorites, and contributed to produce those evils which afterward pressed so heavily on France. It is said to have been principally owing to her that France became involved in the war against Frederick II. The Empress Maria Theresa had propitiated her favor by writing to her with her own hand a letter in which she called her "dear cousin." The burdens and sufferings which this war brought upon France must be laid at her door, since she removed Bernis, who was in favor of peace, and supplied his place by Choiseul, effected the recall of Marshal d'Estrées at the moment of triumph, and promoted incapable generals to the command. She died little regretted by the king (see LOUIS XV.), and hated and reviled by the nation. Consult: Goncourt, 'Madame de Pompadour' (1887); Pavlovski, 'La Marquise de Pompadour' (1888); Fleury, 'Louis XV. intime' (1899); De Caraman, 'La Famille de la Marquise de Pompadour' (1900).

**Pompa'no**, an important food fish (*Trachinotus carolinus*) belonging to the teleostomous family *Carangidae*, and found chiefly in the southern United States. These fishes are related to the mackerels, but lack the median finlets which are so general in the latter. The pompano reaches a length of about 18 inches and has a somewhat elevated and compressed body with a covering of very small scales and a strongly convex steep forehead. The anal and soft dorsal fins are both long and of nearly equal length and similar form, being very high in front and low behind. There is a spinous dorsal fin from which the membrane disappears with age, and a deeply forked caudal without keels or bony

plates on its peduncle. The jaws are at first provided with numerous small teeth which fall out with age, changes in other parts also taking place. The color is a beautiful polished silvery blue with golden reflections in parts and touches of orange on the paired fins. On the Atlantic coast the pompano ranges from Brazil to Cape Cod; but it is only in the warm waters of the South Atlantic and eastern Gulf coasts that it is plentiful. Although occurring on the Pacific side of the continent it is there nowhere common. Except at the extreme southern end of Florida, the pompano is a migratory fish, coming in from the sea and entering the shallow bays in the spring, the migratory wave gradually moving up the coast and reaching the waters of New Jersey and Massachusetts only when the summer is well advanced. In the fall they leave at a correspondingly early date. They approach the shores in large schools, swimming swiftly at the surface but some time after entering the shallow bays break up into small parties to spawn and search for the shell fish which are their chief food. The largest runs come in April and May, and, as the dense schools approach very close to the shelving shores, seines may be operated with great effect, and large quantities are thus taken in Florida and South Carolina. Farther north, in Chesapeake Bay and on the coasts of New Jersey and Massachusetts, they are taken in pound nets. The pompano is the favorite fish of the wealthy and commands a high price in Northern markets. The name pompano is also applied to other species of the same and related genera, but the Irish pompano (*Gerres*) and California pompano (*Rhombus*) are not closely allied. Consult: Goode, 'American Fishes' (New York, 1888); Jordan and Evermann, 'American Food and Game Fishes' (New York, 1902).

**Pompeii**, pöm-pā'yē (Lat. pöm-pē'yī), ancient city of Italy, near the Gulf of Naples, and 12 miles southeast of Naples, lying at the southeast base of Vesuvius, and important as being preserved almost intact to our own time by a shower of ashes and pumice from Vesuvius 24 Aug. 79 A.D., which also covered Herculaneum. The city, according to Strabo, was founded by the Oscans; it must have come under Hellenic influence by the 6th century for a temple unearthed in the city is of the Doric of that century. Held by the Samnites from 420 B.C. to the end of the Samnite War in 290, Pompeii then became dependent on Rome; and two centuries later at the close of the Social War the city which had sided with the Italian allied forces was captured by Sulla, and was forced to cede a third of its territory for a Roman military colony. In the years that immediately followed Pompeii became a favorite resort of rich and fashionable Rome, being near the sea and having a glamor of Greek elegance. An earthquake in 63 A.D. nearly destroyed the city, and when it was rebuilt and resettled, Roman architecture somewhat took the place of Greek and the work of building seems to have been shabby and far from thorough in many instances. But the city had regained much of its old popularity when it was destroyed (or preserved) by the eruption of Vesuvius in the year 79. Few of the inhabitants escaped, but the better class of buildings was scarcely injured by the alternating falls of ashes and *rapilli*, or pumice. These with the addi-



## POMPEY

tional covering of earth now amount to about 20 feet. The eruption is described by Pliny the Younger in letters written to Tacitus telling of the death of the elder Pliny, who perished in the city. The site, for a time occupied by a little village, was deserted after the eruption of Vesuvius in 472, and no attention was paid to this great storehouse of antique life until the middle of the 18th century. Indeed the precise position of the buried city was problematic, for the volcano had changed the coast line so that it is now some distance from Pompeii. In 1748 valuable finds were made by a peasant digging a well. In 1755, Charles III. having become interested in the work, the amphitheatre and other public buildings were discovered. But during the next 50 years nothing systematic was done; there was still search for rare objects, but when these were found houses and streets were left to decay or were covered up again. No one realized that the prime value of the city archæologically is that it is the genuine setting of Roman life, a very different thing from remnants, no matter how curious, in a museum. Under Murat (1808-15) houses and streets were again excavated; and since the establishment of the united Italian kingdom work has been carried on systematically by the government, notably under the management of Fiorelli, who devised a method of making casts of the human remains by pouring plaster into the hollows occupied by the bones of the victims. The streets are now nearly half exposed; the completion of the work may take 50 years more. The fear has occasionally been expressed that an eruption of Vesuvius might undo all this work, and, if lava were poured down on the city, all the ancient monuments be destroyed.

The importance of the city, as has been remarked above, is that the very pose and setting of 1st century Italy is here preserved in a wonderful degree, even loaves of bread keeping their shape though turned to charcoal. It is, however, important to notice that the city is neither typical of Rome because of its being subjected to Greek influence, nor of Greece, because hastily rebuilt after the earthquake of 63 A.D. Hence generalizations as to Roman manners and customs founded merely on Pompeian remains are liable to error. The city was an irregular oval, the length being east and west, surrounded by a wall with a circuit of a little more than a mile and five eighths (2,925 yards), which is pierced by eight gates. At each there were sentry boxes in which the Roman legionaries were found, still "on duty" when the excavations began. The most important gate is that opening toward Herculaneum, on the west end of the ovoid. From this gate leads a road paved with tombs, the Pompeian *Via Appia*. Parts of this region, the Pagus Augustus Felix, were among the earliest excavated: in 1771-4 the diggers discovered the villa of Diomedes, which got its name from the tomb of Marcus Arrius Diomedes across the street. It seems to antedate the empire. Thirty-four bodies were found in this one house, 20 of them in the wine cellar. Within the walls the streets are straight but narrow (14 to 24 feet wide), paved with lava blocks, and with high stepping stones at crossings. The streets are deeply worn with ruts. On the walls there are scribbled inscriptions, the famous graffiti, which are full of the gossip, scandal, and politics of the

city. The forum, a little southwest of the geographical centre of the town, was an open market place surrounded by buildings, the Temple of Apollo lying to the west, the temple of Jupiter to the north, and that of Mercury to the east. The last temple was flanked by the curia on the left, and the House of Eumachia on the right; south of this house, across a street leading to the Sarno gate, was a school. At the intersection of this street with that connecting the Vesuvian and Stabian gates were situated the public baths; and near the latter gate were a second forum, called the "triangular," a temple of Isis north of it, a large and a small theatre to the east, the Gladiator's Barracks (see Illustration) to the southeast, noted for the fine arms, shields, helmets, etc., discovered here, and to the south a temple of Heracles. The gladiator's quarters include a large rectangular enclosure, which measures 183 feet long by 148 feet wide. It is surrounded on all four sides by a colonnade whose columns are painted red at the lower part, and alternately red and yellow at the upper. The wall back of the columns is covered with stucco. Other baths are on the street crossing the city from the Nolan gate. The unfinished Temple of Venus Pompeiana in the southern corner of the city, near the old Sea gate and the modern hotel, seems to have been the repository of many valuables, probably left by the inhabitants who escaped from the city at the first alarm. Valuable finds of the same sort are to be looked for in villas outside the city; in 1895 in a well at Boscoreale a set of silver utensils, lamps, mirrors, and candelabra was discovered. The type of art in these pieces of silver and in the mural paintings is apparently Alexandrian, with a profusion of Cupids. Among the better known private dwellings, apart from the "Villa of Diomedes" already named, are: the House of Pansa, one of the largest residences of the city, a pattern of the Roman house which has often been reproduced, notably at Saratoga; the House of the Tragic Poet, so called because of the incorrect interpretation of one of its mural paintings, a small but tasteful house with remarkable scenes from the Homeric poems; the unusually elegant House of Sallustius; the double house known as Castor and Pollux; and the House of the Vettii, excavated in 1894, the home of a rich fuller, with brilliant, fresh frescoes, and the interior equipment of the house in such good condition that it has been left there instead of being carried to the Museum in Naples.

Consult: Niccolini, 'Le case e i monumenti di Pompei' (1854-96); Nissen, 'Pompejanische Studien' (1877); Rolfe, 'Pompeii, Past and Present' (1884); Fiorelli, 'Gli scavi di Pompei dal 1861 al 1872' (1873); Weichardt, 'Pompeii vor der Zerstörung' (1897); Gusman, 'Pompeii' (Engl. translation by Simonds and Jourdain, 1900); and, above all, Mau, 'Pompeii' (Engl. translation by Kelsey, 1902; also Engelmann, 'Pompeii' (Engl. translation by Talfourd Ely in the 'Famous Art Cities' series, 1904).

**Pompey**, pŏm'pī (CNEIUS POMPEIUS), surnamed the Great (Magnus): b. 106 B.C.; d. 48 B.C. In 89-87 B.C. he served in the Social war with great distinction. For some years subsequently the party of Marius was in the ascendant in Italy, and Pompey, who belonged to the aristocratic party, kept in the background. Learning, however, that Sulla was about to





GRÆCO-ROMAN MURAL DECORATION







POMPEII.



HELMETS, SHIELDS, GAUNTLETS, ETC., FOUND IN THE "GLADIATORS' BARRACKS."







## POMPEY THE YOUNGER — POMPEY'S PILLAR

return from Greece to Italy, he hastened into Picenum, and raised an army of three legions, with which he successively defeated three generals of the opposite party, who attempted to prevent his junction with Sulla. That junction was accomplished in 83, and Sulla received the young soldier with the greatest marks of esteem. When the war in Italy ended, Pompey was sent to Sicily against the Marian general. He won a complete and speedy victory, and on his return was received by the people with great enthusiasm, and greeted with the surname of Magnus. He was also granted a triumph, a noteworthy distinction for one who had as yet held no public office. Subsequently he induced the senate to send him to the aid of Metellus Pius, hard pressed by Sertorius in Spain. Pompey remained in Spain (76-71), but neither he nor Metellus could gain any advantage over Sertorius. But when the latter was treacherously murdered by Perperna, his own officer, the war was speedily brought to a close. On his return he defeated the fragments of the army of Spartacus, and claimed the glory of having finished the Servile war. He now became a candidate for the consulship, and although he was not of the legal age, and had not held any of the lower offices of the state, he was elected consul with Crassus at the end of 71. The aristocracy began to look upon Pompey with jealousy, and ceased to regard him as belonging to their party, as he and his colleague openly courted the people — Crassus, by profuse largesses, and Pompey by the restoration of the tribuneship and other popular institutions. In 67 he was invested with extraordinary powers by sea and land for three years, for the purpose of putting an end to the outrages of the pirates in the Mediterranean, in which he was successful. Meanwhile the war against Mithridates had been carried on with varying fortune, and the Romans were discontented with the slow progress of Lucullus. The tribune, Caius Manilius, proposed that Pompey should have absolute power over the army and fleet in the East, and proconsular authority over all Asia as far as Armenia, a proposal supported by Cicero in the famous oration 'Pro Lege Manilia.' It was opposed by the whole influence of the aristocracy, but carried triumphantly. In 65-62 he conquered Mithridates; Tigranes, king of Armenia; and Antiochus, king of Syria. At the same time he subdued the Jewish nation, taking Jerusalem by storm after a three months' siege. He returned to Italy in 62, and disbanded his army, but did not enter Rome till the following year, when he had the honor of a third triumph. From this date, when he was 45, his star began to wane. The aristocracy still distrusted him, yet he was unwilling to throw in his lot entirely with the popular party, which had been steadily rising in power during his absence, and over which Cæsar now possessed unlimited control. The senate refused to sanction his measures in Asia, and to make an assignment of lands which he had promised to his veterans. Pompey therefore resolved to ally himself closely with Cæsar, who promised to obtain the ratification of his acts provided Pompey would assist him in the attainment of his ends. Through the mediation of Cæsar Pompey became reconciled to Crassus, who, in consequence of his enormous wealth, had a wide

influence in Rome. Thus was brought about the coalition of these three powerful men, which is known in Roman history as the first triumvirate. In order to tighten the bonds of alliance Cæsar bestowed upon Pompey his daughter Julia in marriage. It was soon apparent that this alliance would not last long, as Pompey could brook no rival. The death of Julia in 54 severed one of the ties which bound the two men, soon to become open rivals. In consequence of the serious tumults which broke out in Rome on the death of Clodius in the beginning of 52, the senate called in the assistance of Pompey, who was appointed sole consul for that year, and who succeeded in restoring order in the city. The most important state offices were now filled with Cæsar's enemies, and Pompey persuaded the senate to pass a decree by which Cæsar was to give up the provinces of which he was governor, and the command of his army. This he refused to do unless Pompey would throw up his offices, which was a step the latter would not take. Cæsar was proclaimed an enemy to the state, and his rival was appointed general of the army of the republic. Cæsar crossed the Rubicon in 49, and in 60 days was master of Italy without striking a blow. Pompey fled to Greece, where he collected a numerous army, and was followed by Cæsar in January 48. At first the campaign was in Pompey's favor; Cæsar was repulsed before Dyrrhachium with considerable loss, and was compelled to retreat toward Thessaly. In this country, on the plains of Pharsalia, occurred the decisive battle which made Cæsar master of the Roman world. His rival fled to Egypt, where he was murdered by a former centurion of his own. His head was struck off, and was shown to Cæsar, who, however, ordered the murderer to be put to death. Consult: Merivale, 'The Roman Triumvirates' (1887).

**Pompey the Younger** (SEXTUS POMPEIUS), Roman warrior, 2d son of Pompey the Great: b. 75 B.C.; d. 35 B.C. He accompanied his father in his flight into Egypt and after his death went to Spain, where he organized a force of fugitives and malcontents and demanded from the Roman senate restitution of his father's property. The senate granted him a large sum of money and made him commander of the seas. He marched to Bætica, where he crushed all opposition and assumed the powers of a sovereign. Upon the formation of a second triumvirate in 43 B.C. he was proscribed and thereupon turned pirate, waging continued war upon Rome by cutting off her supplies. He made Corsica, Sardinia, and Sicily, which islands he had captured, the seat of his power, and from them sent forth his marauders. When Rome reached the point of starvation the populace compelled Antonius and Octavianus to sue for peace and a treaty most advantageous to Sextus was signed, in which he was confirmed in his occupation of Sicily, Corsica, Sardinia, and Achaia, and promised the consulship. The war was, however, speedily resumed, and Sextus twice defeated the fleets of Octavianus, but his indecision permitted the Romans to rebuild their fleets and in 36 B.C. he was signally defeated. He escaped but was captured a few months subsequently and put to death at Miletus by the Roman legate, M. Titius.

**Pompey's Pillar**, the name of a celebrated column, standing on an eminence about 1,800



## POMPONATIUS PETRUS—PONCE DE LEON

feet to the south of the walls of Alexandria in Egypt. It consists of a capital, shaft, base, and pedestal, which last rests on substructions of smaller blocks once belonging to older monuments. One of these blocks bears the name of a monarch of the 13th Egyptian dynasty, and another that of Psammetichus I. The total height of the column is 98 feet 9 inches; the shaft, a monolith of red granite, is 73 feet long, and 29 feet 8 inches in circumference. The name it is popularly known by was applied to it by ancient travelers for no assignable reason. An inscription on the base shows that it was erected by Publius, the prefect of Egypt, in honor of Diocletian, probably to commemorate his capture of Alexandria, and the suppression of the rebellion of Achilleus. On the summit there is a circular depression of considerable size, intended to admit the base of a statue.

**Pomponatius, Petrus**, pōm-pō-nā'shī-ūs pē-trūs (Latinized name of PIETRO POMPONAZZI), Italian philosopher: b. Mantua 1462; d. Bologna 1525. He was one of the leading Greek revivalists of the Renaissance and taught peripatetic philosophy in Padua and Bologna, endeavoring to purify the current Aristotelianism from the ecclesiastical admixture of scholasticism. In his essay 'De Immortalitate Animæ' he taught that the application of Aristotle's method would necessarily result in a proof of the soul's mortality. His treatise 'De Incantationibus' was directed against the superstitions of his time. His works were published in Venice (1525) and in Basel (1567).

**Ponape**, pō'nā-pā, one of the Caroline Islands (q.v.) in Micronesia, in form nearly circular, with a diameter of 16 miles and an area of 140 square miles, and ringed by a coral reef three miles distant. The interior is mountainous, the coast fertile. Mangroves flourish and durian and vegetable-ivory nut are exported. Remarkable ruins consisting of great blocks of basalt have been found. Pop. (est.) 2,000. Consult Pereira, 'La isla de Ponape' (1896).

**Pon'ca Indians**, an American tribe of the Dakotah family residing in Nebraska. They are a partly civilized and peaceable race. The remnants of the tribe live on a reservation near the mouth of the Niobrara River, Nebraska.

**Ponce**, pōn'sā, Porto Rico, city; capital of the department of Ponce; three miles from the coast. It is the second largest city of Porto Rico, and the first in commercial importance. Coffee is the most important export. Other exports are sugar, rum, molasses, and tobacco. The main part of the town is connected with the port, Playa, by a good road, and electric railway. The harbor is large, and accommodates vessels drawing 25 feet; the custom-house is located at Playa. Ponce is connected with Yanco, 20 miles distant, by railroad, and with San Juan and Arecibo by highways. The greater part of the inhabitants are engaged in commercial and mercantile pursuits; but there are a few mechanical industries, shoemaking, etc., and the mechanics of Ponce excel in the quality of their workmanship. The city is considered the most progressive on the island; it is well built, and modern in appearance, with wide streets, several plazas or open squares, the largest of which is the Plaza Principal, and a number of handsome residences. It has also

the best market house, and best market on the island. The water supply is excellent, there are electric lights, and electric railways; the chief buildings include the Church of Our Lady of Guadalupe (Roman Catholic), a Protestant church, the municipal hall, and two theatres. There are also several asylums and hospitals. The city has a public library, and a good public school system has been established since the American occupation; in 1903 an industrial school was in process of construction. Pop. (1899) 27,952; of the municipal district, 55,477.

**Ponce de Leon**, pōn'thā dā lā-ōn', **Fray Luis de**, Spanish theologian and poet: b. Belmonte, La Mancha, 1527; d. Madrigal, Spain, 23 Aug. 1591. He entered the Augustinian order at 16, was educated at the University of Salamanca, where he later became professor of theology and of Thomistic philosophy. As a linguist and a theologian he became famous, but in 1572 was brought before the Inquisition on a charge of Lutheranism and of having translated into Spanish without authorization the 'Song of Solomon.' He was held in prison until 1576, when he was reinstated in his offices in the university, and subsequently became vicar-general and finally provincial of his order. His lyrical poetry is chiefly of a religious character and though small in quantity is of great merit. He translated the 'Eclogues' and two of the 'Georgics' of Virgil, about 30 odes of Horace, many of the Psalms, besides selections from modern Italian poets. His most popular prose work was 'Perfecta casada,' a treatise on wifely duties, and the best edition of his works is that of Merino (6 vols. 1804-16). Consult: J. Gonzales de Tejada, 'Vida de Fray Luis de León' (1863); J. D. M. Ford, 'Luis de León, the Spanish Poet, Humanist, and Mystic' (in the Publications of the Modern Language Association of America, Vol. XIV., No. 2).

**Ponce de Leon**, Juan, hoo-än', Spanish discoverer: b. Aragon about 1460; d. Cuba 1521. He fought in the conquest of Granada, and in 1493 shipped with Columbus on the admiral's second voyage. Subsequently he held under Ovando the post of governor of the eastern portion of Española, in 1508 undertook the conquest of Porto Rico, and in 1510 was made governor of the island. He had already played a brave part in the struggles attending Spanish colonization in the New World, when in 1512 he obtained from King Ferdinand permission to conquer Bimini. The Indians seem to have spoken of a land called Bimini, north of Española, and in the 1511 edition of the 'Decades' of Peter Martyr is a map on which appears a large island named Beimeni. To this Bimini Ponce de Leon was going for the "Fons Juventatis," or fountain of youth, the belief in such a fountain being a part of the folk-lore of his day. A spurious letter purporting to be from Prester John (q.v.), circulated through Europe in the 12th century, tells of such a fountain. Sir John Mandeville calmly appropriated the story, described the fount as at a place called Polombe, and said that he "drank thereof thrice," and "feel me the better and the halier." Stories of an island northward of Española, where a fountain of youth was, must have been afloat in Spain; for the same 1511 edition of the 'Decades' refers to them. In the patent granted in 1512 to De Leon, condition was made that the island



## PONCELET — POND

had not been already discovered. In March 1513 the veteran set sail with three caravels from San German in Porto Rico. On the 27th he came in sight of the mainland on which he landed 2 April, taking possession in the name of the king, and calling the region Florida, since 27 March had been Easter Sunday, styled by the Spaniards Pascua Florida ("flowery Easter"). The spot at which he landed was a little northward of the present site of Saint Augustine. He then coasted about the peninsula to the west side, reaching lat.  $27^{\circ} 30'$ . The bay at which he arrived was long known as Juan Ponce. He reached Porto Rico on the return voyage 21 September. He had to subdue the Caribs, a long undertaking; and not until 1521 did he attempt a new expedition. Then with a new patent for conquest and settlement, he set out with equipment for starting a colony. The hostility of the Indians, however, rendered the success of the enterprise doubtful. Ponce de Leon was severely wounded by an arrow, and returned with the whole expedition to Cuba, where he died of his wound. He had not discovered that Florida was not an island, but he opened the path to this knowledge.

**Poncelet, pôns-lâ, Jean Victor**, French military engineer: b. Metz 1 July 1788; d. Paris 23 Dec. 1867. Between the years 1807 and 1810 he attended the Ecole Polytechnique, where he was a pupil of Monge. In 1812 he received the commission of lieutenant in the engineers, but on Napoleon's retreat from Moscow was taken prisoner and transported to Saratov, on the Volga. On returning to Metz in 1814 he worked out the geometrical problems he had begun to consider during his captivity, but these met with little recognition from the French Academy. In 1829 he published his 'Traité des Propriétés Projectives des Figures.' He henceforth gave himself closely to the study of applied mechanics; invented the water wheel which bears his name, and published numerous works on mechanics. In 1835 he was appointed member of the National Defenses Commission and professor of applied mechanics in the University of Paris. He was promoted general in 1848 and went to the Exhibition of 1851 at London as president of the Commission of Mechanics. In 1857 he published his important account of the progress of mechanical science, 'Collection des Travaux de la Commission Française.' The work which he had begun in captivity in Saratov — 'Application d'Analyse et de Géométrie' — he published in 1862. He was really the founder of modern geometry and had gained great influence among German mathematicians at a time that his countrymen had accorded him only scant recognition. Among his other works are: 'Les Roues Hydrauliques Verticales' (1826); 'Experiences Hydrauliques' (1832); 'Traité de Mécanique Appliquée aux Machines' (1845); etc. Consult: Didion, 'Notice sur la Vie et les Ouvrages du Général Poncelet' (1869).

**Pon'cho**, a kind of cloak worn by the Indian and Spanish inhabitants of South America. It resembles a narrow blanket with a slit in the middle, through which the head passes, so that it hangs down loosely before and behind, leaving the arms free.

**Pond, Frederick Eugene** ("WILL WILDWOOD"), American author and journalist: b.

Packwaukee, Wis., 8 April 1856. He was educated at Montello, Wis., and early turned to journalism, in which he made sporting matters his specialty, and was one of the first to urge the establishment of a National Sportsman's Association. In 1881-6 he was field editor of 'Turf, Field, and Farm,' edited 'Wildwood's Magazine' in 1888-9, and when it was merged with 'Turf, Field, and Farm,' he became corresponding editor. Since 1897 he has edited the 'Sportsman's Review.' He has published: 'Handbook for Young Sportsmen' (1876); 'Gun Trial and Field Records of America' (1885); 'A Strike' (1897); edited Frank Forrester's works (1879); etc.

**Pond, James Burton**, American lecture manager: b. Cuba, Allegany County, N. Y., 11 June 1838; d. Jersey City, N. J., 21 June 1903. His parents settled in Wisconsin in 1847 and there he learned the printer's trade. He edited the 'Weekly Journal' of Markesan, Wis., 1860-1, and becoming 2d lieutenant in the 3d Cavalry Volunteers of that State, rose to the rank of major, and was among the 17 survivors of the guerrilla Quantrell's massacre of a band of 118 soldiers at Baxter Springs, Kan., in October 1863. Between 1865 and 1874 he engaged in business and it was as the manager of the lecture tour of the 19th wife of Brigham Young, when she renounced Mormonism, that he chanced to take up the business of manager and for the rest of his life he continued to "manage" platform speakers. He came to New York in 1879. Among famous men whom he "managed" are Wendell Phillips, William Lloyd Garrison, Robert G. Ingersoll, Henry Ward Beecher, Bill Nye, Max O'Rell, and the Dean of Ely, Charles William Stubbs. He published 'Eccentricities of Genius' (1900); 'A Summer in England with Henry Ward Beecher.'

**Pond, John**, English astronomer: b. London 1767; d. Blackheath, Kent, 7 Sept. 1836. He was educated at Cambridge, traveled extensively and on his return to England in 1798 settled at Westbury, near Bristol, where he engaged in astronomical observations. He erected there an altazimuth instrument, two and a half feet in diameter, and by a series of observations proved that the quadrant then in use at Greenwich had changed its form through age, rendering the re-equipment of the Royal Observatory a necessity. He removed to London in 1807, was elected a fellow of the Royal Society, and in 1811 was appointed astronomer royal. By means of the six-foot mural circle mounted by the Royal Society in 1812 Pond compiled a catalogue of the north polar distances of 84 stars, which he presented to the society in 1813. In 1821 he substituted the mercury-horizon for the plumb-line and spirit level, and in 1825 originated the system of making observations alternately by direct and reflected vision, for further experiments in which direction he was subsequently transferred to Queen's College, Belfast. Though his mathematical knowledge was slight and his work wholly technical, he nevertheless performed valuable services to science and succeeded in introducing modern methods and instruments at the national observatory. He was pensioned and retired in 1835. He published a catalogue of 1,113 stars (1833), a work of great value and accuracy.



## POND LAW—PONS ASINORUM

**Pond Law, The**, in American politics and legislation, an act passed by the Ohio legislature in 1882, for the regulation of the liquor traffic. For eight years the liquor question had agitated Ohio politics and the Republicans finally adopted the Pond Law for the taxation of liquor selling. The law was afterward declared unconstitutional by the supreme court of the State.

**Pond-skaters**, long, narrow bugs of the hemipterous family *Hydrometridæ* which glide swiftly over the surface of ponds and quiet pools in search of prey. The front pair of legs, comparatively short, serve to seize prey or to cling to a support; while the strong middle and hind legs carry the insect rapidly over the surface, the film bending but not breaking under the feet. The whole body is covered with a velvety fur; and when the insect dives it carries down a jacket of air, upon which it sustains breathing for a considerable time. Consult Howard, 'The Insect Book' (New York, 1902). See FRESH-WATER INSECTS.

**Pond Smelt**, a small surf smelt, numerous along the shores of Bering Sea, and regarded as excellent food.

**Pond Snail**, a small fresh-water pulmonate mollusk of the family *Limnæidæ*. In this family the shell is large and thin, the lip sharp, the muzzle short and broad, and the eyes are placed at the base of the tentacles. The genera *Limnæa*, *Physa*, *Ancylus*, and *Planorbis* are prominent. The first-named genus contains the gracefully spiral water-snails with triangular tentacles, numerous in all parts of the world, and mostly less than an inch long; a widespread and familiar species (*Limnæa stagnalis*) is often twice that length, and the aperture widely flaring. This form is found in streams and pools, and crawls upon the leaves and stems of aquatic plants. The equally common genus *Planorbis* possesses a flattened discoidal shell, the whorls of which are coiled round a central axis and lie in one plane. The shell aperture is crescentic in shape, and the foot is round and short. The genus *Physa*, represented all over the United States by *P. heterostropha* (see SNAILS), has the spiral whorls of the shell turned to the left hand; the tentacles are long and slender, and the edge of the mantle is fringed.

**Pondicherry**, pōn-dī-shēr'ī (French, PONDICHÉRY, pōn-dē-shā-rē), India, the capital of the French possessions in India, on the east or Coromandel coast, 85 miles by rail southwest of Madras. Its territory with an area of 107 square miles, is surrounded on the land side by the British district of South Arcot. It stands on a sandy beach, and consists of two divisions separated by a canal. The "White Town," or European quarter, on the east, facing the sea, is regularly laid out, contains a spacious square, in which is the government-house, handsome planted boulevards, and a number of well-built houses. The "Black Town," or native quarter, on the west beyond the canal, consists mainly of huts of brick or earth, and a few pagodas. Its streets are broad and shaded by palm-trees, but filthy. The fortifications, formerly strong, were destroyed during the war with the British, and by the Treaty of Paris they are not to be rebuilt, nor is Pondicherry to be garrisoned by a native French force. The territory is partly watered by the Gingee River, but is not very fertile:

some rice, indigo, tobacco, betel, cotton, and cocoanuts are raised; which, with cotton cloths, form the chief exports. The imports consist chiefly of manufactured goods. There is no harbor, but only a roadstead, where the surf beats almost as strongly as at Madras. There is, however, an iron pier. The town has been provided with a good supply of drinking water. The settlement was purchased by the French from the Bejapoor rajah in 1672. It was several times taken by the British, the last being in 1803, being restored in 1815. Pop. (1895) 49,052; (1901) of town 47,972, with territory about 175,000.

**Pon'doland**, Cape Colony, a maritime district; area, 4,040 square miles. Its vegetation is luxuriant, and it is well adapted for the rearing of cattle and sheep. The Saint Johns River flows through its southern part, and forms at its mouth an excellent harbor. It was the last part of Kaffraria that remained independent until it became a British protectorate in 1884, and was annexed to the Cape in 1894. Pop. estimated 198,000.

**Poniatowski**, pō-nyä-tōv'skē, the name of an illustrious Polish family descended from an Italian stock.—GIUSEPPE SALINGUERRA (b. 1612), of the Italian family Torelli, having settled in Poland, took the name of Eziolek, and afterward that of Poniatowski, from the estate of Poniatow belonging to his wife. Among important descendants of his may be cited (1) STANISLAS, COUNT PONIATOWSKI (b. 1678; d. 1762), known for his connection with Charles XII., whom after the battle of Poltava he followed into Turkey, and as whose ambassador at Constantinople, he had the address to involve the Porte in a war with Russia. He wrote 'Remarques d'un Seigneur Polonais sur l'Histoire de Charles XII. par Voltaire' (1741). (2) His eldest son, STANISLAS AUGUSTUS (b. 1732), was elected king of Poland in 1764. (See STANISLAS II.) (3) JOSEPH ANTONY, nephew of king Stanislas, (b. Warsaw 7 May 1762; d. Leipsic 19 Oct. 1812). When the Poles attempted in 1794 to drive the Russians out of their country, he joined the Polish camp as a volunteer. Kosciusko gave him the command of a division, at the head of which he distinguished himself at the two sieges of Warsaw. On the creation of the duchy of Warsaw Poniatowski accepted the place of minister of war in the new state. In 1809 he commanded the Polish army against the superior Austrian force sent to occupy the duchy, and compelled it to retire. In the war of 1812, against Russia, he was again at the head of the Polish forces, and distinguished himself throughout this campaign. After the battle of Leipsic, during which Napoleon created him marshal of France, he was ordered (19 October) to cover the retreat of the French army, but was drowned while crossing the river Elster. His body was afterward removed to Warsaw, and in 1816 was deposited in the cathedral at Cracow. An equestrian statue of Poniatowski was executed for the city of Warsaw by Thorwaldsen.

**Pons Asinorum**, pōnz ās-ī-nō'rūm ("the bridge of asses"), a Latin expression applied early in the 16th century to a diagram showing how to find middle terms to arguments. The original allusion seems to have been the difficulty of getting asses to cross a bridge. The name



## PONSARD — PONTIAC

is also given to the fifth proposition of the first book of Euclid, which sets forth that, if a triangle has two of its sides equal, the angles opposite to these sides are also equal.

**Ponsard, François**, frän-swä pôn-sär, French dramatist: b. Vienne, Dauphiné, 1 June 1814; d. Paris 13 July 1867. His first success was his 'Lucrece,' produced in 1843, and welcomed as a return from romanticism to classicism, and when played in 1853, with Rachel in the title role, very popular. Among other plays by him are: 'Agnes de Méranie' (1846); 'Charlotte Corday' (1850); 'L'Honneur et l'Argent' (1853); 'La Bourse' (1856); 'Le Lion amoureux' (1866); 'Galilée' (1867). He became a member of the Academy in 1855. His complete works were issued in 1876.

**Ponson du Terrail**, pôn-sôn dü tär-ä-ē, **Pierre Alexis**, French romancer: b. Montmaur, Isère, France, 8 July 1829; d. Bordeaux 31 Jan. 1871. He wrote a large number of fictions which were very popular with an uncritical public. Among his works are 'Les Coulisses du Monde' (1853) which established his fame; 'Gown and Sword' (1857); 'The King of Navarre's Mistress' (1863); 'The World's Great Bohemians' (1867); 'Aurora's Amours' (1870).

**Pont, Timothy**, Scottish geographer, son of Robert Pont: b. about 1560; d. about 1630. He was graduated from Saint Andrew's in 1584, was minister of Dunnet, Caithness-shire in 1601. In 1609 he subscribed for 2,000 acres of forfeited lands in Ulster and soon after conceived the idea of a Scottish atlas. In pursuance of his plan he visited all portions of Scotland to the most remote and dangerous sections, making his maps on the spot. He died some time between 1625 and 1630 and his maps, which were exceedingly neat and accurate, were ordered by King James to be purchased and published. In the troublous times following they were forgotten until rescued by Sir John Scott of Scotstarvet, and published in Bleau's 'Atlas' (Vol. V. 1668).

**Ponta Delgada**, pôn'tä dël-gä'dä, or **Ponte Delgada**, Azores, town on the island of Saint Michael, the largest town in the islands. It is defended on the west side by the castle of Saint Braz, and about three miles to the east by the forts of São Pedro and Rosto de Cão. The principal buildings are churches, monasteries, convents, and an English chapel. The town has been lighted with gas since 1884. The harbor accommodations are good. The trade is considerable, and is chiefly with the British, of whom a considerable number are residents. The chief exports are wheat, maize, and oranges; and the imports, cotton and silk goods, and hardware. Pop. (1890) 16,767; (1900) 17,675.

**Pontchartrain**, pôn-chär-trân', a lake of Louisiana, about five miles north of New Orleans, about 40 miles long from east to west, and nearly 25 wide. The water is generally from 12 to 14 feet deep. It communicates with Lake Borgne on the east and with Lake Maurepas on the west. It is connected with New Orleans on the south, by Bayou Saint John and a canal, and also by a railroad. It is surrounded by marshes, which have a dense vegetation of water plants. The residential sections, Madisonville and Mandeville, are on the north shore.

**Pontederia'ceæ**, a family of aquatic plants, the pickerel-weeds, which are perennial water or marsh herbs, with perfect mostly irregular flowers from a one-leafed spathe; perianth corolla-like, equally six-cleft. One genus is *Pontederia*, with one American species (*P. cordata*); another genus is *Heteranthera*, with three species, one of which (*H. graminea*) is very common in Florida.

**Pontevedra**, pôn-tā-va'drä, Philippines, (1) pueblo, province of Negros Occidental; on the western coast on Guimaras Strait at the mouth of the Mangala River; 22 miles south of Bacolod, the provincial capital. It is a military station. Pop. 12,000. (2) Town, province of Cápiz, island of Panay; 12 miles southeast of Cápiz, the provincial capital. Pop. 9,500.

**Pontiac**, pôn'ti-äk, Indian chief: b. on Ottawa River about 1720; d. Cahokia, Ill., 1769. He became the principal chief of the allied tribes of the Ottawas, Ojibways, and Pottawatomies, and it is thought that he led the Ottawas at the defeat of General Braddock (q.v.) near Fort Duquesne. After the taking of Quebec, Maj. Rogers was despatched to take possession of the western forts for Great Britain, under the terms of the treaty of Paris. Pontiac objected to this procedure, which he regarded as an invasion of his domain, and as a result soon began to plot the complete extermination of the English. In 1762 he sent out messengers who secured the allegiance of all tribes as far as the lower Mississippi in a confederation against the common enemy. The plan, as arranged, was that each tribe was to attack the fort nearest it, and that all were then to make a combined descent upon the undefended settlements. A great pow-wow or council was held 27 April 1763 near Detroit; Pontiac made a stirring oration, rehearsing the wrongs inflicted upon the Indians by the English. He was himself to make an attempt to capture Detroit on 7 May, but the design was revealed, and Pontiac could lay siege only to the fort. But a long investment was a thing foreign to Indian warfare, and the lines were so loosely drawn that provisions were freely smuggled into the fort. Pontiac was supplied by the Canadians, and paid in promissory notes of birch-bark, later, it is said, scrupulously redeemed. Schooners sent through Lake Erie with supplies and reinforcements were captured by the savages, but at last one with ammunition and provisions did succeed in reaching the fort. The besieged thereupon believed themselves strong enough to venture a sally against the Indian encampment, but Pontiac, warned of the project, defeated them in the battle of Bloody Bridge (31 July). The siege was sustained until 12 October, when Pontiac withdrew his forces to the neighborhood of the Maumee. This part of the conspiracy had, it is true, been a failure; but elsewhere the success was remarkable. When the detached and unorganized character of Indian warfare is considered, recognition must be made of the notable diplomatic and military talent of the chieftain who directed the largest and most powerful coalition in Indian history, and came so near to realizing his grand object. Of 12 fortified posts attacked, 8 were taken, while the garrisons of most were massacred; several English expeditions were annihilated; and the frontiers were desolated and



## PONTIAC — PONTINE MARSHES

terrified. Hostilities continued in a desultory fashion into 1764, but on 17 Aug. 1765 Pontiac formally made peace at Detroit, and in the summer of 1766 concluded a treaty with Sir William Johnson at Oswego, N. Y. In 1769 a Kaskaskia Indian, bribed by an English trader, murdered Pontiac; in vengeance the northern tribes made war on the Illinois group, which was all but exterminated. Consult Parkman, 'The Conspiracy of Pontiac' (1851; new ed. 1898).

**Pontiac**, Ill., city, county-seat of Livingston County; on the Vermilion River, and on the Illinois C., the Wabash, and the Chicago & A. R.R.'s; about 95 miles north by east of Springfield and 90 miles south by west of Chicago. It was settled about 1825, but was founded permanently in 1829, by colonies from Indiana and Ohio. In 1856 it was incorporated, and received a city charter in 1872. It is in a fertile agricultural region in which stock-raising is given considerable attention. In the vicinity are extensive coal-fields. The chief industrial establishments are candy factories, a hook and eye factory, box factory, and large shoe factories. There is considerable trade in coal, grain, livestock, and manufactures. The principal public buildings are the State Reformatory for juvenile offenders, which will accommodate 1,500, and (1903) has about 1,400; the city-hall, the public library, and the church and school buildings. Pop. (1890) 2,784; (1900) 4,266.

**Pontiac**, Mich., city, county-seat of Oakland County; on the Clinton River, and on the Detroit, G. H. & M., the Grand T., and the Pontiac & O. R.R.'s; about 27 miles northwest of Detroit. It was settled in 1818-20, incorporated as a village in 1837, and in 1861 was chartered as a city. It was named after the Indian chief Pontiac. It is in a section of beautiful lakes in which there is considerable hunting and fishing. It is surrounded by an agricultural region, and has a number of industries connected with farm and forest products. The chief manufacturing establishments are 13 carriage factories, machine shops, a foundry, flour and lumber mills, knit-goods factory, and gas and gasoline engine works. There are about 1,200 employees in the manufactories. There is considerable trade in farm products, fruit, vegetables, wool, and carriages and wagons. It has the Eastern Michigan Asylum for the Insane, with 1,200 patients (1903), a library building (ladies' library), a public high school library, public and parish schools, and eight churches. The four banks have a combined capital of \$250,000 and an annual business of \$1,500,000. The government of the city is vested in a mayor and a council of 10 members. The city owns and operates the waterworks. Pop. (1890) 6,200; (1900) 9,769.

**Pontiac's War.** See COLONIAL WARS IN AMERICA; PONTIAC.

**Pontianak**, pŏn-tē-ä-näk', West Borneo, town on the Kapuas or Pontianak River, at the mouth of the Landak. It is on the equator, and 110° 20' E. longitude. It is in a region in which the chief productions are rice, sago, sugar, birds' nests, pepper, and wax. Salt, opium, some clothing, wares, and machinery are introduced. Pontianak is the chief port of West Borneo. It has a Dutch resident. Pop. (estimated) 10,000.

**Pon'tifex**, one of the highest priestly colleges at Rome, to which was entrusted the over-

sight of all religious observances, public or private. Their institution, like that of all important matters of religion, was ascribed to Numa. The number of pontifices was originally probably six, all patricians, exclusive of the king, whose place, after the abolition of the monarchy, was taken by the pontifex maximus, or chief priest. The Ogulnian Law (300 B.C.) raised this number to eight, or, including the pontifex maximus, to nine, five of whom were to be plebeians. Sulla increased the number to 15 and Julius Cæsar to 16, including in both these instances the pontifex maximus. The duty of this dignitary was the inauguration of the priests, and in earlier time the care of the public records (*annales maximi*). He also superintended the sacred rites of Vesta, held his office for life, and could not leave Italy. The emperors afterward assumed this title until the time of Theodosius, and it was subsequently assumed by the Christian bishop of Rome. The pontifices also had the care of the calendar, and decided lawsuits which were connected with religion (hence the *jus pontificum*). The external badge of the pontifex, at least on solemn occasions and while engaged in the duties of his office, was a dress bordered with purple (*toga prætexta*), and a tapering hat made of the skins of sacrificed animals (*galerum*). Consult: Bouchè-Leclercq 'Les Pontifes de l'ancienne Rome' (1871); Mommsen, 'Römisches Staatsrecht' (1887-8); Wissowa, 'Religion und Kultus der Römer' (1902).

**Pontifical Orders.** See ORDERS, ROYAL.

**Pontigny**, pŏn-tên-yê, France, a village on the left bank of the Serein, in the department of Yonne, on the railway between Laroche and Isle-Angely. Its abbey, founded in 1114 by monks from Cîteaux, was itself the mother abbey of 43 monasteries. Thomas à Becket, St. Edmund of Canterbury, and Stephen Langdon spent their exile here, and St. Edmund died and was buried in the monastery, which was destroyed in the Revolution. The abbatial church is one of the finest examples of Cistercian architecture. Consult Chaillon des Barres, 'L'Abbaye de Pontigny' (1844).

**Pontine** (pŏn'tên) **Marshes**, Italy, a swampy plain, 18 to 30 miles long and 6 to 10 miles wide, lying 25 miles southeast of Rome, bounded on the south and west by the Tyrrhenian Sea and sand dunes covered with oaks, and on the east by Monti Lepini. Only a small part of this large area is actually marshy, but enough to make the whole region and much of its surroundings very unhealthy, the marsh vapors being carried to Rome itself by the south wind and being probably the cause of the Roman fever. In the early days of the Roman republic the Volscians possessed the Ager Pometinus, possibly so named from Suessa Pometia, one of its cities, and by elaborate engineering made it habitable and fertile. But the inhabitants of its 33 cities were conquered and driven out by the Romans in 358 B.C., and the land soon became dangerous; even in 312 B.C. its centre was pierced by the great Appian Way built by Appius Claudius. Cethegus attempted to drain the marsh about 160 B.C. Julius Cæsar planned to turn the Tiber into it, but died before the undertaking was commenced. Augustus built several canals, and after him Nerva, Trajan, Theodoric, and 18 popes attempted to better conditions. A law



## PONTOON — PONZA ISLANDS

passed in 1899 by the Italian government voted 7,000,000 lire to complete the work, which is estimated to take 24 years. Consult: Blanchère, 'La Malaria de Rome et le Drainage antique' (1882); Berti, 'Paludi Pontiche' (1884); Donat, 'Die Pontinischen Sümpfe' (1898).

**Pontoon'**, in military engineering a flat-bottomed boat, or any light and buoyant framework or floating body, used in the construction of a temporary bridge for the passage of troops over a river or arm of the sea. As pontoons form a part of the equipment of an army they must be as light in structure as is consistent with safety. The pontoons used by armies have differed greatly at different times, the two chief types being a kind of undecked boat, and a decked boat or close cylinder. The introduction of pontoons may be considered to date from the 18th century, although long previous to this similar means were used for the passage of streams. Darius passed the Hellespont and Danube by pontoon bridges.

**Pontormo, Jacopo Carucci** (commonly known as JACOPO DA PONTORMO), Italian painter: b. Pontormo, near Florence, 1494; d. Florence 1557. He was a pupil of Andrea del Sarto and painted history and portraits. At 13 he was left an orphan and sent to live at Florence as a pupil of Leonardo da Vinci. He also studied under Pietro di Cosimo and Mariotto Albertinelli. His early work won the approval of both Raphael and Michelangelo, who foretold his future greatness. His pictures are often mistaken for those of Andrea, and the best of them are those produced soon after he had been dismissed from the school of del Sarto who, it is said, had grown jealous of him. He however, altered his style several times, and took at last to imitating Albert Dürer. His work deteriorated in his latter years and when he admitted the public to see his 'Deluge' and 'Last Judgment,' frescoes which he had painted in the chapel of San Lorenzo, his work met with such bitter criticism that he is said to have died of mortification. Pontormo remained a master of design to the end of his days, but his coloring, once rich and harmonious, lost all its grace as he neared his three score years. He was a great portrait painter and some of his works in his department have been attributed to Raphael or Andrea del Sarto. His best works are at Florence, but among his finest portraits are 'A Cardinal' (in the Borghese Palace at Rome); 'Baccio Bandinelli, the Sculptor' (at Milan); 'Portrait of a Boy' (in the London National Gallery). There is a fine 'Holy Family' of his, with life size figures in the Prado Museum, Madrid.

**Pon'tus**, in ancient geography, a country of northeastern Asia Minor, originally the part of Cappadocia lying between Armenia and Colchis and the Halys River; called first Cappadocia on the Pontus (that is, Euxinus, or Black Sea), and then simply Pontus. The country on the east and south is mountainous, but along the coast there are large and fertile plains. A son of the Persian king Darius, Artabazes, received Pontus as a separate satrapy, with the right to transmit it as an inheritance to his posterity. One of his successors, Mithridates (about 400 B.C.), assisted the younger Cyrus, and refused to pay tribute to Artaxerxes. His son, Ariobar-

zanes I. (363-337), made himself independent during the general insurrection of the governors of Asia Minor against Artaxerxes II. Mithridates II. (337-302) transferred his kingdom voluntarily to Alexander. Afterward, in the division of his empire in 322, it fell to Antigonus. His successor, Mithridates III. (302-266), enlarged his paternal kingdom by conquests, and was succeeded by his son Ariobarzanes III., who reigned from 266 to about 240 B.C., and he again by his son Mithridates IV., whose reign extended to about 190 B.C. He drove back the Gauls, who at various times in the course of the 3d century B.C. invaded Asia Minor, formed settlements there, and attacked Pontus shortly after his accession. Pharnaces I., who succeeded Mithridates IV., and reigned till about 156 B.C., took possession of Sinope, and made it his residence. Mithridates the Great in 124 succeeded his father, in whose time Phrygia had become a part of Pontus. He carried on bloody wars with Rome until his death; at last he submitted to Pompey, and killed himself, 63 B.C., from despair. The western part of Pontus was then annexed to Bithynia, and the remaining parts given away to the chiefs of some of the adjoining states. Pharnaces II., the treacherous son of Mithridates, obtained only Bosphorus, and when he attempted to conquer again his paternal kingdom was vanquished by Cæsar, and put to death by Asander, who had made himself king of Bosphorus. Still his son Darius received through Antony a part of Pontus. Polemon, who at the same time possessed the kingdom of Bosphorus, Asia Minor, and Colchis, was his successor. After the death of his widow, Pythodoris, Polemon II. succeeded, as king of Pontus, 39 A.D. Nero took Bosphorus from him, and Pontus, under the name of Pontus Polemoniacus, became, after Polemon's death, a Roman province. When the Latins in 1204 again conquered Constantinople Alexius Comnenus founded a new kingdom in Pontus, which remained until Mohammed II. united it in 1461 with his great conquests. Consult Meyer, 'Geschichte des Königreichs Pontus' (1879).

**Pontus Euxinus**, ūk-sī'nūs, the ancient name for the Black Sea, still called the Euxine. The name, signifying in Greek "hospitable," is supposed to have been given as a good omen to this dangerous sea.

**Ponz, pōnth, Antonio**, Spanish painter, archæologist and art critic: b. Spain 1725; d. there 1792. He became an art pupil of Richart at Valencia, where he had been sent to study literature and metaphysics and subsequently lived at Madrid and Rome (1751), but returned to his native land (1760) and received a commission to paint a series of portraits of Spanish authors for the Escorial. Among his published works is 'Viaje de España,' in which he relates his experiences as a commissioner appointed to collect paintings and statuary from disused monasteries. The book is full of art criticisms and sketches of Spanish social life of the period. He also wrote 'Viaje fuera de España,' an account of travels through England and France.

**Ponza (pōn'zä) Islands**, or **Pontine Islands**, two small groups of volcanic islands on the west coast of Italy, 20 miles from the Gulf of Gaeta and not far from the Pontine Marshes. The larger and more westerly group



## POOD — POONA

belongs to the department of Gaeta in the province of Caserta, and consists of: Ponza, which attains at Monte Guarda a height of 900 feet, is 4 miles long and two thirds of a mile wide, was the place where Tiberius banished Germanicus' son, where Caligula sent his sisters, and Domitian banished Flavia Domitillia, and (1901) had a population of 4,560; Zandone (Lat. Sinone), further north with a cloister at the summit of its mountain; and Palmarola (Lat. Palmaria), whose rude and wild inhabitants brought upon the island the repute of being the home of the Devil. In the second group are Santo Stefano, the most easterly of the Ponza Islands, and Ventotene (Lat. Pandataria), the place of banishment of Julia, Augustus' daughter, of Octavia (q.v.), Nero's wife, and of Agrippina, wife of Germanicus. Pop. (1901) of the second group 1,859.

**Pood**, or **Pud**, a Russian weight of 40 Russian pounds, equivalent to 36 pounds of avoirdupois.

**Poodle**. See Dog.

**Pook, Samuel Hartt**, American naval constructor: b. Brooklyn, N. Y., 17 Jan. 1827; d. Washington, D. C., 30 March 1901. He was graduated from the Portsmouth Academy, N. H., in 1843 and became a shipbuilder, afterward settling in Boston, where as a naval architect he was engaged in building several clipper ships. At the outbreak of the Civil War he entered the government service, superintended the construction of the ironclad Galena and assisted in building the Monitor. He was appointed assistant naval constructor in the United States service in 1866, promoted naval constructor in 1871, and served in different navy yards until his retirement in 1899.

**Pool, Maria Louise**, American novelist: b. Rockland, Mass., August 1841; d. there 19 May 1898. For several years she was a contributor to the New York *Evening Post* and was also connected with the New York *Tribune*. She excelled in descriptions of life in New England and among her works are: 'In Buncombe County'; 'A Vacation in a Buggy' (1887); 'Tenting at Stony Beach' (1888); 'Rowena in Boston' (1892); 'Mrs. Keats Bradford' (1892); 'In a Dike Shanty' (1896); 'In the First Person' (1898).

**Pool**, or **Pooling**, in commerce and finance, a combination intended by concert to make or control changes in current marked rates. In pooling railroad interests the common method of dividing the traffic between competing lines, is to pool the receipts and to redistribute them on percentages based upon experience and decided by an arbitrator.

**Pool**, a game. See BILLIARDS.

**Poole, John**, English dramatist: b. England 1786; d. London 5 Feb. 1879. His success as a dramatist came early in life, and beside his plays he wrote several satirical and humorous books. His dramas were played by the leading actors of the day and were almost invariably successful. His fame, however, rests principally upon the widely popular comedy, 'Paul Pry' (1825), and his farce, 'Twixt Cup and Lip' (1826). Other plays of his that may be named are: 'Hamlet Travestie' (1813); 'Who's Who, or the Double Imposture' (1815); 'Deaf as a Post' (1823); 'The Wife's Strata-

gem' (1827); 'Lodgings for Single Gentlemen' (1829). He also wrote the satirical sketches: 'Little Pedlington and the Pedlingtonians' (1839); 'Comic Miscellany' (1845); etc.

**Poole, Matthew**, English compiler: b. York 1624; d. Amsterdam 12 Oct. 1679. He studied at Emmanuel College, Cambridge, and took orders, but in 1662 was ejected by the Act of Uniformity from his church of St. Michaelle-Querne in London, and turned his leisure to good account by spending ten years on his 'Synopsis Criticorum Biblicorum,' an attempt to condense into one work the opinions of all the biblical critics of all times and countries previous to his own. The work extended to five large folio volumes, and indicates great labor and research as well as no small degree of learning; but it is now of little use, later criticism and research having done much to supersede it. Poole also wrote 'Annotations upon the Holy Bible' (1683-5), and other works, and took an active part in the leading controversies of his time, especially those with the Socinians and Roman Catholics. The intolerant spirit of the Stuarts compelled him to seek an asylum at Amsterdam.

**Poole, Reginald Lane**, English educator and author: b. London 29 March 1857. He was educated at Oxford and at the University of Leipsic, in 1880-1 was assistant in the department of manuscripts in the British Museum and since its establishment in 1885 has been editor of the 'English Historical Review.' He has lectured in modern history at Jesus College, Oxford, since 1886 and is also lecturer on diplomacy in the University of Oxford. He has published: 'A History of the Huguenots of the Dispersion' (1880); 'Sebastian Bach' (1882); 'Wycliffe and the Movement for Reform' (1889); edited Wycliffe 'De Civili Dominio Liber I' (1885), and 'De Dominio Divino' (1890); 'Historical Atlas of Modern Europe' (1897-1902); etc.

**Poole, William Frederick**, American librarian: b. Salem, Mass., 24 Dec. 1821; d. Evanston, Ill., 1 March 1894. Graduated from Yale in 1849, he became assistant librarian of the Boston Athenæum in 1851, and in 1852 librarian of the Boston Mercantile Library. From 1859 to 1869 he was librarian of the Athenæum, in 1869-73 of the Cincinnati Public Library, which he organized, and in 1874-87 of the Chicago Public Library, whose formation he also directed. From 1887 he was in charge of the Newberry Library at Chicago, founded by W. L. Newberry. In 1885-7 he was president of the American Library Association, and in 1877 vice-president of the international conference of librarians at London. He was best known for his 'Index to Periodical Literature,' originally begun in 1848, in the preparation of which he was assisted by many librarians. His writings include 'Cotton Mather and Salem Witchcraft' (1869), and 'Anti-Slavery before 1800' (1887).

**Poo'na**, or **Puna**, India, (1) the capital of a district of the Deccan division, Bombay, at the confluence of the Mula and Muta, tributaries of the Bima in a plain nearly 2,000 feet above the sea, 119 miles eastward from Bombay by the Great Indian Peninsula Railway. It is well built and has a European aspect. Its main street is wide, and lined with buildings orna-



## POOP-DECK — POPE

mented with paintings and carvings; it has numerous pagodas; the Deccan college for classics, mathematics, and philosophy; and a college of science, with special training in civil engineering; a training college for teachers of vernacular and Anglo-vernacular schools, a female normal school, a government first grade high school, besides other schools; legislative council hall, public library, civil hospital, arsenal, and barracks. The European cantonments are on the north, where most of the Europeans reside. In the town are the ruins of the palace of the Peishwa or head of the Mahratta confederacy, whose capital was Poona. This station is famed for salubrity, and from July to November is the seat of the Bombay government. It is an important military post, and has some manufactures of silver and gold jewelry, combs, dice, and other small articles of ivory, silk and cotton fabrics, and articles of brass, copper, iron, and clay. Important works supply Poona with water from the Mula Valley, 10 miles above Poona. Pop. (1901) 111,385. (2) The district is bounded on the north by the district of Ahmednagar, west by the Ghats, south by Satara and east by the Nizam's dominions. Area, 5,369 square miles. It is an elevated table-land, watered by the Bima and its tributaries, and abounding in isolated heights, formerly crowned with strong fortresses. The villages are mostly open, but sometimes surrounded by hedges of cactus. Pop. (1901) 995,074, chiefly Mahrattas.

**Poop-deck**, in ship-building, a deck raised over the after-part of a spar-deck, sometimes called the *round-house*. Ships formerly had several poops, the one above the other.

**Poor, Enoch**, American soldier: b. Andover, Mass., 21 June 1736; d. Hackensack, N. J., 8 Sept. 1780. He engaged as a shipbuilder at Exeter, N. H., until the battle of Lexington, when he raised a regiment of which he was commissioned colonel. He received rank of brigadier-general in 1777, and at Saratoga he performed brilliant service, his brigade leading the advance and bearing a heavy share of the American losses. He joined Washington in Pennsylvania after the surrender of Burgoyne, shared with him the winter at Valley Forge and in 1778 distinguished himself at the battle of Monmouth. He assisted in the campaign against the Six Nations in 1779 and by his able co-operation with General Sullivan gained advantages which resulted in the victory at Newtown. In 1780 at the request of Lafayette he was transferred to the leadership of a brigade of light infantry under his command. Shortly after he contracted the fever from which he died.

**Poor and Poor-laws**. See PAUPERISM.

**Poor Brothers of Saint Francis Seraphicus**. See ORDERS, RELIGIOUS.

**Poor Clares**. See CLARE, SAINT; ORDERS, RELIGIOUS.

**Poor Handmaids of Jesus Christ**. See ORDERS, RELIGIOUS.

**Poor Richard's Almanac**, an American almanac published by Benjamin Franklin (q.v.) from 1732 to 1757. It was noted for the maxims it contained.

**Poor Robin**, the name of an English almanac which first appeared in 1663. It was published continuously until 1828. The title page bore the inscription: "Written by Poor

Robin Knight of the Burnt Island; well-wisher to the Mathematics."

**Poor-soldier**. See FRIAR-BIRD.

**Poore, Benjamin Perley**, American journalist: b. Newbury, Mass., 2 Nov. 1820; d. Washington, D. C., 30 May 1887. Placed by his father in a military school to prepare for West Point he ran away and apprenticed himself to a printer. In 1838 his father purchased for him 'The Southern Whig,' which he edited until 1840 when he became an attaché at the United States legation in Belgium. In 1844-8 he was engaged in France in making a collection of historical manuscripts for the State of Massachusetts, and he also traveled extensively in Europe, Egypt, and Palestine as correspondent for the Boston 'Atlas' in 1843-8. On his return to the United States in 1848 he edited the Boston 'Bee' and 'Sentinel' until 1854, when he became Washington correspondent for the Boston 'Journal' and several other newspapers, a position he occupied for 30 years, with the exception of a brief period as major in the Union army. In 1884 he became clerk of the Senate Committee on Printing Records and edited several publications concerning government affairs. Among his works are: 'The Rise and Fall of Louis Philippe' (1848); 'The Conspiracy Trial for the Murder of President Lincoln' (1865); 'Reminiscences of Sixty Years in the National Metropolis' (1886); etc.

**Poore, Henry Rankin**, American artist: b. Newark, N. J., 21 March 1859. He studied art at the National Academy of Design in New York and also at the Pennsylvania Academy of Fine Arts under Peter Moran. Later at Paris he was a pupil of Luminais and Bouguereau. He has devoted himself mainly to animal subjects, especially dogs, and among his canvases are: 'The Plowing of the Ephrata Brethren' (1894); 'Hounds in Winter' (1898); and 'Clearing Land' (1903). He has published 'Pictorial Composition and the Critical Judgment of Pictures' (1903).

**Popayan**, pō-pä-yän', Columbia, capital city of the department of Cauca, near the left bank of the Rio Cauca, in a plain plentifully watered by that river, 228 miles southwest of Bogota, at the foot of the volcanoes Puracé and Sotara. An episcopal city, Popayan has a college and a seminary for the training of priests. The products of its woolen mills and of the farms of the surrounding country are the main articles of commerce. The city was founded in 1536, was nearly destroyed by an earthquake in 1834. Pop. about 8,500.

**Pope**, the title of the Bishop of Rome, Supreme Pontiff of the Roman Catholic Church. (See PAPACY; TEMPORAL POWER; CATHOLIC CHURCH, ETC.) The following list of Popes has been compiled from the most careful authorities, but the dates up to the 3d century are only approximate, the chronology being very obscure previous to that time:

Peter . . . . .	41-67	Telesphorus . . . . .	127-138
Linus . . . . .	67-79	Hyginus . . . . .	138-142
Cletus or Anen-		Pius I. . . . .	142-154
cletus . . . . .	79-91	Anicetus . . . . .	154-165
Clement I. . . . .	91-99	Soter . . . . .	165-174
Evaristus . . . . .	99-109	Eleutherus . . . . .	174-189
Alexander I. . . . .	109-116	Victor I. . . . .	189-198
Sixtus I. . . . .		Zephyrinus . . . . .	198-217
(Xystus) . . . . .	116-127	Callixtus I. . . . .	217-222



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Urban I. ....	222-230	Boniface VI. ...	896	Martin V. ....	1417-31	Leo XI. ....	1605
Pontianus ....	230-235	Stephen VII. ...	896-897	Eugenius IV. ...	1431-47	Paul V. ....	1605-21
Anterus ....	235-236	Romanus ....	897	Nicholas V. ....	1447-55	Gregory XV. ....	1621-23
Fabianus ....	236-250	Theodorus II. ..	897	Callixtus III. ...	1455-58	Urban VIII. ....	1623-44
Cornelius ....	251-253	John IX. ....	898-900	Pius II. ....	1458-64	Innocent X. ....	1644-55
Lucius I. ....	253-254	Benedict IV. ...	900-903	Paul II. ....	1464-71	Alexander VII. ..	1655-67
Stephen I. ....	254-257	Leo V. ....	903	Sixtus IV. ....	1471-84	Clement IX. ....	1667-69
Sixtus II. ....	257-259	Christopher ....	903-904	Innocent VIII. ..	1485-92	Clement X. ....	1670-76
Dionysius ....	259-268	Sergius III. ....	904-911	Alexander VI. ..	1492-1503	Innocent XI. ...	1676-89
Felix I. ....	269-274	Anastasius III. ..	911-913	Pius III. ....	1503	Alexander VIII. ..	1689-91
Eutychianus ....	275-283	Lando ....	913-914	Julius II. ....	1503-13	Innocent XII. ..	1691-1700
Caius ....	283-296	John X. ....	914-928	Leo X. ....	1513-21	Clement XI. ....	1700-21
Marcellinus ....	296-304	Leo VI. ....	928-929	Adrian VI. ....	1522-23	Innocent XIII. ..	1721-24
Mucellus ....	308-309	Stephen VIII. ..	929-931	Clement VII. ...	1523-34	Benedict XIII. ..	1724-30
Eusebius ....	309 or 310	John XI. ....	931-935	Paul III. ....	1534-49	Clement XII. ...	1730-40
Miltiades ....	311-314	Leo VII. ....	936-939	Julius III. ....	1550-55	Benedict XIV. ...	1740-58
Sylvester ....	314-335	Stephen IX. ....	939-942	Marcellus II. ...	1555	Clement XIII. ..	1758-69
Marcus ....	336	Martin III. ....	942-946	Paul IV. ....	1555-59	Clement XIV. ...	1769-74
Julius I. ....	337-352	Agapetus II. ....	946-955	Pius IV. ....	1559-65	Pius VI. ....	1775-99
Liberius ....	352-366	John XII. ....	955-963	Pius V. ....	1566-72	Pius VII. ....	1800-23
Damasus I. ....	366-384	Leo VIII. ....	963-964	Gregory XIII. ..	1572-85	Leo XII. ....	1823-29
Siricius ....	384-399	Benedict V. ....	964-965	Sixtus V. ....	1585-90	Pius VIII. ....	1829-30
Anastasius I. ....	399-401	John XIII. ....	965-972	Urban VII. ....	1590	Gregory XVI. ...	1831-46
Innocent I. ....	401-417	Benedict VI. ...	973-974	Gregory XIV. ...	1590-91	Pius IX. ....	1846-78
Zosimus ....	417-418	Benedict VII. ..	974-983	Innocent IX. ....	1591	Leo XIII. ....	1878-1903
Boniface I. ....	418-422	John XIV. ....	983-984	Clement VIII. ..	1592-1605	Pius X. ....	1903
Celestine I. ....	422-432	Boniface ....	984-985				
Sixtus III. ....	432-440	John XV. ....	985				
Leo I. ....	440-461	John XVI. ....	986-996				
Hilarius ....	461-468	Gregory V. ....	996-999				
Simplicius ....	468-483	Sylvester II. ...	999-1003				
Felix III. ....	483-492	John XVII. ....	1003				
Gelasius I. ....	492-496	John XVIII. ....	1003-09				
Anastasius II. ....	496-498	Sergius IV. ....	1009-12				
Symmachus ....	498-514	Benedict VIII. ..	1012-24				
Hormisdas ....	514-523	John XIX. ....	1024-32				
John I. ....	523-526	Benedict IX. ....	1033-44				
Felix IV. ....	526-530	Gregory VI. ....	1045-46				
Boniface II. ....	530-532	Clement II. ....	1046-48				
John II. ....	533-535	Damasus II. ....	1048				
Agapetus I. ....	535-536	Leo IX. ....	1049-54				
Silverius ....	536-537	Victor II. ....	1055-57				
Virgilius ....	537-555	Stephen X. ....	1057-58				
Pelagius I. ....	556-561	Benedict X. ....	1058-59				
John III. ....	561-574	Nicholas II. ....	1059-61				
Benedict ....	575-579	Alexander II. ...	1061-73				
Pelagius II. ....	579-590	Gregory VII. ...	1073-85				
Gregory I. ....	590-604	Victor III. ....	1086-88				
Sabinianus ....	604-606	Urban II. ....	1088-99				
Boniface III. ....	607-608	Paschal II. ....	1099-1113				
Boniface IV. ....	608-615	Gelasius II. ....	1118-19				
Deusdedit ....	615-618	Callixtus II. ....	1119-24				
Boniface V. ....	619-625	Honorius II. ....	1124-30				
Honorius I. ....	625-638	Innocent II. ....	1130-43				
Severinus ....	640	Celestinus II. ...	1143-44				
John IV. ....	640-642	Lucius II. ....	1144-45				
Theodorus I. ....	642-649	Eugenius III. ...	1145-53				
Martin I. ....	649-653	Anastasius IV. ..	1153-54				
Eugenius I. ....	654-657	Adrian IV. ....	1154-59				
Vitalianus ....	657-6, 2	Alexander III. ..	1159-81				
Adeodatus ....	672-6, 0	Lucius III. ....	1181-85				
Donus ....	676-6, 8	Urban III. ....	1185-87				
Agatho ....	678-682	Gregory VIII. ...	1187				
Leo II. ....	682-684	Clement III. ....	1188-91				
Benedict II. ....	684-685	Celestinus III. ..	1191-98				
John V. ....	685-686	Innocent III. ....	1198-1216				
Conon ....	686-687	Honorius III. ...	1216-27				
Sergius I. ....	687-701	Gregory IX. ....	1227-41				
John VI. ....	701-705	Celestinus IV. ...	1241				
John VII. ....	705-708	Innocent IV. ....	1242-54				
Sisinnius ....	708	Alexander IV. ...	1254-61				
Constantine I. ..	708-715	Urban IV. ....	1261-64				
Gregory II. ....	715-731	Clement IV. ....	1265-68				
Gregory III. ....	731-741	Gregory X. ....	1272-76				
Zacharias ....	741-752	Innocent V. ....	1276				
Stephen II. ....	752	Adrian V. ....	1276				
Stephen III. ....	752-757	John XXI. ....	1276-77				
Paul I. ....	757-767	Nicholas III. ....	1277-80				
Constantine II. ...	767-768	Martin IV. ....	1281-85				
Stephen IV. ....	768-772	Honorius IV. ...	1285-87				
Adrian I. ....	772-795	Nicholas IV. ....	1288-92				
Leo III. ....	795-816	Celestinus V. ....	1294				
Stephen V. ....	816-817	Boniface VIII. ..	1295-1303				
Paschal I. ....	817-824	Benedict XI. ....	1303-04				
Eugenius II. ....	824-827	Clement V. ....	1305-14				
Valentinus ....	827	John XXII. ....	1316-34				
Gregory IV. ....	827-844	Benedict XII. ...	1334-42				
Sergius II. ....	844-847	Clement VI. ....	1342-52				
Leo IV. ....	847-855	Innocent VI. ...	1352-62				
Benedict III. ....	855-858	Urban V. ....	1362-70				
Nicholas I. ....	858-867	Gregory XI. ....	1370-78				
Adrian II. ....	867-872	Urban VI. ....	1378-89				
John VIII. ....	872-882	Boniface IX. ....	1389-1404				
Martin II. ....	882-884	Innocent VII. ...	1404-06				
Adrian III. ....	884-885	Gregory XII. ....	1406-09				
Stephen VI. ....	885-891	Alexander V. ....	1409-10				
Formosus ....	891-896	John XXIII. ....	1410-15				

Pope, Alexander, English poet: b. in Lombard street, London, 21 May 1688; d. at Twickenham, on the Thames, Middlesex, 30 May 1744. His parents were Roman Catholics. His father, to whom the poet ascribed a not-yet-established connection with the Earls of Downe, was a linen-draper "who dealt in Hollands wholesale"; his mother, Edith Turner, a second wife, was the daughter of William Turner, of Towthorpe, in Yorkshire. About 1700, Pope's father, having prospered in his business, retired to a small property he had purchased at Binfield, in Windsor Forest. Pope was not a strong child. When he was born, his parents were no longer young; and from his father he inherited a frail constitution, from his mother a life-long tendency to headache. But he had in his boyhood, and retained through life, a voice like a nightingale. His education was desultory, and mostly derived from Romish ecclesiastics. Writing he taught himself by copying type. From his first school at Twyford, near Winchester, he was removed because he had been severely punished for lampooning his master at the tender age of nine. At a subsequent school in London, kept by one Thomas Deane, he learned little; but he gave a taste of his future quality by tacking together an acting play from Ogilby's Homer, in which the school gardener personated Ajax. Leaving Deane, he became the director of his own studies at his home in the Forest. Here it is worth while to let him speak for himself: "When I had done with my priests, I took to reading by myself, for which I had a great eagerness and enthusiasm, especially for poetry; and in a few years I had dipped into a great number of the English, French, Italian, Latin, and Greek poets. This I did without any design, but that of pleasing myself: and got the languages, by hunting after the stories in the several poets I read; rather than read the books to get the languages. I followed everywhere as my fancy led me, and was like a boy gathering flowers in the fields and woods, just as they fall in his way. These five or six years I still look upon as the happiest part of my life." (Spence's 'Anecdotes,' by Singer, 1820, p. 193.)

To this self-education his biographers have, with reason, attributed some of the peculiarities of his character and genius. His unremitting application no doubt injured his health, and tended to make his life the "long disease" he



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afterwards called it. Its enforced seclusion, coupled with the disabilities to which Papists were then exposed, fostered some of that—to give it its mildest name—disingenuousness, which came to be one of his worst faults. On the other hand, his natural parts were so keen, and his critical faculty so early matured, that it may be doubted whether any more liberal training would have better equipped him for what he afterwards achieved. He is an excellent illustration of Boswell's dictum about the superior flavor of animals who "feed excur-sively" as contrasted with those who are "cooped up." One result of his course of study was that he began early to versify, or, as he puts it, "lisp in numbers." His first dramatic essay has already been referred to, and he is said to have composed another on the Legend of St. Genevieve. A third effort was an epic on Alcander, Prince of Rhodes, being four books of a thousand lines each on the Dryden pattern, which opened under water in the Archipelago with a description of the Court of Neptune. By his own account this must have been a medley of many notes. "There was Milton's style in one part, and Cowley's in another; here the style of Spenser imitated, and there of Statius; here Homer and Virgil, and there Ovid and Claudian" (Ib. pp. 24, 277, 279). 'Alcander' he afterwards burned; but detached couplets found their way into later works. He also translated part of Ovid's 'Metamorphoses,' of Statius, and Cicero de Senectute. His chief adviser was his father, who criticised his "rhymes," and ruthlessly "sent him down" when he did not think them good enough. The Alcander epic occupied him from thirteen to fifteen (Ib. p. 279), when he went to London to learn French and Italian. His education was completed by much study of Temple and Locke, of Rapin and Bossu, and of Dryden's "Prefaces."

Already, while living at Binfield, he had made friends who served to influence his tastes. One was the old scholar and diplomatist, Sir William Trumbull of Easthampstead Park, who advised him to translate Homer; another, the wit and man of fashion, Henry Cromwell; a third, the veteran dramatist Wycherley, who was foolish enough to submit his senile poetical effusions to the criticisms of his sharp-eyed junior, a circumstance which has generally been held to have brought about a cooling of their friendship, although the manipulation of Pope's correspondence has not made it an easy matter to understand the actual attitude of affairs (Courthope's Life, pp. 73, 387-407). By Wycherley, Pope was introduced to William Walsh of Abberley, in Worcestershire, the critic and minor poet, who enjoined his young friend to make correctness his "study and aim" (Spence, p. 280), in other words, "to study not only accuracy of expression," but also "propriety of design and justice of thought and taste" (Courthope's Life, p. 25). It has been shrewdly suggested that in all probability Pope's native bias to these things suggested the judicious counsels of the critic whom Pope afterwards styles "knowing Walsh." Other literary luminaries with whom he became acquainted at this period were Garth of 'The Dispensary,' Congreve, and Lord Lansdowne.

Pope's first important publication was his 'Pastorals,' (1709). After the 18th century fashion, these were much circulated in MS., and they were already well known to most of the contemporary literati long before they were printed. They appeared at the beginning of the sixth volume of Tonson's 'Poetical Miscellanies' (which also included a modernization by Pope of January and May, Chaucer's 'Merchant's Tale'); and exhibiting, as Johnson says "a series of versification which had in English poetry no precedent," met with complete success. Two years later, appeared the 'Essay on Criticism,' said to have been written in the year in which the 'Pastorals' were printed. In this poem Pope aimed at occupying much the same place in English as Horace had occupied in Latin with the 'Ars Poetica,' and Boileau in French with the 'Art Poétique'; and the performance, though of necessity a *cento*, was certainly an extraordinary one for a youth of three and twenty. Addison, who noticed it in 'Spectator,' No. 253, certainly did not "damn it with faint praise" when he called it "a masterpiece in its kind," which contained things that "would have been very much admired in an Ancient Poet," though he regretted the freedom with which the writer already spoke of his brother moderns. But the commendation shows how closely Pope had followed the injunctions of Walsh; and moreover, fully justified him in offering to Steele's and Addison's paper (No. 378), his next effort, the 'Messiah,' a sacred Eclogue modeled on the 'Pollio' of Virgil. By this time his style was formed, and his metrical skill developed to an extraordinary point of excellence. Nothing was wanting but a theme suited to his peculiar gifts.

This theme he found in a little piece which, as a matter of fact, in its first form, preceded the 'Messiah,' namely the heroi-comic 'Rape of the Lock,' contributed in May 1712, to another 'Poetical Miscellany,' that of Bernard Lintot. It is a flawless piece of executive jewel-work, the fragile theme of which is the theft of a lock of hair by Lord Petre, a Roman Catholic peer, from a noted beauty, Miss Arabella Fermor. Out of this trifling amatory escapade had arisen a family estrangement, which Pope was invited to reconcile by his rhymes. His poem was more successful than his purpose. Upon this he extended his plan, and improved it. Not content with the "let well alone" of Addison, who called it "*merum sal*,—a delicious little thing," Pope proceeded to weave skilfully into his first sketch a subordinate Rosicrucian machinery of sylphs and gnomes, which eventually proved the best part of what Johnson justly describes as "the most airy, the most ingenious, and the most delightful of all his compositions."

He was now launched, and his future popularity assured. His next works were 'Windsor Forest,' of which he borrowed the design from Denham's 'Cooper's Hill'; and the 'Ode for Music on Saint Cecilia's Day,' a competition with Dryden suggested by Steele. Both these came out in 1713. In 1715, following the 'Lock' in its extended form (1714) and another imitation of Chaucer, 'The Wife of Bath,' came a second modernization from the same source the longer 'Temple of Fame.' But the great event of 1715 was the publication in June of



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the first four books of the translation of the 'Iliad.' Proposals for this had been issued in 1713, and the generous advocacy of a new friend, Swift, had largely swelled the subscription list. The task progressed until, in 1720, the Iliad was completed in six quarto volumes, dedicated to Congreve. Then came the 'Odyssey,' in which the poet was assisted by two subordinate "hands," William Broome, 1683-1745, and Elijah Fenton (1683-1730). By these two works Pope must have cleared from £8,000 to £9,000. But though he subsequently boasted that, thanks to Homer, "he was indebted to no prince or peer alive," it is only just to recall the fact that while he was right in contending that no bounty was involved, his subscription list would have been considerably contracted if his patrician supporters were withdrawn. For this famous paraphrase itself, it must be admitted that its fame has somewhat—perhaps too much—faded at the present time. It may be that, in Gibbon's epigram, "it is a portrait with every merit but that of faithfulness to the original,"—it may be that, as Bentley said "it is a pretty poem, which must not be called Homer"; but it is at least a triumph of uniform versification, and a surpassing example of sustained achievement. In that full-wigged Age of Anne, for the meridian of which it was expressly calculated, it bulks largest of the poetical output; and its influence extended far beyond its period of production. No one has written more indulgently of it than one of Pope's modern rivals, Professor Conington: "It has been—I hope it is still—the delight of every intelligent schoolboy; they read 'of kings and heroes and of mighty deeds' in language which, in its calm, majestic flow, unhasting, unresting, carries them on as irresistibly as Homer's own could do, were they born readers of Greek; and their minds are filled with a conception of the heroic age, not indeed strictly true, but almost as near the truth as that which was entertained by Virgil himself." ('Misc. Writings,' 1872, i. 43.)

A minor incident connected with the 'Iliad' was the misunderstanding between the translator and his first critic, Addison, to which it gave rise. Pope's frailty of constitution led him easily to magnify mole hills, and his literary susceptibilities were painfully morbid. His relations, moreover, with Addison had already become strained. Addison, as we have seen, had deprecated that re-casting of 'The Rape of the Lock,' which subsequently proved so fortunate. Pope's suspicious nature resented this advice, especially in view of the result. When again Pope championed Addison against the rancorous old critic, John Dennis, Addison had not approved—he could hardly be expected to approve—the peculiarly Swiftian character of Pope's warfare. Finally, by an unfortunate coincidence, when Pope's 'Iliad' was announced, a rival version was put forward by Addison's bosom friend, Thomas Tickell (1686-1740), which Pope perhaps not unnaturally regarded as prompted, if not edited, by Addison himself. Modern criticism has failed to find any valid ground for this supposition. But the cumulative result of Pope's irritation was the cruelly clever portrait of Addison as "Atticus" which, eighteen years after Addison's death, found its final place in the Prologue to the Satires

("Epistle to Arbuthnot"). Upon the faith of Spence's 'Anecdotes,' pp. 148-149, it was long held that Pope, in his first anger, had actually sent the lines to Addison; but this is now held not to be probable (Courthope's 'Life,' 1889, p. 161); and Spence's entire account is conjectured to be a fabrication by Pope arising out of his desire to establish beyond a doubt the fact that the character was not written after the death, but during the life of Addison. In any case, the "Atticus" is a matchless piece of writing, and (as even Addisonians must allow), in some particulars, presents—to quote Thackeray on Dennis's portrait of Steele—"a dreadful resemblance to the original."

After the already-mentioned 'Temple of Fame,' Pope's published works were the 'Elegy to the Memory of an Unfortunate Lady,' a poem probably idealized from the story of a Mrs. Weston of Sutton, whose relations with her husband had not been of the happiest (Courthope, 133); the 'Epistle of Eloisa to Abelard,' which is supposed to owe something of its passionate rhetorical imagery to the feelings entertained at this date by the writer for Lady Mary Wortley Montagu; and, in collaboration with Gay and Arbuthnot, the dramatic skit upon Dennis and others entitled 'Three Hours after Marriage' which ignominiously failed at Drury Lane in 1717, to which year the pieces above mentioned also belong. In 1725, appeared an edition of Shakespeare in six quarto volumes which has no more authority than that of Johnson. Then, in May 1728, came the first edition of *The Dunciad*, Pope's famous onslaught upon those swarming hacks and poetasters of the day, whom his heated imagination exaggerated into an army of personal enemies. In 1729 followed a more perfect edition with a dedication to Swift. Other issues succeeded; and, in 1742, was added a fourth book directed against dunces theologic and scientific. The scheme of the poem describes the elevation, with fitting ceremonial, of Lewis Theobald (who had earned Pope's hatred by certain merited strictures on his Shakespeare) to the throne of Dulness, then vacant by the death of Dryden's 'Mac Flecknoe' Shadwell,—

"without dispute  
Through all the realms of Nonsense absolute."

In 1742, Pope gratified a new antipathy by substituting Colley Cibber for Theobald, a change which can scarcely be said to have been an improvement. The Epos of the Dunces remains nevertheless a magnificent satire upon a subject which is not worthy of the powers it called forth, though it is perhaps the culminating example of the combative gifts of its author. Ruskin goes even so far as to call it "the most absolutely chiselled and monumental work 'executed' in our country" (Lectures on Art, 1870, p. 70).

Swift has the credit of eventually prompting the 'Duncaid.' Pope's next effort, the 'Essay on Man,' is inscribed to another "guide, philosopher and friend," Bolingbroke. "One truth is clear, Whatever is, is right"—which is the last line of the first of its four epistles, might be described as the key note of this attempt "to vindicate the ways of God to Man." The writer's metrical dexterity, his power of crystallising precept, and his executive skill generally, were never shown to greater advantage than in this



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work; but the consensus of criticism has come to the conclusion that he was not in complete sympathy with, if indeed he thoroughly comprehended, the philosophical tenets of the meteoric genius whom he terms "the master of the poet and the song." Hence critics like the late Sir Leslie Stephen have come to describe the arguments as "confused, contradictory, and often childish." Yet, although the poem labors under these disadvantages, and although, moreover, it is only part of an unfinished whole, it had an extraordinary popularity with its first public, and also on the Continent, where, in its translated form, it must have made its appeal by its matter rather than its manner.

To Bolingbroke also Pope owed what must ever be regarded as his greatest and most personal performances, his 'Moral Essays' and his 'Satires and Epistles.' The 'Moral Essays' appeared from 1720 to 1735; the 'Satires and Epistles' from 1733 to 1738. These last are unrivalled in their pungent criticism and portraiture of contemporary character and manners. "It is no paradox" said the late Rector of Lincoln College, Mark Pattison, "to say that these 'Imitations' are among the most original of Pope's writings. So entirely do they breathe the spirit of the age and country in which they were written that they can be read without reference to their Latin model" (Preface to 'Satires and Epistles').

The discussion of Pope's untiring literary labors has left his life somewhat in the background. In April 1716, not long after the appearance of the first instalment of his *Homer* he moved from Binfield to Chiswick, where he lived in what is now known as Mawson's Row. In 1717, his works had become numerous enough to fill a handsome folio volume which was issued by Tonson and Lintot, with its author's portrait engraved by George Vertue after Charles Jervas. In October of the same year, his father died; and he moved with his mother to a little villa at Twickenham in which he thenceforth resided, "twisting and twirling, and rhyming and harmonising" five acres of garden until it became "two or three sweet little lawns, opening into one another and surrounded with impenetrable woods." Here he received his friends, among others the Joseph Spence, to whom we owe the bulk of our *Popiana*. In 1733, his mother, to whom he had always shown an exquisite filial affection, and whom he tended lovingly to the last, died at an advanced age. Ten years later he himself was passing away, prematurely old, and worn out with asthma and dropsy, though scarcely fifty-five. To the end he continued to "dispense his morality" (in the form of his *Ethic* epistles), and to revise and rearrange his other poems. Finally he died at Twickenham, 30 May, 1744, and was buried in the middle aisle of the parish church, where 17 years later, a monument was erected to him by his literary executor, Bishop Warburton. In 1730 Gilliver had published a second volume of his poems; and in 1737-41 had appeared two corresponding volumes of his letters, etc. The story of these last,—of the artifices employed to secure their publication, of their manipulation and readjustment to suit the writer's own views would take too long to tell here. But the subject has been amply discussed in Dilke's 'Papers of a Critic,' 1875, in the

"Introduction to Pope's Correspondence" in vol. vi (1871) of Elwin and Courthope's 'Works,' and in Courthope's 'Life,' 1889.

Pope was never married. At one period of his career, he had cherished a passion for the brilliant Lady Mary Wortley Montagu, by whom he was encouraged and scorned, treatment for which he took his revenge fiercely in subsequent satires. But his greatest feminine friend was Miss Martha Blount of Mapledurham, an old acquaintance of the Binfield days, with whom he renewed his relations at Chiswick and Twickenham, and whose friendship he retained to the close of his life. He had spent three or four hours a day with her for 15 years, he said in 1730; and the companionship, which was prolonged for nearly 15 years more, seems always to have had a cheering effect upon his drooping and variable spirits. Into the tangle of gossip which has gathered about this connection, memorable among literary alliances, it is profitless to enter. But that Pope was devotedly attached to his blue-eyed goddess, there can be no manner of doubt.

Pope's character is so intimately connected with his personality, that it is impossible to omit here some description of his habits and appearance. Though amiable and attractive in childhood, his sedentary life and close application in early youth speedily affected a constitution not radically sound at the outset. He was remarkably frail and small (four feet six), and he rapidly became deformed. As already stated he was a martyr to headaches. In his diet he required to exercise the greatest caution; and he suffered cruelly for any deviation from his regimen. He was intensely susceptible to changes of temperature and climate. In his earlier days he was able to take horse exercise; but in his manhood he could not dress himself without help, nor could he come abroad without being wadded with furs and stiffened with buckram. That these things reacted upon his views of life can scarcely be contested. "He was the most irritable of the irritable race," says one contemporary; *Mens surva in corpore curvo*, says another. "He played the politician about cabbages and turnips," says a third. *Per contra*, it must be remembered that, however sensitive, artificial and vindictive, he was a devoted son and an attached friend. And at least he was a genuine *litterateur*.

As a poet his general position is easy to define. He was not a great lyrist; he was not a profound thinker; but he is a supreme artificer. Borrowing the heroic couplet from Dryden, he brought it, as the medium for didactic and satirical verse, to a pitch of perfection which has never been surpassed, though it has sometimes been made monotonous by imitation. He could not, as we have implied, originate; but he could decorate to any extent. Granted the theme, he could develop it; he could embroider it supremely; he could lend it every advantage in the way of condensed, perspicuous and epigrammatic exposition. The major part of his work is a triumphant exemplification of Addison's dictum that "Wit and fine Writing doth not consist so much in advancing Things that are new, as in giving Things that are known an agreeable Turn." This was Pope's chief function. With inspiration, with the unatttempted or unimagined in poetry, he had small



## POPE — POPLAR

concern. But he could express, in a given metrical form, and with faultless lucidity and finish, the best floating ideas in circulation at the time of writing. His gifts of wit and irony led him inevitably in the direction of satire; and his high-water mark is his 'Epistle to Arbuthnot,' which exhibits his varied and exceptional powers in their fullest diversity.

*Bibliography.*—There are several early lives of Pope of which that by Johnson ('Poets,' 1781); is the most important. Of later efforts, the most notable are Carruthers (1853-1857); Sir Leslie Stephen (1880); Courthope (1889). Of Pope's 'Works' there are editions by Warburton (1751); Warton (1797); Bowles (1806), and Roscoe (1824); but all these give place to the 10 vol. ed. by Elwin and Courthope (1871-89). Consult also: Spence's 'Anecdotes,' by Singer (1820); Dilke's 'Papers of a Critic,' (above mentioned); Mark Pattison, 'Essay on Man' (1869), and 'Satires and Epistles' (1872); Conington (above mentioned); Abbot's 'Concordance' (1875); and Montégut 'Revue des deux Mondes' (March 1888) for Pope's influence abroad).

AUSTIN DOBSON,  
*Author of 'Life of Goldsmith,' 'Life of Richardson,' etc.*

**Pope, Franklin Leonard**, American electrician: b. Great Barrington, Mass., 2 Dec. 1840; d. there 13 Oct. 1895. He was a telegraph operator in 1857, assistant engineer of the American Telegraph Company in 1862, and in 1864 while holding a similar position in the Russo-American Company made the first survey of the territory between British Columbia and Alaska. Later with Edison he invented the stock exchange "ticker," in 1872. He invented the rail circuit for automatically controlling electric block signals, was editor of the 'Electrical Engineer,' 1884-95; and president of the American Institute of Electrical Engineers in 1885. He published: 'Modern Practice of the Electric Telegraph' (1871); and 'Life and Work of Joseph Henry' (1879).

**Pope, John**, American soldier: b. Kaskaskia, Ill., 16 March 1822; d. Sandusky, Ohio, 23 Sept. 1892. He was graduated from the United States Military Academy in 1842, was assigned to the topographical engineers, in 1846 entered the United States army in Mexico during its advance on Monterey, was brevetted captain, and in 1849 conducted the exploring expedition which opened up Minnesota and demonstrated the navigability of the Red River of the North. In 1853 he was in New Mexico, employed in surveys for the projected Pacific railway; and in 1854-9 explored the plains and the Rocky Mountains, being the first to experiment in the irrigation of arid western tracts by means of artesian wells. After his return from these duties, he criticized the policy of President Buchanan in a lecture delivered at Cincinnati in February 1861, and for this action was summoned to a court-martial. The trial was, however, dropped. Made brigadier of volunteers in May 1861, he was assigned to command in Missouri, quickly organized at Commerce, Mo., an army of about 12,000, and in March 1862 effected the capture of New Madrid and Island No. 10. He was promoted major-general of volunteers and made brigadier-general in the regular army. He was then placed in com-

mand of the Army of Virginia, and fought the battles of Cedar Mountain and the second Bull Run. In the latter he was badly worsted by "Stonewall" Jackson (q.v.); and on his return to Washington requested to be relieved from his command. He was thereupon transferred to the Department of the Northwest, where he directed a campaign against the Sioux; and in 1865 was appointed to the command of the military division of the Missouri; subsequently made the Department of the Missouri. Later he was in command of various military districts, of the Department of the Lakes, and that of the Pacific, and in March 1866 was retired with rank of major-general. 'The Campaign in Virginia' (1863).

**Popham, Sir John**, English jurist: b. Wellington, Somerset, 1531; d. 1607. He was educated at Oxford, studied in the Middle Temple and became sergeant at law in 1571. After having been speaker of the House of Commons in 1581 and attorney-general in 1585 he was made lord chief justice in 1592 and held this post 15 years. He was a brother of George Popham, and in 1607 was associated with him and Sir Fernando Gorges in establishing the Popham colony in what is now the State of Maine, the three holding a patent to an extensive tract of territory in that region.

**Pop'injay**, a parrot; a figure of a bird formerly put up as a mark for archers to shoot at. The green woodpecker is also so called in provincial parts of Great Britain.

**Popish Plot**. See OATES, TITUS.

**Poplar**, a genus (*Populus*) of trees of the order *Salicaceæ* which includes only one other genus, *Salix*, the willows. The species, which probably do not exceed 25, are widely distributed in the northern hemisphere from subtropical regions to the limits of vegetation both in latitude and altitude. Half of them are American. They are mostly of small or medium size, quick growth, and short duration: bear deciduous, broad, heart-shaped or lozenge-shaped leaves on long slender petioles; diœcious, naked flowers usually in pendulous catkins which appear before the leaves; and small 2 to 4 celled fruits (capsules) filled with cottony seeds. Their wood is generally soft, light and white. It is little used for timber or lumber; but it is an important fuel wood in regions such as the Western States, where fuel is scarce and costly. The trees are often planted for this purpose and for windbreaks, their rapid growth being in their favor. They are also favorites for copses and for pollarding (q.v.). The lumber called poplar is generally that of another tree,—the whitewood or tulip tree (q.v.). Poplars are used in enormous quantities for making wood-pulp paper, cardboard, etc., especially in Ontario, Quebec and the New England States, where hundreds of acres of forest are cut for this purpose annually. As ornamental trees they are frequently planted to excess at summer resorts because they quickly make an effect. In such cases they give an air of cheapness to the place not observable where maples, oaks, etc., are prevalent. The latter should always be planted with poplars, in order to replace them.

Poplars are as easily propagated from cuttings as currants or willows; in some cases the switches need only be stuck in moist ground.



## POPLAR BLUFF—POPLAR SPRING CHURCH

The choice horticultural varieties, especially the weeping kinds, are grafted. Suckers may be used, but since their removal generally induces the growth of many more suckers, this method must be practised with caution except where the ground is not valuable. The species will succeed in a great variety of soils from sand to clay, and in almost any situation, even in crevices on rocky mountain slopes. Some of them, however, especially the cottonwood, seem to thrive best in low alluvial land upon the margins of streams.

The best known species are probably the following: The Lombardy poplar (*P. nigra*, var. *italica*, also called *P. pyramidalis*, *P. italica*, *P. fastigiata*, etc.) is probably a native of Asia, whence it has spread to the Mediterranean region and thence to temperate countries throughout the world. It is noted for its erect instead of spreading habit, which makes it a striking specimen in ornamental plantings. It grows very rapidly, attains a height of 100 to 150 feet, but is not long-lived in the coldest States and most of Canada. It is one of the worst species to produce suckers; hence it should not be planted where the soil will be disturbed by cultivation.

The black poplar (*P. nigra*) is a native of northern Asia and Europe, and is occasionally seen as an escape in America east of the Mississippi River. It is of rather pyramidal habit, less erect, however, than its variety the Lombardy, and of darker colored foliage and slower growth than the cottonwood. It seldom exceeds 100 feet in height. The down from its seeds has been used for paper, hat, and cloth-making in France, but the industry has been abandoned as unremunerative. The wood, which is not prone to shrink and swell, is used for turning, cabinet-making, toys, flooring, doors, etc.

The cottonwood (*P. deltoides* or *P. monilifera*) is an American species well known from New Brunswick to the Rocky Mountains and southward to the Gulf States. It is the largest of the genus, specimens often attaining 150 feet in height and more than 6 feet in diameter. It is also one of the most valuable, its timber being considered useful for nearly all the purposes mentioned above. It is also more highly prized for ornamental planting than any other species, since it not only succeeds well in all soils, but possesses qualities of stability and strength lacking in other species. Its bright, glossy foliage, constantly in motion, adds cheeriness and life to plantations as few other trees can. It is one of the most popularly planted species in the Western States, not only for shelter and for fuel but for timber and lumber. In Europe it is often called the Canadian or Italian poplar, and one of its botanical varieties, the Carolina poplar (*P. deltoides*, var. *carolinensis*) is widely popular there under the name Swiss poplar. It has several horticultural varieties, among which a striking form is the golden-leaved *P. vangeertii*, which is one of the choicest of yellow-leaved trees.

The balsam-poplar or tacamahac (*P. balsamifera*) is indigenous from Newfoundland to British Columbia and extends well into Siberia, its southern limits, except in the mountains, being about Pennsylvania. Its erect growth resembles the Lombardy poplar, but it is slower in growth, more rugged and hardy. The type species and its three well-marked botanical varieties exceed

the cottonwood in variability. Its principal variety is probably the balm of Gilead (*P. balsamifera*, var. *candicans*), a well-known tree, frequently planted, with large buds noted for their spring fragrance. It is indigenous from Nova Scotia to New Jersey and westward to Minnesota, and is less pyramidal than the type species, usually making a rather broad top. It seems to be disappearing from the woods, though formerly it was a large tree sought for its timber. For the dark tone of its foliage it is often planted as a background tree, but not in smoky localities.

The certinensis poplar (*P. laurifolia*) is a Siberian species which somewhat resembles the balsam poplar and the cottonwood. It is being extensively planted in the Western States, where its hardiness and exceedingly rapid growth have made it popular. The white poplar or abele (*P. alba*), a European and Asiatic species, which grows about 75 feet tall, has been introduced into America, where it has become naturalized, from Nova Scotia to New Jersey. In Europe it is used for many of the purposes mentioned above. The European aspen (*P. tremula*), common in both Asia and Europe, is known in America mainly by its weeping variety (*P. tremula*, var. *pendula*). The American aspen (*P. tremuloides*) is one of the first trees to appear in clearings, thus acting as an important agent in reforestation, holding the soil until slower-growing trees can obtain a start. (See ASPEN.)

About 100 species of insects feed upon the poplars in America. Among these are several species of plant-lice, leaf-miners, and leaf-rollers (qq.v.). Among the caterpillars which feed upon the foliage, the most common are probably the larvæ of the antiopa butterfly, the io moth, tussock moth, and poplar span-worm; also several general feeders of the families *Noctuidæ* and *Geometridæ*. These creatures may be controlled by spraying, when practical, with arsenites. (See FUNGICIDE.) There are also a large number of borers which live in the trunks or twigs. The roots and trunk are attacked by *Prionus laticollis*, which also feeds upon pine and apple trees and grape vines.

Consult Sargent, 'Silva of North America'; Packard, 'Insects Injurious to Forest Trees' (Washington, 1890).

**Pop'lar Bluff**, Mo., city, county-seat of Butler County; on the Black River, and on the Saint Louis, I. M. & S. railroad; about 125 miles south of Saint Louis. It is in a section where lumbering and the manufacture of lumber products are given much attention. Stock raising is carried on to a considerable extent. In the vicinity are valuable clay deposits. The chief manufactures are foundry and machine shop products, brick, and lumber products. The city owns and operates the waterworks. Pop. (1890) 2,187; (1900) 4,321.

**Poplar Spring Church** (Peebles' and Pegram's Farm, Vaughan Road), Battle of. In co-operation with the movement against Richmond from the north side of James River, 29 Sept. 1864 (see FORT HARRISON, BATTLE OF), Gen. Grant ordered a movement from his left, south of the river, in a northwest direction toward the Boydton road and South Side Railroad, the intention being to extend his intrenched line beyond the Weldon Railroad in the direc-



## POPLIN — POPPY

tion of the South Side Railroad. Gen. Warren, with Griffin's and Ayres' divisions of the Fifth corps, was first to secure the junction of the Squirrel Level and Poplar Spring Church roads, coming in from the southwest, at which point the Confederates had intrenchments covering the roads. Gen. Parke, with Willcox's and Potter's divisions of the Ninth corps, was to follow Warren and form on his left, then both were to advance toward the Boydton road. Gregg's cavalry division was to move on the Vaughan road and other roads on the left and rear to the crossing of Hatcher's Run, where the Confederates had a redoubt at the termination of their intrenchments. At 7.30 A.M., 30 September, Griffin and Ayres moved out of their intrenchments at Globe Tavern, advanced cautiously three miles through a dense growth of woods, and encountered a Confederate picket-line behind light works thrown up along the road in front of Poplar Spring Church. This line was driven in, and the advance continued, until it came under a sharp fire from a line of works on Peebles' farm, held by Dearing's cavalry brigade and some infantry. A short halt was made, the order to assault was given, and the works were carried with small loss. On the left Parke moved through a narrow belt of timber, in a northwest direction toward the Boydton road, and encountered the Confederates on Pegram's farm. The forces holding the Petersburg intrenchments were A. P. Hill's corps and B. R. Johnson's division of infantry, with Wade Hampton's two divisions and Dearing's brigade of cavalry, all under command of A. P. Hill. The main Confederate line of intrenchments had been extended in a southwest direction nearly to Hatcher's Run, covering the Boydton road and South Side Railroad. Hill threw out two divisions, which came into collision with Potter's division, flanked it on the right, and drove it back in some confusion. A new line was now formed by Parke, with Willcox's troops, which, with Griffin's line on the right, after a spirited engagement, checked the Confederate advance about dark, after a loss in Parke's command of nearly 500 killed and wounded, and many prisoners. Late in the afternoon next day (1 October) Mott's division of the Second corps came up, and on the 2d Parke advanced, under a heavy fire of artillery and musketry, and established a line of intrenchments about a mile from that of the Confederates, connecting on the right with the line held by the Fifth corps, and on the left reaching the Weldon Railroad and extending to the left and rear. On the left and rear Gregg's cavalry, 30 September, drove back Dunnovan's cavalry brigade, and next day was heavily attacked by Hampton's cavalry on the Vaughan road, but he repulsed the attack, inflicting heavy loss. The Union loss, 30 September, 1 and 2 October, was 187 killed, 900 wounded, and 1,802 missing. The Confederate loss is not certainly known, but is estimated at less than 1,000. Consult: 'Official Records,' Vol. XLII.; Humphreys, 'The Virginian Campaign of 1864-5'; Powell, 'History of the Fifth Army Corps.'

E. A. CARMAN.

**Pop'lin**, in textile manufacture, a kind of finely woven fabric, made of silk and worsted. In the best poplins the warp is of silk and the

weft of worsted, a combination which imparts peculiar softness and elasticity to the material; in the cheaper makes cotton and flax are substituted for silk, which produces a corresponding deterioration in the appearance of the stuff. The manufacture of poplin was introduced into Ireland from France in 1775 by Protestant refugees, and Ireland is still famous for its production. The term "poplin" is a corruption of the French *papeline*.

**Popocatepetl**, pō-pō-kā-tā-pēt'l, a volcanic mountain of the province of Puebla, Mexico, about 45 miles southeast of the city of Mexico, whence it can be seen as if near at hand because of the clear air of the intervening country. "Smoking Mountain" is the meaning of its name, an Aztec compound, and it is constantly sending out smoke and ashes, and occasionally cinders and stones, but has had only two or three small eruptions in the last four centuries. Its height is 17,783 feet, considerably more than that of Mont Blanc, and it was long reckoned the highest mountain in North America. There are oak and pine forests on its sides to a height of 12,540 feet; then a stretch of sand and sulphur before the snowline at 14,960 feet. There are small glaciers on the eastern slope of the mountain. The crater is much smaller than commonly reported, being probably not more than one fifth of the famed three miles in circumference; its depth, reported as 1,000 feet, seems to be actually only 250. Indians gather sulphur from the rim of the crater. Some of Cortes' men explored the mountain in 1519; three years after Montano seems to have reached the top and let himself down into the crater; in 1827 Glennie and Taylor made the ascent.

**Popoftschins.** See RELIGIOUS SECTS.

**Popol Vuh**, pō-pool' voo, the sacred book of the Quiché (q.v.).

**Poppæa Sabina**, pō-pē'a sa-bī'na, Roman empress, wife of Nero: d. 65 A.D. She was the daughter of Ollius and married Rufius Crispinus, Prætorian prefect, was divorced by him and married to Otho, who in his turn was set aside for the Emperor Nero. She was famous for her beauty, but heartless and immoral. At her desire Nero murdered his mother Agrippina in 59, divorced and put to death his wife Octavia in 62, after which they were married. Three years later she was killed by Nero in a fit of rage. The one redeeming incident in her career seems to be the mercy she urged upon Nero in behalf of the Jews.

**Poppy**, a popular name for several plants of the order *Papaveraceæ*; for instance, California poppy (*Eschscholzia californica*), horned poppy (*Glaucium*), Welsh poppy (*Meconopsis cambrica*), prickly poppy (*Argemone mexicana*), celandine poppy (*Stylophorum diphyllum*), tulip poppy (*Hunnemannia fumariæfolia*), and various species of genus *Papaver*. Unless modified by some adjective as above the term usually refers to members of the last named genus.

The fifty species of *Papaver* are annual and perennial herbs, mostly indigenous to the Mediterranean region. One is South African, one Australian, and one Californian. They are smooth or bristly; have a milky juice, usually dissected or lobed leaves on long peduncles;





1. Poppy (*Papaver sonnifer*).  
2. Peony (*Paeonia arborea*).

3. Primrose (white Chinese variety).  
4. Italian Petunia.







POPULAR SOVEREIGNTY — POPULATION

showy flowers of very varied tints and forms; and capsules containing very numerous small seeds. For several centuries some of the species have been leading garden flowers, not only because of their color and form but because of their ease of cultivation. The seed should be sown very early in the spring where the plants are to remain. Any good, well drained garden soil will do, but it should be finely broken up and the seed covered very thinly. The seedlings should not stand closer together than six inches, for the weak growing kinds and 12 inches for the strong. The removal of the pods as soon as the flowers fade will prolong the blossoming season. If allowed to ripen the seed will stock the garden as weeds. Such plants blossom about two weeks earlier than spring-sown ones. The perennial species should be replaced by new plants each second year, since in cold parts of the country they are likely to winter-kill when old.

The most cultivated species are the opium poppy (see below) and the corn poppy (*P. rhæas*), a European annual with rather small flowers and finely cut foliage.

The Oriental poppy (*P. orientale*), a native of southwestern Asia, is a perennial with large flowers. The Iceland poppy (*P. nudicaule*), an Arctic species, is a remarkably beautiful perennial, which is usually grown as an annual; it is perhaps the best species for cutting as a bouquet flower. Other species are popular with fanciers but have not gained prominent places in general esteem.

As a garden plant the opium poppy (*P. somniferum*), an annual, is the most famous, since it has probably the widest range of color, form and brilliance. It is, however, noted as the source of poppy-seed oil and opium (q.v.). The seeds, which contain no opium, are rich in a bland, fixed oil (about 40 per cent), which is expressed for culinary uses, and to a small extent for painting and soap-making. The growing of the plants for this purpose has been an important industry in the Old World for centuries. In mild climates the land is made very fine by plowing and harrowing in the autumn when the seed is sown; in colder regions, the seed is either scattered on the snow or sown in early spring, the land being prepared previously. Drilling and broadcasting are both popular. Shelter from wind is advisable to prevent scattering of the seed.

**Popular Sovereignty.** See SQUATTER SOVEREIGNTY.

**Population.** Population may be studied either as to its size and composition at a given date, or as to its movement during a period. A single census reveals the number and make-up of a people, but for the disclosure of its move-

ment there is needed either the statistics of births, deaths and migrations, or the comparison of successive censuses. The censuses of the world report more than 900,000,000 persons, and the best estimates of the non-enumerated peoples bring the total human population of the globe up to 1,600,000,000. The distribution compared with that of 70 years ago is supposed to be as follows:

	About 1830 millions	About 1900 millions
Europe .....	216	400
Asia .....	480	868
Africa .....	109	178
America .....	40	148
Oceania, etc .....	2	6
	847	1,600

The changes in the relative population of the principal countries during the century are indicated in the diagram on following page.

Besides *number* the statical studies of population relates to its distribution according to *sex, age, conjugal condition*, etc.

*Sex.*—The proportion of males and females varies widely in different countries and localities. The figures below give the number of females to 1,000 males:

Europe .....	1064	France .....	1014
Norway .....	1091	Belgium .....	1005
Scotland .....	1072	Italy .....	989
Sweden .....	1065	Servia .....	947
Eng. and Wales....	1064	Greece .....	929
Switzerland .....	1057		
Denmark .....	1051	United States .....	953
Austria .....	1044	North Atlantic .....	1000
Germany .....	1039	South Atlantic .....	1000
Ireland .....	1029	North Central .....	938
Holland .....	1024	South Central .....	960
Hungary .....	1015	Western .....	779

In most countries men die off faster than women owing to the nature of their occupations and to their greater addiction to vice and dissipation. Hence, although usually more males are born than females, this excess of male births is overcome and the females preponderate, especially among adults. Old countries, like Norway and Scotland, also lose more men by emigration, whereas the countries receiving immigrants are masculine. The ten millions and over of our foreign born, furnish only 836 females to 1,000 males. The migration to the West abstracts from the East more men than women, so that the proportion of females in Rhode Island is 1,038 and in Massachusetts 1,052. In most of the North Atlantic States, however, the balance is being restored by the heavy foreign emigration. In Montana, on the other hand, the females are only 623, in Idaho 735 and in Utah 951 to 1,000 males. Large cities with their strong demand for domestics and factory hands show an excess of women. The explanation is that the overflow from the rural districts streams either to new regions or to the cities. Owing to the difference

PERCENTAGE OF DECENNIAL AGE CLASS.

	England	Scotland	Ireland	France	Germany	United States	Native white	Foreign-born white	Negro
Under 10 .....	23.9	24.3	20.8	17.5	24.4	23.8	27.1	1.9	27.4
10 to 20.....	21.3	21.6	23.4	17.4	19.8	20.6	22.3	8.6	23.5
20 to 30.....	17.2	16.8	16.2	16.3	17.0	18.2	17.8	19.7	19.3
30 to 40.....	13.1	12.6	10.8	13.8	13.1	13.8	12.6	23.0	11.3
40 to 50.....	9.9	9.6	9.8	12.3	10.1	10.1	9.1	17.7	7.8
50 to 60.....	7.1	7.2	8.5	10.1	7.8	6.8	5.7	14.2	5.3
60 to 70.....	4.7	4.8	6.0	7.6	5.0	4.1	3.3	9.4	3.0
70 and over.....	2.8	3.1	4.5	5.0	2.7	2.3	1.9	5.3	1.8



## POPULATION

in the kind of work to be done men predominate in the flow to new regions and women in the flow to the cities, especially to the industrial and residence cities.

*Age.*—A grouping into age classes reveals striking differences between populations. The figures on preceding page show the percentage of each decennial age class.

In a growing population the lower age classes are well filled, but a stationary population has a larger proportion of adults and aged. Thus in Germany one third are under the age of 15, while in France the proportion is a little over a quarter. Young adults are the most migratory and hence a country, like Ireland, losing by emigration has an unusual proportion of the immature and the old, whereas a country receiving immigration is strong in the age classes that fall within the productive years of life. Economically the latter gains at the expense of the former. Growing cities have a high proportion of adults between 20 and 40, although in an industrial centre with a high rate of marriage and fecundity there will soon be a large percentage of children. The age composition has a great influence on the death-rate. Even a healthy population will show an unfavorable mortality if emigration has left it with more than its quota of children and aged, for these classes contribute most to the death-rate. The moderate mortality of rapidly growing cities, sometimes interpreted as vindicating the healthfulness of urban life, is really due to the favorable age composition of their population. For the same reason newly-settled states have a death-rate lower than they can hope to maintain as they become older. The high death-rate characterizing a rapidly multiplying people is partly due to the lack of proper care of children in large families, but it is also a consequence of there being great numbers in the lower age classes. This factor of child mortality may be appraised from the following table of deaths to 1,000 in each age class:

	Germany	France	Italy	Great Britain
Under 15.....	41	27	50	27
15 to 40.....	8.3	8.7	9.6	8.2
40 to 60.....	19	16	18	18
Over 60.....	76	69	77	71
All ages.....	26.8	22.4	30	20.9

Two populations with the same rate of natural increase may differ widely in age distribution. The coincidence of a high death-rate with a higher birth-rate keeps the lower age classes full, whereas the middle and upper age classes will be filled out when, as occurs in most civilized communities, a low birth-rate coincides with a lower death-rate. A growth that comes by diminishing the number of deaths rather than increasing the number of births adds to the economic strength of a nation because more life is lived in the productive period. The enlargement of population which follows improved sanitation and the spread of economic well-being, represents, in the main, an addition of enjoyable and fruitful years to human lives.

*Movement.*—Animals and plants tend constantly to expand in numbers, seeing that necessarily the more prolific species and stocks have

been able in the course of ages to replace the less prolific. The pressure on subsistence caused by an excessive multiplication precipitates a struggle for existence which thins out vast numbers of the young before they reach maturity and thus restores the equilibrium between numbers and the food supply. Man, like other species, has a power and an instinct to reproduce much stronger than are necessary to maintain his numbers. Statistics show that it is possible for the annual birth-rate of a civilized people to reach 50 or 60 per 1,000. The minimum mortality possible in a population with a high fecundity and therefore a large proportion of children, is 25 or 27 per annum. It is therefore probable that the highest rate of increase that, under the most favorable conditions, can continue in a civilized community for a considerable time is about 3 per cent per annum, which is equivalent to a doubling of population in 25 years. Such a rate of increase is approximated in new countries where there is good land for all and in old countries after war or epidemic has left great gaps in the population. Elsewhere this potential increase does not, in fact, occur because of the difficulty of enlarging the food supply.

In a given state of the arts there is a point beyond which the response of nature to the application of labor progressively declines (law of diminishing returns). The yield of food from a given area does not keep pace with the number of workers; although every mouth is furnished with its pair of hands, the labor of these hands is less productive the more hands there are. Hence, in a static society, as numbers grow the difficulty of procuring subsistence augments, until want causes the deaths to equal the births, and population comes to a standstill. The race may be thought of as expanding against a coiled spring, which, as it is compressed, offers increasing resistance to further compression. In progressive societies the tendency of numbers to outrun the means of subsistence is cloaked by that progress of the arts which, by enhancing the power to produce food upon a given area or by permitting supplies of food to be brought from remote lands, enables an increasing population to maintain itself in ever greater comfort. Nevertheless, the tendency certainly exists and there is no reason to suppose that the improvement of production could forever keep pace with a blindly instinctive increase of population. In the long run, therefore, the inevitable equilibration of numbers and resources must come from the adaptation of the former to the latter. This adaptation, which consists in the numerical balance of births and deaths, may be brought about either by the actual death-rate conforming to the natural birth-rate or the actual birth-rate conforming to the natural death-rate. In the former case such natural agents of mortality as disease and old age are reinforced by misery, epidemic, war and other scourges betokening an acute struggle for existence. In the latter case the procreative appetite is held in check by prudential motives, and by social institutions affecting marriage and the standard of living. An adjustment of numbers to resources through the birth-rate alone implies a developed type of man and a social system that stimulates foresight and the feeling of individual responsibility. The balance is easily

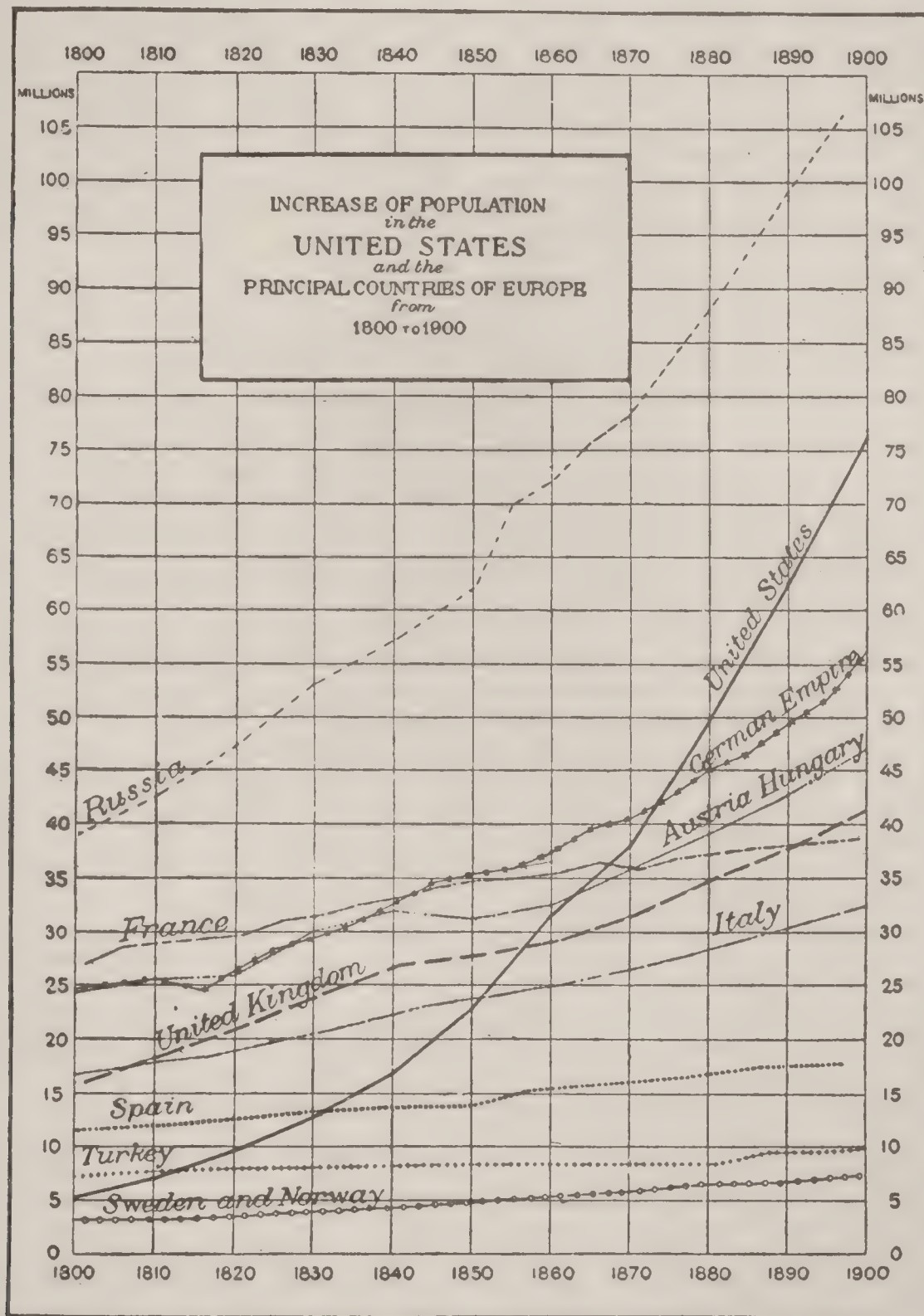


## POPULATION

deranged, however, and the same people that multiplies in a rational way in one age may show a disordered rate of propagation in the next. The law of human multiplication, therefore, far from being the simple physiological formula that suffices for animals, involves psychic and social factors which are not the same for all epochs, peoples or classes. Thus, religion, either by promoting asceticism and celibacy or by encouraging early marriage and trust in Providence, has an important bearing on population. A reputed inferiority of woman subordinates her entirely to wifely functions.

some prospect of rising, are apt to marry early and have large families. In general, the more ignorant and degraded the condition of a class, the more its pleasures are restricted to those of sense and the more animal is its birth-rate.

In recent decades the birth-rate has been falling rapidly in all progressive countries. In Australia, for example, the shrinkage by five-year periods since 1860 has been as follows: 42, 40, 37, 36, 35, 34, 31, and 27. In Massachusetts the native stock has so declined in fecundity that during the period 1883-97 the birth-



The domestic ideal coupled with strong family solidarity favors prolificness, whereas a system that lets each individual stand or fall by himself limits it. Rigid caste barriers produce resignation to one's lot and a rapid multiplication. When, on the other hand, social status depends on style of living, many parents limit the number of their offspring in order the better to maintain or improve their social position. Hence the paradox that the well-to-do classes and districts are the poorest in children. A wide ownership of the soil works for a prudent rate of increase; but propertyless wage-earners, unless they have

rate of the native married women was only five ninths of that of the foreign-born married women. The births are supposed to be fewer than the deaths, in which case the native stock is dying out. In Europe the table shows that the birth-rate is falling most rapidly in countries just coming for the first time under the power of modern civilization, and that it is lowest where the civilizing influences have most profoundly penetrated the masses. If this phenomenon has not checked the increase of population it is owing to a fall in the death-rate which is even more pronounced.



POPULIST PARTY — PORCELAIN

	Average No. births per 1000 1871-90	Average No. births per 1000 1890-1900	Decline in births	Average No. deaths per 1000 1871-90	Average No. deaths per 1000 1890-1900	Decline in deaths	Excess of births per 1000 1890-1900	Increase of pop. per 1000 1890-1900
Hungary 15 years...	44.0	40.4	3.6	33.7	29.7	4.0	10.7	9.5
Austria .....	38.6	37.1	1.5	30.6	26.6	4.0	10.6	8.8
Germany 15 years...	38.1	36.1	2.0	26.0	22.2	3.8	13.9	15.0
Italy .....	37.3	35.3	2.0	28.6	24.7	3.9	10.6	.....
Holland .....	35.2	32.5	2.7	22.6	18.4	4.2	14.2	12.3
England and Wales..	34.0	30.0	4.0	20.3	18.2	2.1	11.7	11.5
Scotland .....	33.6	30.7	2.9	20.4	18.7	1.7	11.9	10.5
Denmark .....	31.7	30.2	1.5	19.0	17.4	1.6	12.7	10.8
Belgium .....	31.0	28.9	2.1	21.4	19.1	2.3	9.8	9.8
Norway .....	30.7	30.4	0.3	16.9	16.2	0.7	14.2	12.1
Sweden .....	29.8	27.1	2.7	17.6	16.3	1.3	10.8	7.1
Switzerland .....	29.4	28.7	0.7	22.1	19.4	2.7	9.3	10.9
Ireland .....	24.9	23.0	1.9	18.0	18.2	-0.2	4.8	-5.4
France .....	24.6	22.1	2.5	22.8	21.5	1.3	0.6	3.8
Average for all.....	.....	.....	2.2	.....	.....	2.4	.....	.....

The slackening of the death-rate is clearly due to advancing medical science, improving administration and sanitation, the slowly rising plane of comfort and the smaller proportion of infants in the population. The decline of the birth-rate has a number of subtle causes. The cost of rearing children is greater in the city and therefore the growth of urban population is unfavorable to fecundity. Higher female education tends to defer marriage. The opening of careers to woman raises her matrimonial value and causes the heavy physiological and personal cost of excessive maternity to be more considered. Compulsory education and the restriction of child labor delays the age at which children may be made to contribute to the family income, and so lessens their economic value. With the diffusion of intelligence new interests spring up which detract from those interests which centre in the home. The most influential cause, however, appears to be the growth of democratic ideas and institutions. Any stratum that is hopeless of bettering its condition is likely to breed recklessly. When, on the contrary, the individual has a prospect of raising himself or his children to a higher plane by his own efforts, his foresight and self-control are stimulated to the utmost. The decay of the principle of heredity and privilege and the movement toward a greater equality of opportunity inspire an almost universal desire to rise which works against early marriages and large families. In the broader strata of the people individualistic democracy awakens powerful motives which curb the procreative instinct and produce in the population as a whole that moderate fecundity characteristic of certain portions of society.

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**Populist Party, The.** See PEOPLE'S PARTY, THE.

**Porbandar,** pōr-būn'dar, India, a seaport town, capital of a native state of the same name, in the political agency of Kathiawar, Bombay. It is built on a creek on the southwest coast

of Gujerat, and has an active shipping trade with Bombay and Malabar. Pop. 19,000. The state has an area of 636 square miles and a pop. of 85,785.

**Por'beagle,** a shark of the family *Lamnidae*, more usually called mackerel sharks (q.v.), on the northeastern American coast. The best known species is *Lamna cornubica*, which occurs in the North Atlantic, attains a length of 10 feet, and feeds chiefly on fishes. The porbeagle has two dorsal fins, a wide mouth, lanceolate teeth, and very wide gill openings.

**Porcelain.** This term is now by general consent applied only to the substance formerly called hard porcelain. The qualifications "hard" and "soft" are still used, but when none is applied the hard form (Fr., *pâte dure*) is meant. The origin of porcelain is ascribed to the Chinese, and was doubtless an accidental development of a pottery made from a white clay. This clay owes its name to a Chinese expression. Being found in a certain hill the name of the hill Kao-ling (lofty ridge) was applied to the clay and speedily became Westernized into Kaolin (see CLAY). But kaolin alone will not make porcelain. Associated, however, with beds of kaolin are usually found masses, more or less pure, of feldspar. This substance serves as the flux which imparts to porcelain its strength and translucency.

Porcelain is essentially a white translucent paste covered with a hard transparent glaze. The paste or body consisting of kaolin and feldspar, with, perhaps, an addition of quartz, is, after being fashioned, burned at a low temperature, in order that it may be freely handled. It is then dipped into the glaze (q.v.), which is so blended with water that a uniform coating is distributed over the whole piece. It is now ready for the hard and final burning. This hard fire (Fr. *grand feu*) is the feature which distinguishes porcelain from other ceramic products. The firing is conducted in a reducing atmosphere, the effect of which is to change the yellow ferric oxide, Fe<sub>2</sub>O<sub>3</sub>, to the blue ferrous oxide, FeO. This change is responsible for the bluish color of porcelain as contrasted with the yellowish white of commoner wares. The change is more especially noticeable by transmitted light. So desirable is this bluish tint that in cheap wares it is simulated by the use of cobalt oxide, which, however, produces quite a different effect.



## PORCELAIN CLAY—PORCUPINE

The Chinese, for the most part, glaze their porcelain upon the clay itself without resorting to the preliminary fire, the Japanese and the Europeans on the other hand always take advantage of the biscuit burn. The use of the reducing fire in porcelain has given rise to many interesting phenomena which appear abnormal to Western potters, but are, in fact, normal to the Oriental method. The production of reds from copper, impossible by Western methods, is the only possible result of the reducing fire, the beautiful Chinese celadon is simply the result of an addition of red clay, common brick clay, to the glaze. A reduction of the iron takes place and the tender green is the result. A potter using oxydizing conditions must resort to clumsy expedients such as the staining of his glaze by chrome or copper, with but a poor success at the best. In America porcelain is made on a practical scale on Long Island, and is supplied to hotels and restaurants. Nothing in the way of ornamental or decorative porcelain has been attempted except by one or two amateurs. There is in the United States an abundance of fine clay and no valid reason for the omission. The earliest reliable date that can be assigned to Chinese porcelain is 618 A.D. The legends and even documents of the country extend much farther back than this, but there is considerable uncertainty as to the product by reason of the fact that the same word in Chinese signifies both pottery and porcelain. The blue ware made in Egypt and commonly called porcelain is, in fact, nothing more than a faience or glazed pottery.

In Europe porcelain was first made in 1709, when Böttger, chemist to the Elector of Saxony, discovered the necessary materials. Certain fabriques, more or less experimental, had existed before this and soft porcelain had been made in France, but Meissen, commonly called Dresden, porcelain was the first successful and genuine product. Following upon this there arose a host of small manufactories supported mainly by princes and other rulers as a pastime. Little variation in the paste is noticeable, but the decorations are very diverse.

In France hard porcelain was made in 1769 and in 1804 Brogniart, the director of the Sèvres manufactory, abandoned the soft paste entirely and devoted himself to the hard. Porcelain of this type was only made for a short time in England, the factories at Plymouth and Bristol alone producing it.

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**Porcelain Clay.** See KAOLIN.

**Porcelain Tower,** a tower which was erected in the early part of the 15th century and destroyed by the Taipings in 1853. It was octagonal in construction, had nine stories, faced with variegated porcelain (from which it received its name), and from these lamps and bells were hung. A miniature reproduction of the tower may be seen in the Green Vault in Dresden.

**Porch,** a covered place of entrance to a building and differentiated from its principal mass. Its forms are various, sometimes extending above by more than one story, sometimes enclosed save for the doorway, then again open to the outside on three sides, with its outer corners supported by columns or piers. It may

be simplified into an overhanging hood or baldachino. In Byzantine and Eastern churches the porch was an enclosed atrium or narthex, a feature that has developed with modifications into the mosque of the Moslems. The enclosed atrium was retained in the early basilican churches and contained a fountain where worshippers might wash their hands,—the origin of the present universal Roman Catholic practice of dipping the fingers in the holy water of the piscina. In this space, probably always called the narthex of the basilica, the penitent or unbaptized persons were compelled to stay. Such a structure may be seen in the Church of San Lorenzo, in Rome, and St. Apollinaire in Clusse, at Ravenna. The narthex extended across the front of the church and its inner wall contained three doors that gave upon the nave and aisles of the main body. Of Romanesque churches, the porch of the Church of Vézelay is an important example; while the Church of St. Germain l'Auxerrois in Paris shows a Gothic edifice with a porch extending across the front, dating from 1431, its horizontal crown at sharp contrast to the climbing lines of the main edifice.

Porches are characteristic of the Gothic style in Italy, though instead of being placed in front they often occupy positions on the flanks, thus forming side entrances. A remarkable specimen in three stories, the upper and surmounting one of a pagoda-like structure, is attached to the Church of Santa Maria Maggiore at Bergamo.

**Porcia.** (1) The plebeian gens of Rome, flourishing from the 3rd century B.C. and whose most famous family was that of Cato. (2) An ancient lady living in Rome, the daughter of Cato, of Utica. She became the wife of M. Bibulus, who was Cæsar's colleague in the consulship, in 59 B.C., and after his death married M. Brutus in 45 B.C. After the death of Brutus, she committed suicide.

**Por'cupine,** a rodent of the family *Hystri-  
cida*. Porcupines are distinguished by the peculiar nature of the body-covering, which consists, especially on the back and haunches, of hairs specially modified to form the so-called *quills*, or dense, solid, spine-like structures. These quills are intermixed with bristles and stiff hairs, and in the American sub-family *Synetherina* are almost concealed beneath the hairy fur of the body. The incisor or front teeth number two in each jaw and spring from permanent pulps, so that they continue to grow throughout the lifetime of the animal as in the other members of the order. There are four molar teeth on each side of each jaw, exhibiting complicated foldings of the enamel on both the internal and external sides; and sometimes they, like the incisors, continue to grow throughout life from persistent roots. The skull exhibits an infraorbital foramen of very large size. The muzzle is generally short and broad. The lip is divided and the ears short and rounded. The anterior feet possess four and the hinder feet five toes, all provided with strong, thick nails. The tongue is roughened, or, as in the Javan porcupine, may be provided with horny plates or scales.

The family *Hystri-  
cida* includes two sub-families. The *Hystri-  
cina* or Old World porcupines are terrestrial, and have imperfect clavicles and open rooted molar teeth. They fall into



## PORCUPINE ANT-EATER—PORK

several genera. Of these the most familiar is *Hystrix*, represented by the true porcupines. The common or crested porcupine, *Hystrix cristata*, found in southern Europe and in northern Africa, is the best known species. The true porcupines have non-prehensile tails, which may be spiny or covered with scales or bristles. When fully grown the common porcupine measures nearly two feet in length, and some of its spines exceed one foot. The general color is a grizzled, dusky black. The upper part of its head and neck is furnished with long, light-colored hairs, capable of being raised or depressed at pleasure; and most parts of the back and sides are armed with spines, which are longest on the centre of the back. In their usual position they lie nearly flat upon the body, with their points directed backward; but when the animal is excited they are capable of being raised. The quills are loosely inserted in the skin, and may, on being violently shaken, become detached—a circumstance which may probably have given rise to the purely fabulous statement that the animal possessed the power of actually ejecting its quills like arrows or darts at an enemy. These animals generally lead a solitary life, and inhabit burrows during the day, coming forth at night in search of food, which consists of vegetable matter. The common species is quiet and peaceable, but shows no disposition to become familiar or domesticated. An Indian form (*H. leucurus*) resembles the crested porcupine, but is larger.

The genus *Atherura*, including three species, possesses a long scaly tail, which is terminated by a tuft of bristles. The species of this genus occur in the Malayan region and West Africa. The *Atherura fasciculata*, or brush-tailed porcupine, is a familiar species of this genus. The *Synetherinae*, or American tree-porcupines, are easily distinguished by their well-developed clavicles, molars with closed non-growing roots, usually prehensile tails, the feet with tuberculated soles and the absence of the pollex. The three genera are confined to America.

The Canadian porcupine (*Erethizon dorsata*) is the best known, and is a robust animal with a short non-prehensile tail. It is about 2½ feet long; of a brownish color, mingled with white; the spines are about 4 to 6 inches long, concealed in the fur and attached in a very slight manner to the skin, and, from being barbed at the tip with numerous small reversed points or prickles, they by degrees penetrate very deeply into the flesh after having once pierced it. Small and insignificant as these defensive weapons may appear, they are capable of severely injuring dogs, wolves, or indeed any animal that incautiously attempts to seize the porcupine. These spines or quills were much used among the Indians to ornament different articles of dress; they dyed them various colors, in a very permanent manner. The Canada porcupine is found in the thickly wooded parts of north-eastern United States and in Canada, the northernmost limit of its distribution being the shores of the Mackenzie River, and the southernmost the high mountains of Pennsylvania. They feed on the barks of various trees, apples, corn, etc. Their flesh is said to be very unpalatable, resembling flabby pork. They pair about the latter end of September, and the female brings forth two young in April or May.

The genus *Synetheres* of South America to Mexico possesses a distinctive feature in the elongated prehensile tail, adapting it for an arboreal existence. They are the true tree porcupines. About 10 species of these animals are indigenous to America, the spines, as in the Canadian porcupine, being of much smaller size than in the Old World forms. In length the typical species of this genus averages 1½ feet, the tail measuring about 10 inches.

Consult: Stone and Cram, 'American Mammals' (New York 1902); Merriam, 'Adirondack Mammals' (New York 1884).

**Porcupine Ant-eater.** See ECHIDNA.

**Porcupine Fish.** See DIODON.

**Porcupine-wood,** the timber of certain Oriental palms. (See PALMS.)

**Pordenone de Sacchis**, pôr-dā-nō'nā dā sāk'kēs (or DE CORTICELLIS) really named GIOVANNI ANTONIO DA PORDENONE, Italian painter: b. Pordenone 1483; d. Ferrara January 1539. He painted in his native home and worked without much influence from abroad, until in his 27th year he visited Venice and was captivated by the productions of Giorgione, Palma, and Titian. In 1535 he settled at Venice and before the end of the year was knighted by the king of Hungary (taking in addition to his own the name "Regillo"), and in 1538 was summoned to the court of the Duke of Ferrara, who desired his services to prepare designs for Flemish tapestry, but here he died suddenly the following year. These are the few incidents of his life with which we are acquainted. His works consist of altar-pieces and frescoes, painted in the spirit of the Renaissance. Of these the most important are: the New Testament series of frescoes in the church of San Salvatore, Cotalto; the paintings on the walls and roof of the cathedral chapels at Treviso; and those in the cathedral of Cremona (1520-2). He also painted the altar-piece of the cathedral at Pordenone—'The Madonna Attended by Saints' (1515). Most of the frescoes he painted in houses and churches at Venice have perished.

**Pore Fungi.** See FUNGI; POLYPORUS.

**Porif'era**, the phylum of animals which includes the sponges, the term referring to the apertures or pores which characterize them. See SPONGE.

**Po'rism**, in geometry, a name given by ancient geometers to a class of mathematical propositions having for their object to show what conditions will render certain problems indeterminate. Playfair defined a porism thus: "a proposition affirming the possibility of finding such conditions as will render a certain problem indeterminate, or capable of innumerable solutions." Euclid's three books on porisms have been lost, and in consequence there has been much controversy as to what the ancients meant by the term.

**Pork**, the flesh of swine, is one of the most important and widely used species of animal food. Fresh pork, though by some considered a delicacy, especially when killed young, is a much inferior article of diet to beef or mutton, and is much less used. The flesh of pork, particularly the lean, is coarser and ranker than that of the other animals chiefly used for food, but there are certain advantages which



## PORPHYRITE — PORPHYRY

give pork a place in the supply of animal food that can be filled by no other article. The appetite of swine being much more catholic than that of their daintier neighbors, the feeding of them answers the purposes of economy, and extends very materially the supply of food. This, it is true, is attended with considerable dangers. If care is not taken that the feeding of swine should be wholesome and cleanly, their flesh becomes tainted with disease and unfit for food. Unscrupulous breeders sometimes take advantage of their exorbitant and omnivorous appetite to make them consume the most disgusting offal, and even when their feeding is not conducted with this utter recklessness of consequences it is often less careful than is consistent with sound sanitary conditions. There is in fact no animal to the perfection of whose flesh as an article of diet careful attention to feeding is more indispensable. The main recommendation of pork lies in its superiority to other kinds of animal food in undergoing the process of curing. The quality of beef and mutton is seriously deteriorated when long kept, even under the best methods of curing; that of pork is decidedly improved, and when of good quality and well cured it develops a richness and delicacy of flavor in marked contrast with the dryness and insipidity of other salted meat. Another recommendation of pork is the abundance and very digestible quality of its fat, which makes it a very suitable diet for cold climates, but which is, on the contrary, rather a disadvantage in hot ones. For long sea voyages, especially before the introduction of modern methods of keeping fresh meat, pork was by far the most common and acceptable form of animal diet, and it is still one of the most valuable items in naval stores. The swine was among the unclean animals forbidden to be eaten by the Mosaic law. It is still regarded by the Jews as specially typical of the unclean animals. The Egyptians, Arabians, and other eastern nations had similar opinions as to the use of pork. See HOGS; NUTRITION OF FARM ANIMALS; PACKING INDUSTRY.

**Por'phyrite**, a porphyritic orthoclase rock free from quartz; so named by some petrologists, by whom the name has been applied to various rocks generally of this character. Some of these rocks, however, include varieties in which the orthoclase constituent is more or less replaced by oligoclase. Many porphyritic dolerites have been also included under this name. By the presence of hornblende it often approaches the composition of a syenite, with which it is frequently associated.

**Por'phyry** (PORPHYRIOS), Greek philosopher of the Neo-Platonic school, celebrated as an antagonist of Christianity: b. Batanea, the Bashan of Scripture, about 233 A.D.; d. Rome about 304. His original name was Malchus, from the Syrophœnician *melech*, king. Longinus, whose pupil he became, gave him the title of Porphyrios, that is, purple-clad. He early became the pupil of Origen, and afterward studied under Apollonius and Longinus in Athens. At 30 he came for the second time to Rome to place himself under the teaching of Plotinus. Porphyry at first disputed the doctrine taught him, in a treatise in support of the position "that the things perceived by the mind exist out of the mind," which he submitted to

Plotinus. Amelius, his associate and assistant, wrote a treatise in reply; and after some further controversy Porphyry read a recantation in the school. This incident is important, as indicating the teaching of Longinus, and possibly by implication of Ammonius, the instructor of Plotinus. Porphyry finished by entirely adopting the opinions and obtaining the confidence of Plotinus, whose literary assistant and executor he became, and whom he induced to commit his views to writing. Porphyry was naturally of a hypochondriacal disposition, and the abstruse mysticism of Plotinus incited in him a tendency to cherish thoughts of suicide, which Plotinus perceiving recommended to him a change of situation, and about 268 he went to Sicily. Here he is said to have written his treatise against the Christians, in 15 books. It was publicly burned by the Emperor Theodosius, and is known only from fragments in the authors who have refuted him. Porphyry, as well as Plotinus, recognized Christ as an eminent philosopher; but charged the Christians with corrupting his doctrines. The philosophy of Porphyry is completely identified with that of Plotinus (q.v.). Porphyry represented chiefly the religious phase of this philosophy, and we need here only refer to its relation to the popular mythology and theurgy, which has been merely adverted to in the life of Plotinus. The best ancient philosophers found no difficulty in reconciling polytheism with the belief in one supreme and omnipotent God. Plotinus and Porphyry joined a belief in good and evil demons, and a respect at least for the Greek mythology with their philosophical tenets. These beliefs have been the ground of accusations of inconsistency against Porphyry, who dwells on them occasionally in his writings. He believed, as did Plotinus, in enchantment as a means of acquiring power over demons and the souls of the dead; but always ranked philosophy higher than mythology, and from his letter to the Egyptian prophet Anebo it appears that at a later period of his life doubts of the popular theology, and of the theurgical notions associated with it, had begun to prevail with him. The practical tendencies of his philosophy were ascetic. He held that all matter was polluted, and that no material sacrifice ought to be offered to the supreme God. He abstained from animal food, and would also, had it been possible, have abstained from vegetable diet. He distinguished four degrees of virtue—political virtue, or that of moderation is the first grade; purifying virtue, which sets the soul free from passion, and by means of which men are made to resemble demons, is the second grade; in the third grade, which corresponds with the absorbing devotion of philosophy, man becomes a god; and in the fourth, answering to the ecstatic state of Plotinus, he becomes the father of the gods. He recognizes a soul in animals, and accords to them a certain amount of intelligence and reason. Porphyry was a voluminous writer, but comparatively few of his works are extant. Besides his editorial work for Plotinus, the most important are his *Lives of Plotinus and Pythagoras*, the latter supposed to be a fragment of a larger history of philosophers. Among his other works are: 'Principles Concerning Intelligibles,' a resumé of the Philosophy of Plotinus, and the 'Cave of the Nymphs in the Odyssey,' a contribution



## PORPHYRY — PORPORA

to a symbolical interpretation of Homer. Consult: Bouillet, 'Porphyre, son Role dans l'Ecole Neoplatonicienne' (1864).

**Porphyry**, any one of various kinds of compound rock having a basis in which the other contemporaneous constituent parts are imbedded. The base is sometimes clay-stone, sometimes hornstone, sometimes compact feldspar, jade, pitchstone, pearlstone, and obsidian. The imbedded parts are commonly orthoclase feldspar and quartz; the former in more or less distinct crystals. There are porphyries of different ages. One variety is found graduating into granite and gneiss, but this does not possess the characteristics of the rock in the highest perfection; another is found in overlying strata, and unconformable to other rocks, which is the true porphyry. Its color is often red or green, and when polished it is valuable for ornamental work, being superior to marble on account of its great hardness.

**Porpoise.** Any small or moderate-sized cetacean is usually called a porpoise, but the name is applied chiefly to members of the family *Delphinidæ*, belonging to the suborder *Odontoceti*, or the toothed whales. Its principal characters are as follows: The anterior pairs of ribs are joined to the vertebræ by both a tubercle and a head. The sternal ribs are completely ossified. The cervical vertebræ are more or less united. In the skull, the pterygoid bones are inflated. The symphysis of the mandible is short. Teeth are always present, but vary greatly in number in different genera; they usually occur in both jaws and are simple and conical. The genus *Grampus* is without teeth in the upper jaw, and the genus *Monodon* without teeth in the lower jaw. The blowhole is single and crescentic in form.

Between 60 and 70 species of porpoises are known, representing 19 genera. They are greatly diversified in form and color. Some have a large, falcate dorsal fin, while in others the fin is reduced in size, or is represented only by a low ridge, or is entirely absent. The pectoral fins are equally varied in size and proportions, being short and broad in some forms and very long and narrow in others. The beak may be long or short, compressed or depressed, and is sometimes replaced by a narrow rim, or is absent altogether. The representatives of several genera of porpoises have received special names, such as killers (genus *Orcinus*), grampuses (genus *Grampus*), blackfish (genus *Globicephalus*), beluga or white whale (genus *Delphinapterus*), narwhal (genus *Monodon*), etc.

The *Delphinidæ* are chiefly marine, but some species of the genus *Sotalia* live in the Amazon River, and in the rivers of China, and one species of the genus *Orcæella* in the Irawadi River, Burma. The harbor porpoise (*Phocæna phocæna*) and the bottle-nosed porpoise (*Tursiops truncatus*) frequently ascend the Potomac, Hudson and other rivers of the eastern coast of the United States, and the beluga ascends the Saint Lawrence regularly every spring in large numbers.

The geographical range of the porpoises as a group extends over all seas from the Arctic to the Antarctic, but while some species, such as the common dolphin (*Delphinus delphis*) have a

very wide distribution, that of others is more circumscribed. Thus, the narwhal is confined to the Arctic ocean, and rarely leaves the ice. The beluga is also an Arctic species, though it ranges southward regularly in spring to the Saint Lawrence, as already stated, and occasionally individuals stray as far south as Cape Cod and the New Jersey coast. The white-lipped porpoise (*Lagenorhynchus albirostris*) is common about the British Isles, but is not found on the coast of the United States. The species of blackfish (*Globicephalus melas*) found on our east coast north of New Jersey is different from that occurring further south. Our commonest east coast porpoise (*Tursiops truncatus*) is not found in Greenland waters, while the harbor porpoise (*Phocæna phocæna*), which is abundant in the gulf of Maine and northward, does not range south of New Jersey. Many species occurring in the tropics and the south seas are never seen in North American waters.

The majority of porpoises feed upon fish, but the various species of blackfish, the narwhal and the white whale subsist chiefly or exclusively upon cuttlefish, while the killers devour the young of other cetaceans and of various amphibious mammals, such as seals, sea-lions, etc. The stomach of a porpoise (*Sotalia teüszii*) recently discovered on the west coast of Africa was found to contain leaves of the mangrove tree and other vegetable matter. Porpoises are gregarious animals, congregating in large herds or "schools," which sometimes comprise an enormous number of individuals. Schools of blackfish numbering hundreds of individuals occasionally approach the land at the Faroe Islands, the Orkney Islands, Cape Cod, and other points, where they strand, or are driven ashore by the fishermen. They are the source of a considerable profit, on account of their oil, which is of a superior quality. The skins of the blackfish and of the white whale are valuable for leather, but the dermis of the majority of porpoises is too thin, or too irregular in texture, to form good leather.

Besides the porpoises of the family *Delphinidæ*, there are a few species generally called river dolphins, representing three genera, which belong to a separate family, the *Platanistidæ*. The best known are the susu of the Ganges River, genus *Platanista*, a blind form which subsists chiefly upon fresh-water crustaceans; the inia, genus *Inia*, of the Amazon River; and the *Pontoporia*, found about the mouth of the La Plata River. These porpoises are remarkable for their long beaks, their broad pectoral fins, their free cervical vertebræ, and their rugose or otherwise peculiar teeth. They are regarded as highly specialized forms of ancient origin. Numerous fossil species of *Delphinidæ* and *Platanistidæ* occur in the Tertiary and latter geological formations, beginning with the Miocene.

F. W. TRUE,  
U. S. National Museum.

**Porpora**, pōr'pō-rä, **Nicolo**, Italian composer: b. Naples 19 Aug. 1685; d. there February 1766. He studied under Scarlatti and his first opera, 'Ariana e Teseo,' was brought out at Vienna, 1717. In 1725 Porpora went to Vienna with his celebrated pupil, Farinelli, and in 1728 accepted a pressing invitation from the court at Dresden. He had already composed 50 operas,



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and was regarded as without a rival. In 1729 a faction in London, discontented with Handel, opened another opera house, and called Porpora to take the direction of it. Porpora, supported by Farinelli and other distinguished singers whom he had trained, triumphed, and Handel accordingly gave up the theatre, and devoted himself to oratorio. Porpora now gave up his engagements in Dresden, and established himself in London. Here his reputation, especially as a singing-master, continued to be great; but after a few years he went to Venice and later was established in Vienna, where in 1754, Haydn, for the sake of obtaining his instructions, became his valet. In 1760 he presided at the production in Naples of his last and feeblest opera, 'Il Trionfo di Camillo.' Only a few of his operas are now known, and none of them have retained popularity; but he is regarded as the most accomplished singing-master who has ever existed. His religious compositions, and especially his cantatas, are the works in which he appears to most advantage.

**Porsena**, pôr'sě-nā, or **Porsen'na**, Lars, king of the Etrurian city of Clusium. According to the legend narrated by Livy, he received the Tarquins on their expulsion from Rome, and after endeavoring in vain to effect their restoration by negotiation, advanced with an army to Rome. He would have entered the city with the flying Romans had not Horatius Cocles disputed the passage until the bridge was broken down. Porsena then besieged Rome, and a famine was produced in the city, when another Roman youth, Mucius Scævola, gave striking proof of his patriotism. (See SCÆVOLA.) A truce was now agreed upon, and the Romans sent ten young men, and as many girls, as hostages to the Etrurian camp. The latter escaped to Rome by swimming across the Tiber, but the consul Publicola conveyed them back again to Porsena, and was on this occasion treated with the greatest indignity by the Tarquins. Indignant at the perfidy of the Tarquins, and respecting the magnanimity of the Romans, Porsena separated himself from the former, and concluded peace with the latter without taking away their hostages. To relieve the wants of the Romans without offending their pride by a formal present, he left behind at his departure his camp with all its stores, and in remembrance of his magnanimity the senate erected to him a monument, and presented him with an ivory chair and sceptre, a golden crown, and a royal robe. Thenceforward Porsena lived in undisturbed friendship with the Romans. Modern critics have held that Rome was completely conquered by Porsena, and that the gifts they are represented as offering from gratitude were really a tribute indicating subjection. Aruns, the son of Porsena, was defeated by a league of the Latin cities, after which the Romans are believed to have recovered their independence. According to Pliny Porsena forbade the Romans the use of iron, except for agricultural purposes.

**Por'son**, Richard, English Greek scholar: b East Ruston, Norfolk, 25 Dec. 1759; d. London 25 Sept. 1808. He was educated at Eton and Cambridge, took the degree of M.A. in 1785, and not choosing to take holy orders, on account of conscientious scruples in regard to signing

the Thirty-nine Articles was obliged to relinquish the fellowship he had held from 1781. In 1792 he was appointed Greek professor, and in 1794 began the publication of the Tragedies of Euripides, with annotations, but continued his labors only through four — 'Hecuba,' 'Orestes,' 'Phœnissæ,' and 'Medea.' He assisted in editing the Grenville Homer (1800), and corrected the texts of the tragedies of Æschylus for an edition which issued from the Foulis Press at Glasgow. He had the reputation of being one of the best Greek scholars and critics of the age, notwithstanding which he experienced little patronage, a circumstance partly attributable to his intemperate habits. He was the author of 'Letters to Archdeacon Travis, in Answer to his Defence of the Three Heavenly Witnesses' (1790, 8vo.), in which he is allowed to have proved that the received text of 1 John v. 7, 8 is spurious. After his death were published his 'Adversaria, or Notes and Emendations of the Greek Poets'; and his 'Tracts and Miscellanies' (1815). In Porson acute discernment and solid judgment were united to intense application and a stupendous memory. Consult: Watson, 'Life of Richard Porson' (1861).

**Port.** See HARBOR; SHIPBUILDING; ETC.

**Port Adelaide**, Australia. See ADELAIDE.

**Port Arthur**, Canada, city in Thunder Bay District, Province of Ontario; on Lake Superior; the lake terminus of the Canadian Northern, also on the Canadian P., and the Grand T. P. R.R.'s; about 200 miles northeast of Duluth, Minn., and about 500 miles from Manitoba. It is the principal commercial point on the northwest shore of Lake Superior. It is in a lumbering region and valuable mines of gold, silver and iron are adjacent. Large shipments of merchandise, coal, wheat, etc., are made to eastern ports. Iron is smelted here. The city is the iron centre of the north shore and district, and there are also foundries, blast furnaces, brick yards and other manufactories. There are four banks capitalized at \$30,000,000. Port Arthur has several churches, a high school, public schools, and a Separate school. The city was first settled in 1870, became a borough in 1884, and a city in 1907. The government is vested in a mayor and council of 10 members. The city is the county-seat for judicial purposes. Pop. (1907) 15,000.

**Port Arthur**, or **Lu-Shun-Kou**, Manchuria, a strongly fortified seaport town at the southern extremity of the Liao-tung peninsula, dominating the Lao-tie-shan channel entrance to the Gulf of Pe-chi-li from the Yellow Sea and Korea Bay. Prior to its capture by the Japanese in the war of 1894 it was a Chinese fortress and naval arsenal. Its occupation by the Japanese was prevented by the Russian, German, and French coalition, but on 27 March 1898, the Chinese government leased it to Russia with adjacent territory for 25 years. Under the Russians it became the terminus of a railway line connecting with the Trans-Siberian Railway, the Chinese railway systems, and with modern Dalny, the important commercial seaport city, 14 miles to the northeast. It was fortified, its harbor and dock accommodations extended, and it was considered one of the strongest fortresses and naval stations in Chinese waters. At the outbreak of the Russo-Japanese war in 1904, it



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was the scene of a series of disasters inflicted on the Russian navy, not only by the torpedo boats of the enemy, but also by their own submarine mines and forts. It was surrendered to the Japanese, 3 Jan. 1905. See CHINA; DALNY; JAPAN; MANCHURIA.

**Port Arthur Ship Canal**, Texas, an artificial waterway, named after the town of Port Arthur which is situated on Sabine Lake, a body of water three miles long and ten miles wide, which marks the boundary of Texas and Louisiana. Seven and one half miles from Port Arthur Sabine Lake narrows into a long channel called Sabine Pass. This channel is from 26 to 40 feet deep and extends for seven miles to the south, terminating in the Gulf of Mexico. At the outer end of the pass is a bar which has been pierced by a channel formed by extending for a mile or more from shore two jetties of piled stone, built by the United States government, and which when completed will cost \$1,050,000. The jetties narrow the entrance to the pass from the Gulf, and the wash of the imprisoned waters to and fro, with the ebb and flow of the tide, has scoured a channel over the bar of 16 to 25 feet deep. The opening of this canal signalized the creation of a new seaport on the Gulf for the largest ocean vessels, the connection of a land-locked fresh-water harbor with the terminus of an 800-mile railway system, and the reduction by 500 miles of the distance over which the export food products of the southwest States have been hauled by east and west lines. The canal was formally opened 25 March 1899, in presence of about 5,000 people, with appropriate ceremonies.

**Port Blair**, the principal port of the Andaman Islands (q.v.) on South Andaman.

**Port Bret'on**, a name given to the southeast part of New Mecklenburg (formerly New Ireland), in the Bismarck Archipelago off Kaiser Wilhelm Land, New Guinea, the scene in 1879 of a disastrous colonizing experiment by a company of French Legitimists. In 1883, the Marquis Du Rays, who floated the company, and his associates were condemned to various terms of imprisonment for fraud and raising money by false pretenses.

**Port Ches'ter**, N. Y., village, Westchester County; on Long Island Sound, and on the New York, New Haven & Hartford railroad; 26 miles northeast of New York city. It was settled in the middle of the 18th century, and was at first called Saw Pit; the name was changed in 1837, and the village incorporated in 1868. It contains foundries, screw and bolt factories, carriage works, shirt factories and a woolen mill. It is also a summer resort. It contains a public hospital, also a public library, and high school which has its own school library. The village is governed by a president and a board of trustees, all holding office for two years. Pop. (1890) 5,274; (1900) 7,440.

**Port Clarence**, Alaska. See CLARENCE HARBOR.

**Port Clin'ton**, Ohio, village, county-seat of Ottawa County; on Lake Erie at the mouth of the Portage River, and on the Lake Shore & Michigan Southern railroad; 64 miles west of Cleveland. It has a good harbor, and carries on a considerable lake trade, being the commer-

cial centre of a region where the chief industry is grape and peach culture; lime and building stone are also obtained in the vicinity, and gypsum is mined. Fruit baskets are manufactured, and the fisheries are also of commercial importance. The village contains a public high school. Pop. (1890) 2,049; (1900) 2,450.

**Port Dar'win**, Australia, one of the finest harbors of the Commonwealth, on the north coast of the state of South Australia. Its entrance is two miles wide, and vessels of any tonnage can float in it with safety. Palmerston, the chief town on its shores, is the land terminus of the overland telegraph, 1,973 miles from Adelaide, and of the cable to Java. Since 1891 it is also the starting point of a railway to the gold fields of the interior, 150 miles distant.

**Port Eliz'abeth**, South Africa, a seaport town of Cape Colony, on the west side of Algoa Bay, about 420 miles east of Cape Town. It has many fine buildings, including a handsome town-hall, custom-house, hospital, etc. It is the great centre of trade for the eastern portion of the colony as well as for a large part of the interior, being the terminus of railways that connect it with Kimberley and other important inland towns. The exports and imports together amount to over \$50,000,000. There are a seawall and two iron jetties, but the shipping is much exposed to easterly winds and extensive harbor works are being built. Pop. 25,000.

**Port Es'sington**, Australia, an inlet in the Coburg Peninsula of the northern territory of South Australia, on the Arafura Sea, forming a fine harbor. The British Government had a penal settlement on its shores from 1831 to 1850.

**Port Fam'ine**, Chile, a deep bay on the east coast of the Straits of Magellan, so named in 1587 by Cavendish. It was a Chilean penal colony in 1843-53.

**Port Gibson, Battle of.** After much unsuccessful effort to reach Vicksburg from the north, Gen. Grant, late in January 1863, directed his attention to opening a canal which had been begun the year before across the peninsula on the west bank of the Mississippi. The canal proving impracticable, and other plans failing, among them an expedition up the Yazoo River, Grant determined to move his army by land down the west bank of the river some 70 miles and cross the Mississippi below Vicksburg, while transports for crossing should run past the Vicksburg batteries. Admiral Farragut had already run two of his vessels past the Confederate batteries at Port Hudson and Grand Gulf, and cleared the river of the enemy's boats below Vicksburg. On the night of 16 April, Admiral D. D. Porter ran the Vicksburg batteries with a fleet of six vessels and three transports carrying stores, one of the transports being lost. Six days later, five more transports, towing 12 barges, ran the batteries safely, a sixth being sunk, and half the barges disabled. Meanwhile Grant had marched McClernand's and McPherson's corps from Milliken's Bend for New Carthage, and upon arriving at that place and finding a limited number of transports the troops were marched to Hard Times, where a number of boats were collected from the different bayous in the vicinity, and 29 April, having 10,000 troops on barges and transports, Grant



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was opposite Grand Gulf, prepared to land and carry the place by storm the moment the batteries bearing on the river had been silenced by the navy. Admiral Porter, with seven ironclads, opened the attack at 8 A.M., and engaged at close quarters until 1.30 P.M.; but from the great elevation of the Confederate batteries, he found it impracticable to silence them with his guns, and therefore withdrew, when Grant immediately decided to land his men on the Louisiana shore and march them across the point to below Grand Gulf, the gunboats and transports to run the batteries. At dusk the gunboats engaged the batteries, and all the transports ran by, the gunboats following. Grant had heard of a good landing on the east bank of the river, and at daybreak of the 30th transports and gunboats began the ferrying of the troops across to Bruinsburg, ten miles below Grand Gulf and 32 in a straight line below Vicksburg. At noon McClernand's corps, four divisions, 18,000 men, had been landed, and at 4 P.M. McClernand pushed out into the country, and at 1 A.M. of 1 May met the Confederates 12 miles from Bruinsburg and four from Port Gibson, and after a slight skirmish the advance division, under Gen. Carr, lay on its arms until daybreak. The Confederate force met was Gen. Green's brigade, which had marched from Grand Gulf on the afternoon of the 30th. During the night it was joined by Gen. Tracy's brigade from Vicksburg, and line was formed about three miles west of Port Gibson, across two roads converging on the town and uniting just outside of it. Green was across the southern road, and Tracy across the northern one, the roads running on two ridges, separated by a deep ravine, filled by a dense growth of cane and underbrush. At 5 A.M. 1 May the battle was opened by the advance of Osterhaus' division on the left, which was checked and repulsed by Tracy's brigade with much loss, and made no further progress until late in the afternoon. Carr's division, supported by Hovey's, advanced on the right and assaulted the ridge held by Green's brigade, and after a hard fight carried it, capturing two guns and over 300 prisoners, Green falling back toward Port Gibson. Gen. J. S. Bowen, commanding the Confederate forces at Grand Gulf, arrived on the field with Gen. Baldwin's brigade, about 9 A.M., and formed line in Green's rear, Carr and Hovey continued to press Green, who was soon withdrawn and sent to assist Tracy, leaving Baldwin to oppose them. Early in the afternoon Baldwin was attacked, and a severe contest ensued, lasting nearly two hours, during which Bowen, with two regiments of Col. F. M. Cockrell's brigade, which had arrived about noon, made a very determined effort to turn McClernand's right, but the attempt was defeated, and Cockrell's men joined Baldwin. Meanwhile Logan's division of McPherson's corps had come up and, part of it joining Osterhaus, both advanced on Tracy's and Green's brigades and slowly forced them back. McClernand's troops on the right again attacked Baldwin, and just at sunset the entire Confederate force, Baldwin covering the rear, fell back, through Port Gibson and destroyed the bridge over the south fork of Bayou Pierre, two miles beyond Port Gibson. Grant entered the place next morning. The Union forces engaged were four divisions of McClernand's corps and part of Logan's divi-

sion of McPherson's, in all about 23,000 men, and their losses were 131 killed, 719 wounded and 25 missing. The Confederate forces, under Bowen, were four brigades of 6,000 men and 13 guns. They lost five guns and reported 68 killed, 380 wounded, and 384 missing. Consult: 'Official Records,' Vol. XXIV.; Greene, 'The Mississippi'; Grant, 'Personal Memoirs,' Vol. II.

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**Port-Glas'gow**, Scotland, a seaport town of Renfrewshire, on the estuary of the Clyde, 20 miles west-northwest of Glasgow, and about two and a half miles above Greenock. In 1662 the magistrates of Glasgow purchased here 13 acres of land on which they built harbors and the first dry dock in Scotland. The town was intended to be the seaport of Glasgow and long did a large shipping trade; but when the Clyde was deepened so as to enable large vessels to sail up to Glasgow, the trade rapidly diminished. The staple industries are ship-building and marine engineering; and there are manufactures of sail-cloth, ropes, etc., iron and brass foundries, bolt and rivet works. Pop. (1901) 16,840.

**Port Ham'ilton**, Korea, a spacious, well sheltered harbor, formed by three islands of the Nanhow group in the Korean archipelago, 30 miles south of Korea and 45 miles northeast of Quelpart Island. It was explored and named by Belcher in 1845. In 1885 it was annexed by Great Britain as a prospective coaling station, but was abandoned the following year.

**Port Hope**, Canada, town, port of entry in Durham County, in the Province of Ontario; on Lake Ontario, and on the Grand Trunk railroad; about 60 miles east by north of Toronto. There are steamer connections with the principal lake ports, and there is here a good harbor. The chief industries of the place are fishing (it has a large fishing fleet), and manufacturing of leather, machinery, steam engines, iron castings, buttons, woolen goods, and wooden-ware. There is a large trade in its own manufactures, grain, and lumber. Pop. (1891) 5,042; (1901) 4,188.

**Port Hudson, Siege of.** Port Hudson, a small village in Louisiana, on the east bank of the Mississippi, 135 miles above New Orleans, was occupied by the Confederates, under Gen. Breckinridge, after their defeat at Baton Rouge, 5 Aug. 1862. The place was in a sharp bend of the river, on bold bluffs rising 75 to 90 feet above it, which for three miles along the river were strongly fortified and armed with heavy guns. In November 1862 Gen. Banks was ordered to relieve Butler, in command at New Orleans, under instructions from Halleck requiring Banks to clear the Mississippi River, also to occupy the Red River country as a protection for Louisiana and Arkansas, and as a basis for future operations against Texas. He was authorized to assume control of any military forces from the upper Mississippi which might come within his command, and to exercise superior authority as far as he might ascend the river. When these instructions were issued Gen. McClernand had been given authority to organize an expedition on the upper Mississippi to reduce Vicksburg, and the intention was that Banks should ascend the river from New Orleans, join forces with McClernand at Vicksburg, and assume command for operations against that



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place. When Halleck gave the instructions he did not suppose that there were any barriers on the river that would seriously interfere with Banks' movement to Vicksburg. Banks arrived at New Orleans with about 20,000 men 14 December, relieved Butler, and was surprised to learn that the Confederates held Port Hudson, with 21 heavy guns on the bluffs and a garrison reported as numbering from 12,000 to 16,000 men. Nothing was heard from McClernand or Grant. On the 18th Gen. Grover, with a division of 18,000 men and some artillery, was sent to occupy Baton Rouge, 25 miles south of Port Hudson, which was accomplished without opposition and was the first step in the reduction of Port Hudson.

After providing for the security of New Orleans, Banks organized his available forces into a corps of four divisions, under command of Gens. Augur, Thomas W. Sherman, Emory and Grover. Exaggerated reports of the strength of the Confederates at Port Hudson forbade a direct attack upon it, and Banks endeavored to turn it on the west and reach Vicksburg by means of the Atchafalaya, the mouth of Red River, and the various bayous connecting the Atchafalaya with the Mississippi, but was unsuccessful, and was turning his attention to a movement from Berwick Bay by the Atchafalaya, when news came that two of Col. Ellet's rams, after running the batteries of Vicksburg, had been captured. Admiral Farragut, who was co-operating with Banks, now proposed to run his fleet past the batteries of Port Hudson, recapture or destroy the rams, and thus control the river as far up as Vicksburg, and cut off supplies from the Red River country. Banks promptly assented and moved from Baton Rouge, with 17,000 men, to the rear of Port Hudson, on 14 March 1863 to co-operate with the fleet. That night Farragut started to run the batteries with nine vessels, carrying 116 guns. Most of the fleet, under the heavy fire brought to bear upon them, failed to get through, and put back; the Mississippi passed the lower batteries, then ran aground and, being under fire of three heavy batteries, was burned by her commander, the crew taking to boats and going back; the Hartford and Albatross made the passage and communicated with Porter's fleet above Vicksburg. Farragut's loss was 113 killed and wounded; one vessel had been destroyed and four disabled. The navy now had control of the mouth of Red River, and Banks, reverting to the execution of his turning movement by the Atchafalaya, recrossed the Mississippi, drove back the Confederate forces of Gen. R. Taylor, after two severe engagements at Fort Bisland and Irish Bend, in which he lost 353 men, and occupied Opelousas 20 April, from which place he marched to Alexandria, on Red River, reaching there 7 May, Taylor retiring before him to Shreveport and into Texas. He had captured a large number of prisoners and 22 guns, and Farragut had destroyed three gunboats, including those that had been taken from Ellet. Meanwhile he had received word from Farragut that Grant, 23 March, had written him that should river transportation be secured he would send 20,000 men through the Tensas, Black and Red rivers to join in reducing Port Hudson, and at the same time a letter from Grant that he could spare him an army corps

to enable him to get up the Mississippi. Upon arriving at Alexandria Banks received a despatch from Grant, dated at Milliken's Bend 14 April, proposing to send an army corps to Bayou Sara by the 25th, and requesting that Banks should, after the reduction of Port Hudson, send all the troops he could spare to Vicksburg. Banks assented to the proposition, saying that the troops could be supplied from New Orleans, but he was afterward informed by Grant, in a despatch dated Rocky Springs 10 May, and received on the 12th, that he had crossed the Mississippi to Grand Gulf and was then in close pursuit of the enemy and, under the circumstances, could not retrace his steps, nor send the promised troops; and as he had heard and believed that Port Hudson was almost entirely evacuated, he requested Banks to join his command at Vicksburg. Regarding the proposed co-operation Grant says: "While at Grand Gulf [3 May] I heard from Banks, who was on the Red River, and he said that he could not be at Port Hudson before the 10th of May, and then with only 15,000 men. Up to this time my intention had been to secure Grand Gulf as a base of supplies, detach McClernand's corps to Banks, and co-operate with him in the reduction of Port Hudson. The news from Banks forced upon me a different plan of campaign from the one intended; to wait for his co-operation would have detained me at least a month. . . . I therefore determined to move independently of Banks." Halleck was intensely provoked at the action of Grant and Banks, and wrote sharply to both of them. That it was his intention that their two armies should unite or co-operate under the chief command of Banks, and first take Port Hudson, is evident from his letters. To Grant he wrote 11 May, after he knew that he was operating in rear of Vicksburg, that his forces and those of Banks should be concentrated between Port Hudson and Vicksburg, so as to attack these places separately with the combined armies. Grant says that he received this letter on the Big Black, on the 17th, and that in it he was ordered "to return to Grand Gulf and to co-operate from there with Banks against Port Hudson, and then to return with the combined forces to besiege Vicksburg." To Banks Halleck wrote a few days later: "I assure you that the government is exceedingly disappointed that you and Gen. Grant are not acting in co-operation. I thought to secure that object by authorizing you to assume the entire command as soon as you and Gen. Grant could unite." When these letters were received both Grant and Banks had fully committed themselves to the independent sieges of Vicksburg and Port Hudson.

The failure of Grant to co-operate with him was a keen disappointment to Banks. He could not join Grant for want of water transportation; he could not leave Port Hudson, with its large garrison, in his rear, without endangering New Orleans and all the Red River region; and therefore he concluded to concentrate his command and move immediately against Port Hudson. On 14 May he marched from Alexandria for Bayou Sara, crossed the Mississippi on the night of the 23d, and on the night of the 24th was in rear of Port Hudson, where he was joined next day by Gen. Augur, who had come up from Baton Rouge, defeating the Confederates at Plains' Store, on the 21st, with a



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loss of 86 killed and wounded, the Confederate loss being about the same. The investment was completed on the 26th with about 14,000 men, Gen. Frank Gardner, commanding at Port Hudson, having about 7,000 men. Gardner had been ordered by Gen. J. E. Johnston, 19 May, to evacuate the place forthwith and move toward Jackson, but the order came too late. Under the impression that Gardner's force was much less than it was in reality, as it was reported much reduced by troops sent to oppose Grant in rear of Vicksburg, Banks ordered a general assault to be made on the morning of the 27th. The Confederate fortifications on the land side of Port Hudson consisted of a series of strong works connected by rifle-pits, with their flanks resting on the river above and below the place. Their length was nearly four miles, and upon them were about 30 field-guns. The approach to them was difficult, being cut by ravines and for the most part covered by dense groves of magnolia and other trees. The investing line was seven miles in length. The brigade of Gen. Weitzel and the divisions of Gens. Dwight and Grover were on the right, Augur's division in the centre, and a part of Thomas W. Sherman's on the left. The assault, which was ordered simultaneously along the entire line, was preceded by a heavy fire of artillery, and at 10 A.M. Weitzel, on the right, commanding his own troops and Dwight's, moved forward fighting severely until late in the afternoon, and gaining some ground; Grover, on his left, gained and held commanding positions within 200 yards of the Confederate works. In the centre and on the left Augur and Sherman did not advance until 2 P.M., when they made a most determined effort, under a severe fire of canister and musketry, and reached the ditch of the works, but could not cross the parapet, and were withdrawn at night. The only advantages gained were the advanced positions held by Weitzel and Grover. The Union loss in the assault, in which 13,000 men participated, was 293 killed, 1,545 wounded, and 157 missing. The Confederate loss was about 235 killed and wounded. Regular siege operations began next day, siege-guns were planted, and constant skirmishing was kept up, during which, with some checks, the Union lines gained some ground, which was immediately intrenched. On 10 June a heavy artillery-fire was kept up, and at 3 o'clock on the morning of the 11th an attempt was made to get within assaulting distance of the works. A portion of the troops worked their way through the abatis, but were repulsed with loss and some captured. Meanwhile Banks had reorganized his command. Sherman, who had been severely wounded on the 27th of May, was succeeded by Gen. Dwight, and Gen. Grover was assigned to the command of the right wing, consisting of his own and Paine's divisions and Weitzel's brigade. The line was formed in this order from right to left: Weitzel, Grover, Paine, Augur, and Dwight. On 14 June, the line of investment being well advanced, Banks made a second general assault at daylight from his left and right. Dwight, on the left, endeavored to gain entrance to the works by passing a ravine, while the main attack was made on the right by Grover and Weitzel. The assault ended in a bloody repulse, the Union loss being 203 killed, 1,401 wounded, and 188 missing. The Confed-

erates had 22 killed and 25 wounded. The only advantage gained was a few yards nearer approach to the works on the right, and on the left an eminence commanding a strong part of them, and which later enabled Banks to get possession of the bluff within ten yards of the enemy's lines. Siege-operations were continued and on the right saps were run to the very line of the Confederate works. On the left a mine had been prepared for a charge of 30 barrels of powder, and a storming column of 1,000 volunteers organized, when, during the night of 6 July, news was received that Vicksburg had surrendered. Gardner soon heard the news, and asked Banks to give him an official assurance of its truth, adding that if true, he requested a cessation of hostilities, with a view to consider terms for a surrender. Banks furnished him a copy of Grant's despatch, terms were agreed upon, and on the 8th Gardner surrendered 6,340 officers and men, 51 guns, about 7,500 muskets, large quantities of ammunition, and two river steamers. In an address commending the gallantry of his men, Gardner stated that his surrender was not on account of the fall of Vicksburg, nor for want of ammunition or provisions, but was due to the exhaustion of his men, who had been without rest for more than six weeks, and who could not resist another attack. In all the operations against Port Hudson the fleet under Farragut had co-operated and assisted. The Union loss during the siege was 708 killed, 3,336 wounded, and 319 missing, an aggregate of 4,363. Incomplete Confederate returns show a loss of 176 killed and 447 wounded. Consult: 'Official Records,' Vol. XXIV., XXVI.; Greene, 'The Mississippi'; Grant, 'Personal Memoirs,' Vol. I.; The Century Company, 'Battles and Leaders of the Civil War,' Vol. III.

E. A. CARMAN.

**Port Hu'ron**, Mich., city, port of entry, county-seat of Saint Clair County; at the mouth of Black River, the head of Saint Clair River, and at the outlet of Lake Huron; on the Grand Trunk Western, the Grank Trunk, and the Pere Marquette R.R.'s; about 58 miles north-east of Detroit. Port Huron is the most easterly point in the State. It has steamer and electric railway connection with Detroit, and steamer connection with all the principal ports of the Great Lakes. A railroad tunnel under Saint Clair River extends from Port Huron to Sarnia, Ontario. This tunnel is over a mile long directly across, but including the approaches, it is nearly two miles long. It cost about \$2,700,000, and was opened in 1891. The climate, scenery, mineral springs, and opportunities for fishing have combined to make Port Huron a favorite summer resort. It has considerable manufacturing interests; the chief industrial establishments are shipbuilding works, which have 450 employees; engine and thresher works, 1,000 employees; Grand Trunk car and locomotive shops, 800 employees; fibre works, 250; other industries have about 1,500 employees. Port Huron has an extensive commerce, especially with Canada. The exports in 1902 were nearly \$10,000,000; and the imports over \$3,000,000. The principal public buildings are the custom-house and post-office, court-house, auditorium, hospital and home, and the Carnegie Library. The educational institutions are 16 public schools, including a high



## PORT ISABELA — PORT-AU-PRINCE

school, two business colleges, teachers' training school, two parish schools, the Academy of the Sacred Heart, Carnegie Library, and the county bar library, which contains about 12,000 volumes. There are over 30 church edifices. The four banks have a combined capital of \$400,000. The government is vested in a mayor, who holds office two years, and a council of 20 members. The council elects the school and cemetery boards; the mayor appoints, subject to confirmation of the council, the police commission and the board of assessors. The board of estimates is elected by the people. The city owns and operates the waterworks. Port Huron was from 1686 an Indian village known as Delude, and was first permanently settled in 1790 by a French colony. It has been known as Fort Gratiot, La Rivière, Desmond, and Saint Joseph. It was incorporated as a town in 1838, and as the city of Port Huron in 1857. Pop. (1900) 19,158; (1903) 20,962.

FRED W. SHERMAN,  
*Business Manager, 'Times.'*

**Port Isabela**, ē-sā-bā'lā, Philippines, harbor in channel between Malamaui Island and the northwest coast of the island of Basilan. It has a naval hospital, a small arsenal and equipment for the repair of small vessels. The town Isabela de Basilan is the capital of the island, and is garrisoned by United States marines.

**Port Jack'son**, Australia, the beautiful and extensive inlet on the east coast in New South Wales, forming the well-sheltered harbor on the south shore of which Sydney stands. See SYDNEY.

**Port Jackson Shark.** See CESTRACION.

**Port Jer'vis**, N. Y., village in Orange County; on the Delaware and Neversink rivers, where the states of New York, New Jersey, and Pennsylvania meet; and on the New York, O. & W., the Erie, and the Milford & M. R.R.'s; about 85 miles northwest of New York city. It was settled in the last of the 18th century, and laid out as a village in 1826. The first permanent settlers were descendants of the French Huguenots and the Dutch, who settled the town of Deerpark. It is a popular summer resort on account of the many waterfalls nearby and the beauty of the scenery in general. Its water-power and transportation facilities have contributed toward making the village of commercial and industrial importance. The chief manufacturing establishments are railroad shops, which have about 1,000 employees; glove factories, which have 200 employees; silk mill, 75 employees; silver plating works, 200; necktie factory, 100; overall factory, 100; saw factory, 100; shirt factory, 50; and other industrial works are a shoe factory, flour and planing mills, sash factory, printing works, and a number of smaller establishments which supply local needs. The principal public buildings are the Carnegie Free Library, cost \$30,000; Port Jervis Board of Trade, two hospitals, the Y. M. C. A. building, Saint Mary's Orphan Asylum, and 10 churches. The educational institutions are public and parish schools, two private schools, a conservatory of music, and the public library which contains about 15,000 volumes. The two banks have a combined capital of \$230,000; the surplus and other undivided profits in the

National bank, 9 Sept. 1903 was \$131,943.27, and the business for 1903 for the same bank was nearly \$1,300,000. The government is vested in a board of village trustees chosen by popular vote. Pop. (1890) 9,327; (1900) 9,385.

W. T. Doty,  
*Editor, 'Port Jervis Union.'*

**Port Louis**, loo'is or loo'ē, Mauritius, capital of the British colony of Mauritius; on the northwest coast, on a cove formed by a series of basaltic hills, portions of which are covered with forests. The streets are narrow, laid out at right angles with basaltic curbstones, and shaded by large acacias. A mountain stream traverses the town. The town and harbor are protected by Forts Adelaide and George. The principal buildings and institutions are the Roman Catholic and Protestant cathedrals, the barracks, theatre, hospital, botanical gardens, an observatory, and library. It is the chief commercial port of the island and a coaling station for the British navy. Great damage and loss of life were caused by a hurricane in April 1892. Pop. (1891) 62,046; (1901) 52,740. Consult: Flemyng, 'Mauritius, or the Isle of France'; Decotter, 'Géographie de Maurice et de ses Dépendances.'

**Port Mahon.** See MAHON.

**Port-Moo'dy**, Canada, a harbor at the head of Burrard Inlet, British Columbia, a little to the north of New Westminster. It was at one time intended for the terminus of the Canadian Pacific Railroad, but was abandoned for Vancouver, at the entrance to Burrard Inlet.

**Port Natal**, na-täl', South Africa. See DURBAN.

**Port Or'chard** (formerly Sidney), Wash., a United States naval station in Kitsap County; on Port Orchard Bay, an inlet of Puget Sound; about 20 miles west of Seattle. The station was established in 1891, when the government purchased here 200 acres of land, built a dry dock 600 feet long and 75 feet wide, and capable of holding vessels with a 30-foot draft. The original cost of the improvements, not including purchase price of land, was \$700,000.

**Port de Paix**, pōr dē-pā, Haiti, town on the Tortugā Channel, and on the right bank of Trois Rivières; about 95 miles north of Port-au-Prince. The place was visited by Columbus in 1492, and by him was named Valparaíso. It is in an agricultural region, in which coffee is the principal production. There is a large trade in coffee and fruit. Pop. estimated (1903) 12,000.

**Port Phillip**, Australia. See MELBOURNE.

**Port-au-Prince**, pōrt'ō-prīns' (Fr. pōr-tō-prāns), or **Port Républicain**, pōr-rā-püb-lē-kān, Haiti, city, capital of the Republic of Haiti; on the Bay of Haiti. It is the principal seaport, and although it has an excellent harbor, the low marsh land surrounding it renders it undesirable as a place of residence. The buildings are mostly of wood. There is considerable trade in fruits, the cocoanuts, and cabinet woods. It has municipal buildings, a mint, college, and lyceum.

The city was founded in 1745, and was completely destroyed by an earthquake in 1770. It has also been ravaged by fires in 1791, 1843, and 1867. Pop. estimated (1903) 61,000.



## PORT REPUBLIC — PORT-ROYAL

**Port Republic, Battle of.** Gen. "Stonewall" Jackson defeated Gen. Banks at Winchester 25 May 1862, drove him across the Potomac, and then retreated up the Shenandoah Valley, slipping between the converging forces of Gens. Frémont and McDowell near Strasburg on the 31st. Frémont pursued by the Valley road, and Gen. Shields, commanding a division of McDowell's corps, endeavored to fall upon his flank and intercept him by moving up the Luray Valley. On the evening of 1 June Shields moved out of Front Royal, Col. S. S. Carroll leading, with some cavalry, infantry, and four guns, to destroy the bridges over which Jackson might retreat to Stanardsville. But Jackson himself had destroyed the bridges by which his flank could be reached, and Shields halted his advance brigades at Conrad's Store and Columbia Bridge. On hearing that Jackson had passed through Harrisonburg in the direction of Port Republic, and that Frémont had reached Harrisonburg in close pursuit, Shields ordered Carroll's and Tyler's brigades forward to head off Jackson while Frémont pressed his rear. The orders to the two brigade commanders were to guard the river at Port Republic and cut the railroad at Waynesboro. Shields, with two brigades, remained at Luray to watch Longstreet, who was incorrectly reported moving into Luray Valley, by the gaps of the Blue Ridge, with 10,000 men. Carroll, with less than 1,000 infantry, 150 cavalry, and Clark's regular battery of six guns, marched from Conrad's Store on the afternoon of 7 June, and halted in the night six miles from Port Republic, where his scouts brought information that Jackson's train was packed near the place, guarded by about 300 cavalry. Carroll, with his 150 cavalry and four guns, leaving his infantry to follow, started very early in the morning of the 8th, drove in the Confederate outposts and put two guns in position commanding both ends of the bridge over the South Fork of the Shenandoah River, and ordered the cavalry to charge and seize the bridge. The charge was made and the bridge seized, Jackson, whose headquarters were in the village narrowly escaping across it, while some of his staff were captured. Carroll, with two guns, followed his cavalry to the bridge; some of the cavalry entered the village and attacked the wagon-train. By some misunderstanding the bridge was not burned as Shields says it was intended to be, and Jackson, the moment he crossed it, ordered batteries in position which opened on Carroll, and a regiment of infantry rushed down and over the bridge, driving him away and capturing one of his guns. Carroll retreated two miles down the river, with a loss of 39 men killed and wounded, the greater part of which was in the 7th Indiana, which came under artillery fire as it was moving to the support of the cavalry. Jackson moved Taliaferro's brigade into the village to hold the fords of South River, a branch of the South Fork of the Shenandoah, and placed Winder's brigade on the north side of the latter to observe Carroll and by artillery check any renewed advance. While all this was transpiring the battle of Cross Keys (q.v.), was going on, and Jackson, hearing the sounds of the engagement, rode to the field. At 2 P.M. Tyler came up with his brigade and joined Carroll, and as senior officer assumed command. He had about 3,000 men and 16 guns, and took position

with his right on the South Fork of the Shenandoah and his left on commanding ground, on which was disposed the greater part of the artillery. Jackson, who had repulsed Frémont at Cross Keys, on the 8th, returned to Port Republic during the night, leaving Ewell, with a small force, to confront Frémont, and early in the morning of the 9th led Winder's brigade across the bridge and attacked Tyler's right, with the intention of turning it, but was repulsed. Winder, rallying a part of his brigade and reinforced by a regiment of Taylor's Louisiana brigade, made another effort and was again repulsed, with the loss of one of his guns and many men. Meanwhile some of Ewell's troops from Cross Keys came on the field and Taylor's Louisiana brigade was ordered to turn Tyler's left and take his guns. Taylor moved under cover of dense woods to a position on the flank of Clark's battery of six guns, from which support had been withdrawn, and charged it; but Clark, turning his guns upon him, repulsed him with shell and canister. The attempt was renewed on that flank, but Tyler's infantry was now supporting the guns, and the contest around and among them, at close quarters, was severe, but the Confederates were held in check. The fight had now raged more than four hours, Jackson had withdrawn all his forces from Frémont's front, crossed the bridge and destroyed it, and concentrated against Tyler, who saw that the time had come to retreat, and gave the order, Carroll having charge of the movement. The artillery and infantry on the right were withdrawn in good order, but on the left so many horses had been killed or disabled that but one gun was saved, the Confederates advancing and seizing five, as Tyler's men began the retreat, and turning them upon the retiring troops, throwing the rear of the column into some disorder. The Confederate infantry followed four miles, the cavalry until Shields came up with the rest of his division, when pursuit was checked and Shields continued the retreat to Conrad's Store. After the retreat Frémont appeared on the opposite side of the river, which he could not cross, and opened upon Jackson with his artillery. During the morning Jackson had put his trains in motion for Brown's Gap of the Blue Ridge, and after the battle he followed them. The Union loss was 67 killed, 393 wounded, and 558 missing; the Confederate loss, 816 killed, wounded, and missing. Consult: 'Official Records,' Vol. XII.; Allan, 'Jackson's Valley Campaign'; The Century Company's 'Battles and Leaders of the Civil War,' Vol. II.

E. A. CARMAN.

**Port-Royal**, pōrt-roi'al (Fr. pōr rwä-yäl), a Cistercian convent in France, which played an important part in the Jansenist controversy (see JANSENISM). It was founded in 1204 by Mathieu de Montmorency, was situated near Chevreuse, about 15 miles southwest of Paris, and was under the rule of St. Bernard. The original name of the site was Porrais or Porrois; this was transformed first into Port-du-roi, then into Port-Royal. Port-Royal had declined from its original severity, when in 1609 the abbess Jacqueline-Marie-Angelique-Arnauld undertook its reform. The number of the nuns increased under her rule, and in 1625 amounted to 80. The building had become insufficient, and the



## PORT ROYAL—PORT ROYAL BAY

situation was unhealthy. The mother of the abbess therefore presented to the nuns the house of Cluny, situated at the end of the Faubourg Saint Jacques in Paris. The old site was subsequently improved by drainage, and a new house built on higher ground. The two sections of the convent were now distinguished as Port-Royal des Champs and Port-Royal de Paris. About 1636 a group of eminent literary men of religious tendencies, mostly the relatives of the abbess, took up their residence at a house called Les Granges, near Port-Royal des Champs, where they devoted themselves to devotional exercises, manual and literary work, the education of youth, and the compilation of educational works. These were regarded as forming a joint community with the nuns of Port-Royal, among whom most of them had relatives, and who in most matters followed their counsels. Among them were Antoine Arnauld, Arnauld D'Andilly, le Maistre de Sacy and his two brothers, the first two being brothers, the last three nephews of the abbess; Nicole, and subsequently Pascal, whose sister Jacqueline was a nun of Port-Royal. These men founded here an educational institution, which flourished till 1660, and became a rival to the institutions of the Jesuits, and as they adopted the views of Jansenius, subsequently condemned by the pope, a quarrel ensued, in which the Port-Royalist nuns, siding with their male friends, became subject to the opposition of the Jesuits, which culminated in the ruin of their institution. Port-Royal de Paris had, in the meantime, been growing rapidly in wealth and influence. It was protected by many persons of high rank at the court, some of whom made it their last retreat and bequeathed their fortunes to it. It was under the direction of the Abbé de Saint Cyran (Duvergier de Hauranne), whose virulent Jansenism led, during the last days of Richelieu, to his imprisonment in Fort St. Vincennes. During the wars of the Fronde the house in the country exercised a liberal hospitality. The history of the struggle in which the two convents of Port-Royal successively succumbed to their foes is too long to be dealt with here. It has been related in detail by Racine, the most distinguished pupil of the Port-Royalist seminary, in his 'Histoire de Port-Royal.' The most remarkable incident in it was the miracle alleged to have been wrought upon the person of the niece of Pascal, and firmly believed in by two such men as Pascal and Racine. The object of this miracle, wrought by means of a thorn from the crown of our Saviour, was to demonstrate the innocence of the nuns of Port-Royal, accused by their opponents of contempt of the holy sacrament. But this vindication was unavailing. In 1664 Port-Royal de Paris was occupied by the police. The nuns, save few who acceded to the terms of the court, and henceforth became declared enemies of their former associates, were imprisoned for some months and then sent to Port-Royal des Champs, which was put under military surveillance till 1669. In 1669 the two houses were permanently separated by royal authority. Port-Royal des Champs retained 80 nuns and two thirds of the joint property, Port-Royal de Paris ten nuns and one third of the joint property, and was placed perpetually under the nomination of the king. The nuns of Port-Royal des Champs still persisted in refusing to

sign the papal edict condemning the doctrines of Jansenius, and on 29 Oct. 1709 the convent was finally suppressed by order of Cardinal Noailles, in execution of a bull of Pope Clement II. The nuns were dispersed in different convents, and their property given to Port-Royal de Paris. This convent continued in existence till the Revolution, when its house was converted into a prison, and subsequently (1814) became the Maternity Hospital. See PASCAL, BLAISE. Consult: Gregoire, 'Les Ruines de Port Royal' (1809); Beard, 'Port Royal' (1861).

**Port Royal, Jamaica**, the principal naval station owned by the British in the Caribbean Sea. Port Royal, the city, which was destroyed by an earthquake in 1693, was near the site of the present naval station. The present Port Royal is at the entrance to Kingston Harbor. It has a barracks, arsenal, and a hospital.

**Port Royal, S. C.**, village in Beaufort County; at the southern end of Port Royal Island, on the Port Royal & Augusta railroad; 53 miles southwest of Charleston. Near here, a French Huguenot colony was established in 1664 by Ribault, which was taken by the Spaniards in 1665 and all the garrison killed. On 3 Feb. 1779, during the southern campaign of the Revolution, Maj. Gardiner, with 200 British soldiers, attempted to seize Port Royal Island, but was attacked and defeated by Gen. Moultrie with about the same number of men, the British loss being serious, that of the Americans slight. In the Civil War the harbor of Port Royal was defended by two forts, Fort Walker and Fort Beauregard, built by the Confederates and garrisoned by a Confederate force under Drayton and Ripley. On 7 Nov. 1861 an attack was made on these fortifications by the Federals with a force of two frigates, three sloops, and seven gunboats, commanded by S. F. Dupont (q.v.). This fleet opened fire on both forts at once, on entering the harbor, but later concentrated the attack on Fort Walker till that fort surrendered; Fort Beauregard was surrendered shortly afterward. Port Royal has an excellent harbor, and a large drydock, and has been the rendezvous of the North Atlantic Squadron. Pop. (1900) 601. Consult: Parkman, 'Pioneers of France in the New World' for an account of the Huguenot colony.

**Port Royal Bay, Battle of.** As early as June 1861 the United States authorities, in order more effectually to maintain the blockade and to secure a military and naval base of operations on the southern Atlantic coast, determined to seize a good port south of Cape Hatteras, and in August a naval and land expedition was ordered for the purpose. Capt. S. F. Dupont was ordered to organize the naval expedition, and Gen. Thomas W. Sherman to organize a force of 12,000 men to accompany it. It was agreed between Dupont and Sherman to seize Port Royal Bay, one of the finest harbors on the coast, 56 miles south of Charleston and 25 north of Savannah. The destination was kept a profound secret. The fleet of 16 war vessels and nearly 40 transports, carrying Sherman's 12,000 men with supplies, sailed from Hampton Roads on the morning of 29 October, and on the night of 1 November was struck by a furious storm off Hatteras and scattered. Four vessels and a few lives were lost, one war vessel was disabled and, with two transports, returned to



## PORT ROYAL-DES-CHAMPS — PORT ROYAL FERRY

Hampton Roads; but by the 6th the fleet had assembled off the entrance to Port Royal Bay, the gunboats, preceding, having driven into the harbor three Confederate vessels that had run out and opened fire upon them, and coming under a long cross-fire from two works commanding the entrance to the bay. It had been the intention to silence and take these works on the afternoon of the 6th but necessary arrangements were not perfected until too late in the day. The bay was defended by two earthworks and some shore-batteries, one earthwork on each side of the entrance, Fort Walker, on Hilton Head, the south side, and Fort Beauregard, on Bay Point, St. Phillips Island, on the north. These were strong and well-constructed works, mounting 42 heavy guns, 22 of which were in Fort Walker, and garrisoned by nearly 3,000 men, under Gen. T. F. Drayton. The distance between the two works was  $2\frac{1}{2}$  miles. In addition to the land-works, there were three small Confederate gunboats of two guns each in the bay, under command of Com. Josiah Tatnall. The Wabash, the flagship of the fleet, carrying 46 guns, was to lead in the attack, followed by nine other vessels, a ship's length apart, and a flanking column of five gunboats was to move on the right. The fleet was to pass up the roads on the Bay Point side, delivering broadsides on Fort Walker until each vessel had reached a point two miles above the fort, when they were to turn and come down and again deliver their broadsides at Fort Walker and enfilade its two water-faces. Having completed the circuit, the line was to repeat the movement until the forts surrendered. At the same time the five flanking gunboats were to pass and attack Fort Beauregard and, on reaching the turning-point two miles above it, remain there and hold Tatnall's fleet in check, with special orders to see that it did not make a dash upon the transports. At 9 A.M. 7 November the fleet crossed the bar and advanced in a long well-ordered column to the attack, while the transports lay at anchor outside ready to land troops. Capt. Dupont led the Wabash up the middle of the bay, receiving the first fire from both forts at 9.26 A.M., and replying to both, until two miles beyond them; then he turned to the left in a wide circle and led back past Fort Walker at 800 yards distance, opening upon it broadside after broadside. The rest of the column followed, each vessel in succession opening its guns, as it came within range and maintaining a rapid fire as it slowly drew past. The gun-fire from the fleet was a terrific continuous roar and was replied to by a well-maintained fire, notwithstanding the fact that hundreds of shells were dropping into the fort and almost burying its defenders, under the dirt thrown up. At the same time the flanking column of five gunboats steamed up the bay, nearer to Bay Point, and poured broadsides into Fort Beauregard and then, steering to the other side, advanced against Tatnall's fleet, driving it into Scull Creek and, taking position near the shore and flanking Fort Walker, opened upon it a destructive fire, to which it could not respond, as the one gun on that flank of the fort had been shattered by a round shot. After the main column had passed down the bay about two miles, it turned, at 11 A.M., and again passed in front of Fort Walker, at 300 yards closer range than before, and with a more terrific fire, part

of which was against Fort Beauregard. As the maneuver was repeated for the third time it was discovered that the Confederates were abandoning Fort Walker; its guns were silenced; a few shots were fired, to which there was no response; a small party was sent ashore, the Confederate flag hauled down, and the Union flag run up at 2.20 P.M. Before the close of the action the Pocahontas, Commander Percival Drayton, which had been delayed by injuries received in the storm, entered the bay and opened fire on the fort. Commander Drayton was a brother of the commanding officer of the Confederate forces. The Confederates had left in haste, leaving tents standing, and escaped across Scull Creek, being assisted by the boats of Tatnall's fleet. By nightfall the transports had come into the bay and landed Gen. H. G. Wright's brigade at Hilton Head. Fort Beauregard was abandoned about 5 P.M., after its commanding officer had spiked the guns and destroyed the greater part of the powder. It was occupied next morning by Gen. Stevens' brigade. The battle was of great value to the Federal Government in its moral and political effect, in addition to the fact that it gave the Union army one of the finest harbors on the Atlantic coast, as a base for future operations for both the army and the navy. The Union loss was 8 killed and 23 wounded; the Confederate loss, 11 killed, 48 wounded, and 7 missing. Consult: 'War Records,' Vol. VI.; 'Naval War Records,' Vol. XII.; Ammen, 'The Atlantic Coast'; Maclay, 'History of the United States Navy,' Vol. II.; The Century Company's 'Battles and Leaders of the Civil War,' Vol. I.

E. A. CARMAN.

**Port Royal-des-Champs**, pōr rwä-yäl dā shān. See PORT ROYAL.

**Port Royal Ferry, Engagement at.** After the naval battle of Port Royal Bay (q.v.), 7 Nov. 1861, the navy explored the various sounds and creeks in the vicinity, capturing some abandoned guns. While the navy was thus employed the army had completed a very large and strongly intrenched camp on Hilton Head, surrounding Fort Walker, and on 11 December occupied Beaufort, some Confederate cavalry falling back across Coosaw River, taking to the farther side the ferry-boat and ropes and all other boats and covering the crossing by a blockhouse, which was soon destroyed by two adventurous soldiers who swam the river. By the end of December the Confederates had erected a strong field-work on the mainland opposite and commanding Port Royal Ferry, on the Coosaw, and they repulsed the efforts of the gunboats to dislodge them. The position was held by the 14th South Carolina regiment, four companies of the 12th South Carolina, about 45 cavalry, and a section of Leake's battery, all under command of Col. James Jones. Obstructions had been placed in the Coosaw above and below the ferry to prevent the ascent of the gunboats, and a battery put in position opposite Seabrook's Point. A combined land and naval expedition was set on foot to take the position and clear the river. Gen. I. I. Stevens' brigade, reinforced by two regiments, in all 3,000 men, was to cross the Coosaw several miles below Port Royal Ferry, advanced up the left bank of the river, and take the work in rear, while two gunboats, an armed



## PORT SAID — PORT TOWNSEND

tug, and four boats armed with howitzers, all under Commander C. R. P. Rodgers, were to enter the Coosaw by Beaufort River. A naval co-operating force was to move up Broad River and thence to the Coosaw to attack the battery opposite Seabrook's Point. On the night of 30 December a large number of flatboats were collected and sent up Beaufort River, and at 1 A.M. 1 Jan. 1862 the embarkation began and, passing up the Coosaw, the troops were landed during the morning. At 1.30 P.M. they moved for Port Royal Ferry, marching parallel with and close to the river, the gunboats and launches shelling the woods in advance of the skirmish-line. A mile had been marched when a concealed battery opened its fire on Stevens' column, but Stevens soon drove it and its infantry support from the field and, closely following, reached the fort which had been abandoned, upon the appearance of the gunboats, the enemy leaving one gun. Meanwhile the gunboats moving by way of Broad River had cleared the Coosaw, beyond the ferry. During the night the ferry was completely restored, the captured fort leveled to the ground, and next morning the troops crossed the ferry and marched back to Beaufort with the captured gun and a few prisoners. The result of the action was an abandonment of any future attempt to plant batteries on the Coosaw or the adjacent network of waters; and, being almost the first Union success since the defeat at Bull Run, it was considered of so much importance that the thanks of the government were given in general orders to Gen. Stevens and his command for their victory at the battle of Port Royal Ferry. The Union loss was 3 killed and 14 wounded; the Confederate loss, 8 killed and 23 wounded. Consult: 'Official Records,' Vol. VI.; Ammen, 'The Atlantic Coast'; Stevens, 'Life of Gen. I. I. Stevens,' Vol. II.

E. A. CARMAN.

**Port Saïd**, sä-ēd', Egypt, sea-port at the Mediterranean end of the Suez Canal and capital city of the Egyptian department of the Isthmus. It lies in the easternmost part of an island between the Mediterranean and Lake Menzaleh, about 110 miles north-northeast of Cairo, in lat. 31° 16' N. and lon. 32° 19' E. Its whole being is dependent on the canal and it was not founded until the canal was partly built. Hence its architecture is European, and many of the houses are wooden with sloped roofs. North of the city on the coast of the canal and of the Mediterranean is an electric light about 173 feet high and visible 20 miles out. Two great concrete moles, 5,300 and 7,400 feet long reach out into the sea. The trade of the city is almost entirely transit. The city was named for Saïd Pasha, viceroy of Egypt 1854-63. A fountain and statue of Queen Victoria was built in 1898, and a colossal statue of De Lesseps, by Frémiet, has stood since 1900 at the entrance of the canal. The population, including more than 10,000 Europeans, mostly French and Greek, numbered 42,095 in 1897.

**Port of Spain**, Trinidad, city, capital of Trinidad (q.v.), one of the West Indies group, belonging to Great Britain. The city has a large safe harbor, steamer connections with all the principal ports of the Caribbean Sea and Gulf of Mexico, and with many South American

ports; and railroad connection with San Fernando, to the south, and with several other places on the island. The most of the products of the Orinoco region are shipped from Port of Spain. The city is well built and has many fine residences. It has the government buildings, botanical gardens, and the Immaculate Conception College. It is a Roman Catholic archiepiscopal see. Pop. (1891) 33,782; (1901) 54,100.

**Port Tam'pa City**, Fla., town, Hillsboro County; on Tampa Bay, and on the Atlantic Coast Line railroad; eight miles south of Tampa. It was founded in 1889, and incorporated as a town in 1891. In the Spanish-American War, the United States troops were mobilized here for embarkation to Cuba. It is the port of Tampa (q.v.), has a large and excellent harbor, and is connected with the West Indies, Mobile and other ports by steamer. It is in a fruit-growing and agricultural region for the products of which it is the shipping point. Pop. (1900) 1,367.

**Port Tonnage.** Some interesting facts are shown as to the relative rank in tonnage movement of the principal ports of the world, in a table prepared by the Bureau of Statistics of the Department of Commerce and Labor at Washington. The table is as follows:

PORT	Year	Entered Tons	Cleared Tons
London.....	1902	10,179,023	7,385,085
New York.....	1902	8,982,767	8,415,291
Antwerp.....	1902	8,373,528	8,347,483
Hamburg.....	1902	7,860,323	7,993,166
Hong Kong.....	1901	7,383,683	7,340,586
Liverpool.....	1902	6,843,200	6,314,514
Cardiff.....	1902	4,688,088	7,868,556
Rotterdam.....	1901	5,950,445	5,733,763
Singapore.....	1901	5,459,032	5,453,999
Marseilles.....	1902	4,911,784	4,552,088
Tyne ports.....	1902	3,615,046	4,754,301
Gibraltar.....	1901	4,171,350	4,159,272

Hong Kong would show a much higher figure, but for the fact that Chinese junks engaged in the foreign trade are excluded from the estimate, the tonnage of these vessels entered in 1901 having been 1,126,931, and of those which cleared, 1,130,279. Singapore excludes native craft, and vessels under 50 tons, excepting vessels engaged in trade between the Straits Settlements.

**Port Town'send**, Wash., city, port of entry, county-seat of Jefferson County; on Port Townsend Bay, at the entrance to Puget Sound (q.v.), and on the Northern Pacific and the Port Townsend Southern R.R.'s; about 70 miles north of Olympia. It has steamer connection with San Francisco, Alaska, and many of the principal ports on the eastern coast of Asia. The harbor ranks with the largest in the world. The place was settled in 1851, and in 1860 was incorporated as a city. Fort Townsend is on the west side of the bay, five miles by land and two and one-half miles by water from the city, and other government fortifications will be on Admiralty Head, Point Hudson, Point Partridge, and Marrowstone Point. The government has established a marine hospital and a quarantine station. Port Townsend, as the port of entry for the Puget Sound district, had, in 1902, an export trade of \$34,726,000, and an import trade of \$12,752,000.



## PORT WINES—PORTEOUS RIOT

The city is in an agricultural and lumbering region. In the vicinity are deposits of oil and valuable minerals. The chief industrial establishments are lumber and planing mills, a shipyard, machine shops, bottling works, steam boiler works, herring pickling and curing works, salmon and sardine canneries, grain elevators, and flour mills. The chief exports are grain, lumber, fish, oil, live stock, farm and dairy products, and pig iron. The pig iron is from the Irondale furnaces. The principal public buildings are the Government Custom House, city hall, county court-house, United States Marine Hospital, the quarantine station, a sanatorium, and Saint John's Hospital. The educational institutions are a high school, public elementary schools, private business schools, and a public library. The scenery around Port Townsend is beautiful, surrounded as it is by water and mountains. The government is administered under a charter of 1890, which provides for a mayor who holds office one year, and a council. The administrative officials are appointed by the mayor or elected by the council. Pop. (1890) 4,558; (1900) 3,443.

**Port Wines.** The name of Port wines, or Oporto wines, is given, in commerce, to the produce of the vineyards of Portugal, the district in which they are produced being a rugged and mountainous tract that begins about 60 miles above Oporto, and extends for 30 or 40 miles with an extreme breadth of about 12 miles. Port is naturally a very rich and delicate wine, varying in color from a pale rose to a deep red. It owes its special character partly to the soil of the district where it is grown, partly to the climate, which is cold in winter and very hot in summer. The harvest lasts from the beginning of September to the middle of October. The wines for export are very much mixed, and are strongly fortified with brandy, partly to make them sooner ready for export, and partly to suit the taste of the foreign markets. The mixing of the various wines considerably reduces the variety of qualities of port exported, compared with those which are naturally produced. The English market has always been the principal market for port wine. English connoisseurs have tended more than anything else to spread its fame in other countries. The taste for this wine was introduced into England in the 17th century, and English establishments were formed in Oporto to direct the purchase and shipping of the wines. These companies eventually united into a sort of corporation called the English Factory, which became completely master of the market. In the following century (1756) the Marquis of Pombal organized an association of producers to oppose this monopoly of buyers, and the company then established imposed restrictions on the trade which were not finally abolished till 1853, a new company having latterly taken the place of the old. In recent times the vines have suffered rather severely both from the oidium and from the more serious plague of the phylloxera. See WINES.

**Portaels, Jean François,** zhõn frän-swä pör-täls, Belgian painter: b. Vilvorde near Brussels 1 May 1818; d. Brussels 8 Feb. 1895. He owed his early art training to Navez of Brussels, and afterward proceeding to Paris became the pupil of Paul Delaroche, gaining the "Grand Prix" in 1842. After traveling in

Syria, Egypt, Palestine, Greece, and Turkey, he was appointed Director of the Academy in Ghent, an office he retained for three years. He then resumed his travels which included the whole of Europe in their range. He ended his days as director of the Brussels Academy. His works are faulty in composition and deficient in living characterization, but in spite of occasional insipidity, they are pleasing and full of expression. Among them the most important are 'The Journey of the Magi'; 'Funeral Procession in the Desert of Suez'; 'Jephtha's Daughter'; 'The Daughter of Zion'; 'The Flight into Egypt'; 'Leah and Rachel'; 'The Young Witch'; 'The Simoon.'

**Por'tage, Wis.,** city, county-seat of Columbia County; on the government ship-canal between the Fox and Wisconsin rivers, and on the Chicago, M. & St. P. and the Wisconsin Central R.R.'s; about 85 miles west by north of Milwaukee, and 35 miles north of Madison, the State capital. It was settled in 1835, incorporated in 1837, and in 1854 was chartered as a city. It is in a productive agricultural region, and is the commercial and industrial centre for quite a large portion of Columbia County. The chief manufactures are flour, brick, hosiery, knit-goods, and farm implements. The educational institutions are a high school, public and parish elementary schools, and a public library. In the vicinity are the ruins of Fort Winnebago (1828). The government is vested in a mayor, who holds office two years, and a council. The city owns the waterworks. Pop. (1890) 5,143; (1900) 5,459.

**Portage Group,** in geology, a portion of the Devonian series, so called by the geologists of the New York State survey because largely developed near the town of Portage, N. Y. The rocks of this period are chiefly sandstone and shale.

**Portage la Prairie,** Canada, a town in Manitoba, on the main lines of the Canadian P. and Canadian N. Railways, 56 miles west of Winnipeg and 15 miles south of Lake Manitoba. It is an important railway centre and the receiving and distributing point for the fertile "Portage Plains," one of the finest wheat-growing sections in the world. It has railway machine shops, a large flouring mill, grain elevators, a paper mill; churches, schools, banks, warehouses, and daily, semi-weekly, and weekly newspapers; and is the seat of an Indian Industrial School, and the Provincial Home for Incurables. Pop. (1904 est.) 4,200.

**Porte, The, or Ottoman Porte.** See **SUBLIME PORTE.**

**Porte Crayon.** See **STROTHER, DAVID HUNTER.**

**Por'teous Riot,** so called from the lynching of Captain John Porteous, commander of the city guard of Edinburgh, 7 Sept. 1736, was occasioned by various incidents connected with the trial and execution of Andrew Wilson, a smuggler, who with two companions had robbed the Kirkcaldy excise officer. The mob after the execution became disorderly and commenced throwing stones, whereupon Porteous ordered his command to fire into the crowd, with the result that seven people were killed and 20 wounded. Porteous, after trial was condemned to death, but being reprieved, a mob broke into



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the jail and hanged him. The city was fined \$4,500 for the benefit of the widow, and the provost was imprisoned for a year and disqualified from holding any further official position. The Porteous Riot is one the main features of Sir Walter Scott's 'Heart of Midlothian.'

**Por'ter, Alexander**, American jurist: b. Armagh, County Tyrone, Ireland, 1786; d. Attakapas, La., 3 Jan. 1844. He came to the United States in 1801, settled in Nashville, Tenn., studied law and was admitted to the bar in 1807. He established a law practice in Saint Martinsville, La., in 1810; was a member of the convention which framed the State constitution in 1811; in 1821 was appointed a judge of the supreme court of Louisiana. During his 12 years' occupation of that office he established a fixed system of jurisprudence to supersede the chaotic mixture of Spanish, French, and civil law in use. Elected United States senator in 1833, he voted to censure President Jackson for removing the deposits from the United States bank, opposed the abolition of slavery in the District of Columbia and the bill to compel specie payment for public lands, advocated the division of surplus revenue among the States and also the recognition of Texas' independence. He was re-elected to the Senate in 1843.

**Porter, Anna Maria**, English novelist, sister of Jane Porter (q.v.): b. 1780; d. near Bristol, Gloucestershire, 21 Sept. 1832. Before she was 15 she published two volumes entitled 'Artless Tales.' The greater part of her life was spent with her mother and sister Jane in the neighborhood of London. She produced numerous novels, which enjoyed considerable popularity in their day. Among them are: 'The Lake of Killarney' (1804); 'Honor O'Hara' (1826); 'The Barony' (1830). She also published 'Tales of Pity' and 'Ballad Romances and Other Poems.' Nearly all her books were translated into French and several were republished in this country.

**Porter, Benjamin Curtis**, American portrait painter: b. Melrose, Mass., 27 Aug. 1843. He studied art in Paris and Vienna and during the first of his career devoted himself to figure painting, but has since made portraits his specialty. In 1880 he became a member of the National Academy. His work shows harmonious coloring, and his portraiture is accurate and striking. Among his works are: 'Henry V. and the Princess Kate' (1868); 'Cupid with the Butterflies' (1874); 'Portrait of Boy with Dog' (1884); etc.

**Porter, David**, American naval officer: b. Boston 1 Feb. 1780; d. Pera, near Constantinople, Turkey, 3 March 1843. He made voyages in the West Indian merchant service, was twice impressed by the British, but escaped, and in 1798 entered the United States navy as a midshipman. He was on board the *Constitution* in the fight with *L'Insurgente* in 1799, and served as a lieutenant in the war with Tripoli. Captured with the *Philadelphia*, he remained in imprisonment until the peace. In the War of 1812, he fought with distinction, capturing many English merchantmen, and seriously crippling Great Britain's whale-shipping in the Pacific. His vessel, the *Essex*, was blockaded in 1813 in Valparaiso harbor by two English vessels, which

he offered to fight either singly or together. This offer having been refused, he attempted to make a dash for the open sea, but his ship was severely damaged by a squall, and he put back, anchoring a half mile off the shore, and three miles from the town. There the English, regardless of neutrality laws, attacked him, and after a struggle of two and a half hours, one of the fiercest in naval history, compelled him to surrender. He described the situation in a communication to the secretary of the navy by saying, "We have been unfortunate, but not disgraced," and upon his return he was voted the thanks of Congress and several State legislatures, and received with much distinction. He was sent in 1824, being then a commodore, to operate against pirates in the West Indies. An officer sent by him to make an investigation at Fajardo, Porto Rico, was seized and imprisoned. Porter compelled the Spanish authorities to apologize for the act; was deemed to have exceeded his authority; and was suspended for six months by court-martial. On 18 Aug. 1826 he resigned his commission, and became rear-admiral in the Mexican service. From this, too, he resigned in 1829; and later was consul-general to the Barbary states and *chargé d'affaires* at Constantinople. Among his writings are: 'Journal of a Cruise Made to the Pacific Ocean' (1815), and 'Constantinople and its Environs' (1835). Consult: D. D. Porter, 'Life of Commodore David Porter' (1875).

**Porter, David Dixon**, American naval officer: b. Chester, Pa., 8 June 1813; d. Washington, D. C., 13 Feb. 1891. He was son of David Porter (q.v.). In 1826 he entered the service of the Mexican navy as midshipman, and while serving on board a vessel employed in damaging Spanish commerce, was captured and for a time held prisoner in the Spanish guardship at Havana. Not long after his release, he was made midshipman in the United States navy, and until 1835 was on duty on the European station. In the Mexican War he distinguished himself as a lieutenant, and later as commander of the *Spitfire*. After the war he commanded passenger steamers during an extended furlough. At the beginning of the Civil War he was made commander of the *Powhatan* for the relief of Fort Pickens. On 22 April 1861 he was made commander, soon afterward was placed in charge of the mortar fleet, in March 1862 joined Farragut, and on 18-24 April exploded 20,000 bombs in the Confederate forts Jackson and St. Philip, below New Orleans. Farragut's fleet was thereby enabled to pass them and capture New Orleans; and the forts finally surrendered on 28 April. At Vicksburg, also, Porter by his remarkably effective bombardment of the forts, enabled the fleet to pass safely. He was ordered in September 1862 to command the Mississippi squadron as acting rear-admiral. With an improvised navy-yard at Mound City, he quickly increased his squadron to 125 vessels, and in January 1863 aided Sherman in the capture of Arkansas Post. Not long afterward he ran the Vicksburg batteries, captured the enemy's fortifications at Grand Gulf, communicated with Grant, and then co-operated with that general in the well-known siege of Vicksburg. On 4 July 1863 the city fell. Porter's commission as rear-admiral bore that date; he also received the thanks of Congress. He then aided Banks



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(1864) in the Red River expedition, and only with difficulty rescued his vessels. He was placed in command of the North Atlantic blockading squadron in 1864; and with Gen. A. H. Terry co-operated in the capture of Fort Fisher 15 Jan. 1865. After the war he was superintendent of the United States Naval Academy in 1865-9, and did much to improve it. He was promoted vice-admiral in 1866 and admiral in 1870. He wrote a 'Life of David Porter' (1875); 'Incidents and Anecdotes of the Civil War' (1885); 'History of the Navy in the War of the Rebellion' (1887), and other works. Consult: Chesney, 'Essays in Military Biography' (1874); Soley, 'Admiral Porter' (1903).

**Porter, Fitz-John**, American soldier: b. Portsmouth, N. H., 13 June 1822; d. Morristown, N. J., 21 May 1901. He was graduated from the United States Military Academy in 1845, was assigned to the 4th artillery, served in the war with Mexico, and was brevetted successively captain for services at Molino del Rey and major for similar services at Chapultepec. After the war he was on garrison duty until 1849, and then was made assistant instructor of artillery at West Point, where in 1854-5 'he was instructor of artillery and cavalry. Appointed assistant adjutant-general in 1856, he served under General A. S. Johnston (q.v.) in the Utah expedition of 1857-60. In 1860 he was made assistant inspector-general, with headquarters at New York; and in this post, during the Baltimore riots, he superintended the defense of the railway between Harrisburg and Baltimore. He became colonel of the 15th infantry, a newly organized regiment, on 14 May 1861, and on 17 May brigadier-general of volunteers. After having been for a time on duty in Washington, he participated in the peninsular campaign (1862) in Virginia, and after the capture of Yorktown, in the siege of which he had fought (5 April-4 May), was for a brief while its governor. He was then made commander of the Fifth corps, which he led at Mechanicsville (26 June 1862) and Gaines' Mills (27 June). He was in command of the left flank, the centre of the conflict, at Malvern Hill (1 July 1862); and for his conduct at the battle of Chickahominy was brevetted brigadier-general, U. S. A. On 4 July 1862 he was made major-general of volunteers. While he was temporarily attached to Pope's army of Virginia, the battle of Manassas or the second Bull Run occurred (29-30 Aug. 1862). On the first day his corps was ordered to advance, but found itself unable to do so; on the afternoon of the second day, however, it was in action, and by its stubborn bravery saved the defeat from being a complete rout. Pope was greatly dejected by the reverse, which he attributed largely to Porter's failure to execute orders. He made a complaint in his report but preferred no charges. Porter was in the defenses of Washington 2-13 September, then commanded the Fifth corps, Army of the Potomac September-November, fought at Antietam (17 September), and afterward in the skirmish at Shepardstown (19 September). On 27 Nov. 1862 he was arraigned before a court-martial at Washington, charged with disobeying orders at the second Bull Run. On 21 Jan. 1863 he was cashiered, and, for violation of the 9th and 25th articles of war, was "forever disqualified from holding any office of trust or profit under

the government of the United States." This sentence for years remained unaltered. Its justice was much debated. Numerous appeals were made for a reopening of the case, and Porter himself several times petitioned for a reversal of the judgment. Grant, while president, declined to reopen the case; but after his second term, upon an examination of all the testimony, published in an article entitled 'An Undeserved Stigma' (December 1882) his conclusions to the effect that Porter was by the evidence vindicated of the charges against him. Under President Hayes a military board acquitted Porter of all fault save unwise criticism of his superior. On 4 May 1882 President Arthur remitted the sentence so far as disability to hold office under government was concerned, but a bill for Porter's relief failed to pass. A subsequent bill passed the 48th Congress, but was vetoed by Arthur on a technicality. A third bill, however, passed, and was signed by President Cleveland; and by the act of Congress of 1 July 1886 Porter was made colonel of infantry 5 Aug. 1886 to rank from 14 May 1861. On 7 Aug. 1886 he was placed on the retired list. Subsequent to 1863, Porter was superintendent of certain mining operations in Colorado in 1864-5; a merchant in New York 1865-71; superintendent of the erection of the New Jersey State asylum for the insane at Morristown; commissioner of public works, New York, 1875-6; assistant receiver of the Central Railroad of New Jersey, 1877-82; police commissioner, New York, 1884-8; fire commissioner 1888-9; and cashier of the post-office 1893-7. An offer, received in 1869, from the khedive, to command the Egyptian forces with major-general's rank, was declined by Porter. Among the best statements of the case for and against Porter may be respectively mentioned, besides the article by Grant above cited (Vol. 135 'North American Review'); Lord, 'A Summary of the Case' (1883), and Cox, 'The 2d Battle of Bull Run as Connected with the Fitz-John Porter Case' (1882). See also POPE, JOHN.

**Porter, Horace**, American diplomat: b. Huntington, Pa., 15 April 1837. He studied at Harvard and was graduated from West Point in 1860; served for a short time as instructor there and at the outbreak of the Civil War was assigned to duty in the Department of the East. He commanded the siege batteries at Fort Pulaski and was brevetted captain for his gallantry. After the battle of Antietam he was transferred to the Army of the Ohio and later to that of the Cumberland. He was engaged at Chattanooga, Chickamauga, the battle of the Wilderness, and New Market Heights, and as aide-de-camp on the staff of General Grant witnessed the surrender at Appomattox. In 1865 he was brevetted brigadier-general for his services throughout the war. He was assistant to Grant when that general was secretary of war for a few months in 1867 and upon Grant's election to the presidency Porter became his private secretary. In 1873 he resigned from the army. After the close of Grant's second term as President, Porter entered upon a business career in which he was eminently successful, became noted as an author and lecturer, and through his efforts the Grant Monument was completed. In 1897 he was appointed by President McKinley United



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States ambassador to France, which position he filled with tact and ability till 1905. He succeeded in finding the burial place of John Paul Jones, the American naval hero, and recovered the body, later sending it to the United States for burial in Annapolis. He wrote: 'West Point Life' (1866); 'Campaigning with Grant' (1897).

**Porter, James Davis**, American politician: b. Paris, Tenn., 7 Dec. 1828. He was graduated from the University of Nashville in 1846; admitted to the bar in 1850; and sat in the Tennessee legislature 1859-61. He served in the Confederate army during the Civil War, and was adjutant-general on the staff of Major-General Cheatham. In 1870-4 he served as judge of the 12th judicial circuit and in 1874-8 was governor of Tennessee. He was United States assistant-secretary of State in 1885-9; and minister to Chile in 1893-7. He wrote: 'The Confederate Military History of Tennessee.'

**Porter, Jane**, English novelist: b. Durham, England, 1776; d. Bristol, Gloucestershire, 24 May 1850. She was a sister of Sir Robert Ker Porter (q.v.) and was brought up at Edinburgh and in London. She became immediately famous in 1803 by her historical romance, 'Thaddeus of Warsaw,' and 'The Scottish Chiefs' (1810) was even more successful despite its high flown sentiment and stilted characterization. Other works of hers were: 'The Pastor's Fireside' (1815); 'Duke Christian of Luneburg' (1824); 'Tales Round a Winter's Hearth' with A. M. Porter (q.v.) (1824); 'The Field of Forty Footsteps' (1828); and 'Sir Edward Seaward's Narrative of his Shipwreck and Consequent Discovery of Certain Islands in the Caribbean Sea' (1831), a praiseworthy fiction, edited.

**Porter, Jermain Gildersleeve**, American astronomer: b. Buffalo, N. Y., 8 Jan. 1852. He was graduated from Hamilton College, Clinton, N. Y., in 1873 and studied at the University of Berlin. He was appointed to the United States coast and geodetic survey in 1878 and since 1884 has been director of the Cincinnati Observatory and professor of astronomy at the University of Cincinnati. He has published: 'Zone Catalogue of 4050 Stars' (1887); 'Our Celestial Home' (1888); 'Catalogue of 2030 Stars' (1898); 'The Stars in Song and Legend' (1901); etc.

**Porter, Noah**, American educator: b. Farmington, Conn., 14 Dec. 1811; d. New Haven, Conn., 4 March 1892. Graduated from Yale in 1831, he was a tutor and student of theology there in 1833-5, was pastor of Congregational churches at New Milford, Conn., 1836-43, and Springfield, Mass., 1843-6. In 1846 he was made professor of moral philosophy and metaphysics at Yale, and from 1871 until his resignation in 1886 was president of that institution. His administration was a distinguished one. During it the curriculum was broadened by the introduction of new elective subjects, although Porter never favored the development of the elective system attempted at Harvard and supported the classics for the leading place in a scheme of liberal training. The material progress was also of note, large additions being made to the buildings and funds. Porter was also known as the editor of revised editions of

Webster's 'Unabridged Dictionary.' He ranked among the foremost American metaphysicians of his time. Among his writings are: 'Historical Discourse on Farmington' (1841); 'The Educational Systems of the Puritans and Jesuits Compared' (1851); 'The Human Intellect' (1868; and many subsequent edd.); 'Books and Reading' (1870); 'American Colleges and the American Public' (1871); 'Science of Nature vs. the Science of Man' (1871), a review of the philosophy of Spencer; 'Evangeline; the Place, the Story, and the Poem' (1882); 'Science and Sentiment' (1882); 'The Elements of Moral Science' (1885); a 'Life of Bishop Berkeley' (1885); and 'Kant's Ethics: A Critical Exposition' (1886).

**Porter, Peter Buel**, American soldier: b. Salisbury, Conn., 14 Aug. 1773; d. Niagara Falls, N. Y., 20 March 1844. He was graduated at Yale College in 1791, studied at the Litchfield law school, and in 1795 began practice at Canandaigua, N. Y. In 1808 he was chosen a representative in Congress, where as chairman of the committee on foreign relations he prepared and introduced the celebrated report of December 1811, recommending war against Great Britain. As soon as hostilities had been declared he resigned his seat in Congress, was appointed quartermaster-general of New York, and took command of a body of Pennsylvania and New York volunteers and Indians of the Six Nations. Black Rock, where General Porter resided, having fallen into the hands of the British in June 1813, and his own house, from which he had barely time to escape, being their headquarters, he rallied a force by which they were expelled, and their commander mortally wounded. In July 1814 he joined Brown's invading army with a brigade of 3,500 volunteers and Indians and distinguished himself at Chippewa, and Lundy's Lane, and the siege of Fort Erie. Porter was one of the earliest projectors of the Erie Canal, and was named, with Morris and Clinton, on the first board of commissioners to explore a route for it. In 1816 he was appointed commissioner under the treaty of Ghent for determining the northwestern boundary. In May 1828 he was appointed secretary of war by President Adams.

**Porter, Sir Robert Ker**, English artist, brother of Jane and Anna Maria Porter (qq.v.): b. Durham 1775; d. Saint Petersburg, Russia, 4 May 1842. He studied at the Royal Academy in London, and became famous for his battle pieces. In 1804 he was appointed historical painter to the czar of Russia. In 1808 he served under Sir John Moore in Spain, and in 1811 returned to Russia, where he married the Princess Sherbatoff. He was knighted in 1817, and from then until 1820 was engaged in antiquarian studies in Asia. In 1826-41 he was British consul at Venezuela. Of his paintings the most notable were: 'The Storming of Seringapatam' (1800, destroyed by fire); 'The Siege of Acre'; 'Agincourt'; 'Peter the Great Planning the Port of Cronstadt and Saint Petersburg'; 'Christ at the Last Supper Blessing the Cup'; etc. He wrote: 'Travelling Sketches in Russia and Sweden' (1808); 'Travels in Georgia, Persia, Armenia, and Ancient Babylonia' (1821-2); etc.



**Porter, Robert Percival**, American journalist and statistician: b. Norfolk, England, 30 Jan. 1852. He came to this country in 1867, engaged in journalism, and was employed on the Chicago *Inter-Ocean* when it was established in 1872. He made the report on wealth, debt, taxation, and transportation in the United States for the tenth census, and in 1882 was a member of the tariff commission. He traveled in Europe, studying industrial conditions for several American newspapers, was one of the founders of the New York *Press*, and in 1889-93 superintended the eleventh United States census. He traveled in Japan to investigate industrial and commercial conditions there, and in 1898-9 was United States commissioner to Cuba and Porto Rico. He has written 'Local Government at Home and Abroad' (1879); 'Breadwinners Abroad' (1884); 'Life of William McKinley' (1896); 'Industrial Cuba' (1899); 'Municipal Ownership and the Public Franchise' (1903); etc.

**Porter, Rufus**, American inventor, founder of the 'Scientific American': b. West Boxford, Mass., 1 May 1792; d. New Haven, Conn., 13 Aug. 1884. He had a common school education and early displayed inventive abilities, and while at Billerica, Mass., in 1825, invented a successful cord-making machine. Among later inventions of his were a steam carriage, a portable horse-power, a corn sheller, churn, washing machine, signal telegraph, and a fire alarm. He became editor of the 'New York Mechanic' in 1840, and soon made it a scientific newspaper, the first of its kind in the country. The next year the title was changed to the 'American Mechanic,' and the office removed to Boston, but after a few issues Porter's attention was diverted to other things and the publication stopped. In 1845 he went to New York and began the issue of the 'Scientific American' with a cash capital of \$100, dating the first number 28 Aug. 1845, and on the title page styling it "The Advocate of Industry and Enterprise, and Journal of Mechanical and Other Improvements." The 'Scientific American' of to-day is conducted substantially upon the plan originally marked out by its founder, but after publishing it six months he transferred the publication to its present proprietors. During the remainder of his life he continued his inventive experiments.

**Porter, William David**, American naval officer, son of David Porter (q.v.): b. New Orleans, La., 10 March 1809; d. New York 1 May 1864. He entered the United States Navy as a midshipman in 1823, attained rank as lieutenant in 1833, served in the Gulf of Mexico in the Mexican War, and in 1855 was placed on the retired list. He originated the lighthouse system in use in the United States, and in 1859 re-entered the navy with the rank of commander. He built the ironclad Essex and commanded her in the Mississippi flotilla in 1861-2, participated in the capture of Forts Donelson and Henry, forced a passage by the Confederate batteries down the Mississippi to New Orleans, was engaged at Vicksburg and Baton Rouge (where he destroyed the Confederate ram Arkansas), Natchez, and Port Hudson, and received rank as commodore in July 1862.

**Porter**, in mechanics, (1) a long bar of iron attached in continuation of the axis of a heavy forging, whereby it is guided beneath the hammer or into the furnace, being suspended by chains from a crane above. A cross lever fixed to the porter is the means of rotating the forging beneath the hammer. (2) A smaller bar from whose end an article is forged, as a knife blade, for instance. Also the name of a beverage popular in Great Britain. See BEER.

**Portfo'lio, The**, the first American periodical which reached an age of over 10 years. It was established in Philadelphia by Dennie in 1801, and was published monthly until 1825. See PERIODICAL.

**Portia**, pōr'shī-a, (1) the principal feminine figure in Shakespeare's 'Merchant of Venice.' An heiress, beloved of Bassanio, she is compelled by the terms of her father's will to accept as her husband whichever of her suitors, choosing from among three caskets of gold, silver, and lead, shall select the one containing her picture. Bassanio, taking the leaden casket, is successful. Later in the play, disguised as a learned doctor of the law, she defends in court Antonio, Bassanio's friend, against the demands of Shylock. (2) Daughter of Cato of Utica and wife of Marcus Brutus who afterward became the assassin of Cæsar. After the death of Brutus she put an end to her life. The common story was she effected her purpose by swallowing live coals. It is scarcely necessary to contradict this tale, which it is conjectured covers the fact of her having suffocated herself with the fumes of charcoal.

**Portici**, pōr'tē-chē, Italy, town and port in the province and administrative circle of Naples, between Naples and Vesuvius, and on the Naples-Salerno railroad. It is a suburb of Naples, well built, with many fine residences and villas. Just beyond it are the ruins of Herculaneum. There is a palace built in 1738 by Charles III., and in the royal park an excellent agricultural school. The sea-bathing here is excellent. Pop. (1901) 4,538. As the scene of Masaniello's revolt it figures in Auber's opera, 'La Muette de Portici.'

**Por'tico**, a term in architecture distinguished from porch with which it is sometimes confused in common modern usage. It is a feature common to classical and derivative styles of architecture and consists of a vestibule or ambulatory covered by a roof which is sustained on one side by columnar support. The term is applied to the peristyle, an ambulatory surrounding the naos of a temple; or the prostyle, properly the vestibule, when it projects before a building, and also when the supporting columns are *in antis*, that is, enclosed between the prolonged side walls.

**Port'land, Dukes of**. See BENTINCK.

**Portland, Conn.**, town, Middlesex County, on the Connecticut River, opposite Middletown (q.v.), and on the New York, New Haven & Hartford railroad, 30 miles west of New London. Its chief industry is the quarrying of brown sandstone; it also has manufactures of steam governors, and tin-ware, and contains foundries and machine shops. It has a public high school founded in 1889. Pop. (1900) 3,856.



## PORTLAND

**Portland, Ind.**, city, county-seat of Jay County; on the Salamanic River, and on the Grand Rapids & I. and the Lake Erie & W. R.R.'s; about 45 miles southeast of Fort Wayne. It is in a productive agricultural region and in a natural gas belt. The chief manufacturing establishments are flour mills, cooperage, brick works, machine shops, creameries, and natural gas supply works. The educational institutions are the public schools and a free public library. The city owns and operates the electric-light plant and the waterworks. Pop. (1900) 4,798.

**Portland, Maine**, the largest city in Maine, important sea-port and county-seat of Cumberland County; on Casco Bay and on the Boston & Maine, Grand Trunk and Maine Central railroads; 106 miles northeast of Boston. It has direct steamship connections with Boston, New York and other Atlantic coast ports, and steamship lines to Europe. The government defense works here, recently enlarged, include Fort Preble, Fort Williams on Portland Head, Fort Levett on Cushing's Island, and Fort McKinley on Great Diamond Island. Forts Scammel and Gorges, formerly strongly equipped, enhance the beauty of the harbor.

*Topography.*—The city proper has an area of  $17\frac{1}{2}$  square miles, and is well laid out, with beautiful shade trees lining its streets and avenues. The site is one of great natural beauty rising on a peninsula extending into Casco Bay, in view of many small islands, which have become popular summer resorts for Portland residents. In the vicinity are numerous resorts and watering places, popular with New York and Boston people. The drives around the two hills at the extremities of the peninsula are not surpassed in beauty by any in the United States. The city slopes from the water front to two heights, forming a natural amphitheatre, giving the city a picturesque appearance from the sea. The harbor is protected by a massive breakwater.

*Park System.*—The extensive public park system of Portland includes over 115 acres, and embraces the Eastern and Western Promenades, Lincoln Park, Fort Sumner and Fort Allen Parks, Deering's Oaks and Monument Square, in the latter of which stands an elaborate memorial to the Maine soldiers who were killed in the Civil War. There is an observatory on Munjoy Hill.

*Public Buildings.*—Among the prominent buildings are the court-house, the city-hall, the custom-house, post-office, Mechanics' Hall, United States Marine Hospital, Maine General Hospital; the Public Library, containing 54,597 volumes, and the library of the Maine Historical Society of 14,000 volumes; the Portland Society of Natural History; the Maine Eye and Ear Infirmary, Portland School for the Deaf, Old Men's Home, Home for Aged Women, Saint Elizabeth's Academy, Female Orphan Asylum, Episcopal and Roman Catholic Cathedrals, and several noted colonial mansions, including the Wadsworth Mansion or "Longfellow House"; the Dearborn Mansion and others.

*Government.*—The city is governed under a charter granted in 1863, subsequently amended, and later acts, by a mayor elected annually, a bicameral council, consisting of 36 members, 3 councilmen and 1 alderman from each ward, and city officials, most of them elected by the

people. The city marshal, commissioner of public works, and members of the Board of Health are appointed by the mayor. The members of the Board of Education are elected by popular vote. The city has waterworks, electric lighting system and electric street railways.

*Schools.*—The graded school system of Portland is excellent and managed by a school board of 12 members, including three women, who are elected as members at large. The mayor is chairman ex-officio of the board. There are two high schools, numerous grammar and primary schools, and 9 kindergarten schools, besides a manual training and teachers' training school. The cost for maintaining the schools for 1903 was \$158,175.21. The Roman Catholics maintain three parochial schools.

*Fire Department.*—There is an efficient fire department, under the charge of a chief and four assistants. The department is managed by a committee of the city government; the cost for 1903 was \$87,386.25.

*Churches.*—Portland has 52 churches, among which are 3 Baptist, 3 Roman Catholic, 14 Congregational, 4 Episcopal, 3 Lutheran, 15 Methodist, 1 Presbyterian, 2 Second Advent, 2 Unitarian, and 5 Universalist churches. No city of its size has more benevolent societies.

*Courts and Police Department.*—There are United States courts, circuit and district; supreme-judicial; superior; probate and municipal courts. The police department is under the charge of a chief and two deputies. The mayor is at the head of the department. The cost of maintenance in 1903 was \$70,429.89.

*Manufactures.*—Portland has about 700 manufacturing establishments, with an annual output valued at over \$12,000,000. The industries include boot and shoe factories, rolling-mills, foundries, machine shops, locomotive works, engine and boiler works, petroleum refineries, match factory, chemical works, carriage and sleigh factories, manufactories of stoneware, jewelry, edge tools, varnishes, soap, meat packing establishments, cooperage shops, lumber mills, etc. The capital invested in these industries according to last census was \$6,991,000. Shipbuilding is still carried on, though of less importance, relatively, than in former years. Fishing and the shell-fish industry are extensively pursued. The assessed property valuation is \$49,295,415; polls, \$14,875; bonded debt, \$2,720,750 (1903).

*Trade and Commerce.*—In the earlier days Portland had an extensive and valuable trade with the West Indies, a portion of which it still enjoys. It has large commercial interests and is noted for its exports of grain, fruit and live stock. The exports for the year 1901 amounted to \$12,419,000 and the imports \$633,114. The harbor is of easy access, capacious, safe, deep enough for the largest vessels, and rarely obstructed by ice; hence it is an important seat of winter traffic between Great Britain and Canada. There are docks and other facilities for the repair of vessels. The greater part of the steamship carrying trade to and from foreign parts is in British ships. The coasting trade is extensive. England, France, Portugal, Uruguay, Haiti, Argentine Republic, Norway and Sweden maintain consular service here.

*History.*—In 1623, Christopher Levett of York, England, visited the Maine coast and under a patent embracing the present site of



PORTLAND MAINE.



1. Birthplace of the Poet Longfellow.

2. A View of Portland Head.







## PORTLAND

Portland, built on one of the islands in the harbor a fort, in which he placed ten men and sailed for England, intending to return and plant a colony. To the site of his proposed plantation he gave the name York, from his native city. The project failed, owing to war between England and France, and the place remained uninhabited by Europeans until 1632, when George Cleeve and Richard Tucker of England made a settlement on the eastern extremity of the peninsula within the limits of the present city of Portland. The Indian name of the place was Machegonne, and was entitled in the patent to Cleeve and Tucker Stogomor, from Stogumber, the birthplace of Tucker. This was shortly changed to Casco Neck. In 1658 the name was changed to Falmouth. The Indians made an attack on the town in 1676, burning the houses, killing some of the inhabitants and making many captives. It was again destroyed by the French and Indians in 1690. The General Court authorized its resettlement in 1714 and in 1716 it had but 15 male inhabitants. On 10 March 1719 the first town meeting was held. The town suffered severely during the Revolutionary War from a bombardment by a British fleet in 1775. It was again rebuilt, and in 1836 received its first city charter. On 4 July 1866 a fire destroyed 1,500 buildings, involving a loss of \$10,000,000. Longfellow, N. P. Willis, William Pitt Fessenden, Neal Dow, and Thomas B. Reed were natives of Portland.

*Population.*—In the year 1800 Portland had a population of 3,822; (1850) 20,815; (1870) 31,413; (1880) 33,810; (1890) 36,425; (1900) 50,145; (1904), estimated 58,000.

*References.*—Neal, 'Portland' (1874); Willis, 'History of Portland' (1865); Elwell, 'Portland and Vicinity' (1876); 'George Cleeve and His Times' (1885); 'Portland in the Past' (1886); 'Christopher Levett' (1893); Powell, 'Historic Towns of New England' (1898).

JAMES PHINNEY BAXTER.

**Portland, Ore.**, the largest city of Oregon, port of entry and county-seat of Multnomah County; on the Northern Pacific, Union Pacific, and Southern Pacific railroads. It is located on the banks of the Willamette River, 12 miles from its confluence with the Columbia River, and 120 miles from the Pacific Ocean; 700 miles north of San Francisco and 52 miles northeast of the State capital, Salem. It is an important industrial, commercial and shipping centre and, next to San Francisco, the most notable city on the Pacific coast. Area, 40 square miles; population (1904) \$125,000.

*Topography.*—The city is built on a natural slope rising gradually from the river back to the forest-covered foothills, and the mountains. There are many natural attractions and fine scenery in the neighborhood, including a number of picturesque water-falls. From Portland Heights, in the western part of the city, can be obtained magnificent views of five snow-covered peaks and the Willamette and Columbia River valleys. There is a public park system embracing over 200 acres and 650 miles of streets, fully two thirds of which are paved. The city has a most enjoyable climate, being much warmer in winter than many Southern cities and cooled in summer by ocean breezes.

*Public Buildings.*—Portland being a modern-built city has numerous and costly buildings; a

city-hall, post-office and custom-house, each occupying an entire block; Chamber of Commerce Building, Public Library (27,000 volumes), Union Railroad Depot, Northwest Industrial Exposition Building, the *Oregonian* building, Marquam Grand Theatre, Weinhard Building (200 x 200 feet), Medical and Law Schools of the State University, the Dekum and Worcester Buildings, and many fine residences. There are two steel and two wooden bridges across the Willamette River and there are two large public fountains in the heart of the city. There are numerous charitable institutions, including the Good Samaritan, Saint Vincent and Portland Hospitals.

*Government.*—Portland is governed by a mayor elected every two years and a unicameral council. A majority of the city officials are appointed by the mayor or nominated by him with the consent of the council. The members of the Board of Education are elected by the citizens. The system of waterworks, owned by the city, cost nearly \$4,000,000, and includes 155 miles of mains. There is a sewer system covering 90 miles. The streets are lighted by electricity at a cost of about \$70,000 per annum. The police department costs annually about \$100,000, and the fire department about \$125,000. There is an annual expenditure for public education of nearly \$250,000. The annual cost of maintaining the city government is over \$960,000. In 1903 the net debt of the city was \$5,637,000, and the assessed property valuation \$44,261,000.

*Manufactures.*—The principal manufactures of Portland are lumber, flour, woolen goods, furniture, cordage, beer, wagons and carriages, engine boilers, clothing, boots and shoes, canned goods, and planing mill products. There are also creameries, paper bag factories, coffee and spice mills, paint works, saddlery and harness factories, stock yards, soap and candle works, and an immense dry dock recently completed. Excellent water power for manufacturing purposes is obtained from the Willamette Falls, at Oregon City, 12 miles distant. The power is transmitted by electricity and is also used for lighting the city and for operating the electric street railways.

*Trade and Commerce.*—The Willamette River is navigable for large vessels, and a considerable trade is carried on with Great Britain, Japan, China, Hawaii, and the South American republics. The annual value of exports which include wheat, flour, wool, fish, timber, etc., is over \$20,000,000. The manufacturing establishments have an output valued at more than \$49,000,000 per annum. There are about 20 National, State and private banks, and many daily, weekly, and monthly periodicals. Lumber, wheat, oats, hay, flour, wool, hops, and salmon are among the exports. Portland is considered the most important distributing point in the Northwest, its wholesale and jobbing trade in 1903 amounting to about \$175,000,000.

The industrial interests represent, according to the census of 1900, an invested capital of \$13,332,000. The country surrounding Portland is rich in timber and minerals, and a vast agricultural region is tributary to this rapidly growing western metropolis.

*Education.*—The city has an excellent public school system with an enrolment of over 15,000 scholars. It also has the Portland Uni-



## PORTLAND — PORTLAND CEMENT

versity, Portland Academy, Saint Helen's School for Girls, the Bishop Scott School, and as already stated the medical and law schools of the State University. There are many churches here, all leading denominations being represented.

*History.*—The city of Portland was founded in 1845 by A. L. Lovejoy and T. W. Pettygrove, two New England real estate men, who named the new town after Portland, Maine. It received its first charter as a city in 1851. A disastrous fire nearly destroyed the city in 1872 and again in 1873. In the latter year the loss was estimated at \$1,400,000. In 1891 it annexed the smaller cities of East Portland and Albina.

*Population.*—The growth of Portland has been almost phenomenal. In 1850 it had a population of 821; in 1860 of 2,874; (1870) 8,293; (1880) 17,577; (1890) 46,385; (1900) 90,426; (1904) estimated 115,000. There are some 30,000 inhabitants of foreign birth and 800 of negro descent.

HARVEY W. SCOTT,

*Editor of the Portland 'Oregonian.'*

**Portland, Isle of,** England, in the south of Dorset, 10 miles west-southwest of Weymouth, a precipitous peninsula supposed to have been formerly an island. It forms the western boundary of Weymouth Bay, and is attached to the mainland by the Chesil Shingle Bank. It consists of a mass of Portland limestone (see PORTLAND BEDS), and is about four miles long by one and a half miles broad, terminating southward in Portland Bill. It is a noted convict settlement, and its most prominent object is the prison on the top of a hill. A great breakwater at the northeast end forms a fine harbor of refuge, used as a naval station. There are several villages on the isle, a castle built by Henry VIII., another attributed to William Rufus, the rock-hewn Verne fortress, and at Portland Bill are two lighthouses. Pop. (1901) 15,262.

**Portland Beds,** in geology, a series of marine beds of Upper Oölitic age, found chiefly in Portland (q.v.), England, and also in Oxfordshire, Buckinghamshire, and Yorkshire. They constitute the foundation on which the fresh-water limestone of the Lower Purbeck reposes, and are divided into 14 well-defined beds; the first nine constitute the Portland stone, the remaining five the Portland or marly series. The Portland stone is again subdivided into the building beds, namely, the first two and the flinty beds, the third to the ninth. About 50 species of *Mollusca* occur in the Portland beds, some of them great ammonites and *Stenosaururus*, *Goniopholis*, and *Cetiosaurus*, are among the reptiles.

**Portland Cement.** This is a hydraulic material made by calcining at nearly white heat an artificial mixture of carbonate of lime and clay, in certain definite proportions, and grinding the resulting clinker to powder. It was first made by Aspdin, in England, in 1824, and is believed to have been named from its resemblance in color, when hardened, to the oolitic limestone of the Island of Portland, in the English channel. It was found greatly superior to the "Roman" (natural-rock) cement, pozzuolana cement and hydraulic lime previously used, and its manufacture extended rapidly, especially in England and Germany. In this country it was first successfully made at Coplay, Pa., in 1878.

Until after 1890 practically all the Portland cement used was imported from Europe; after that date the industry increased with great rapidity, until the United States ranks as the chief cement-producing country of the world. In 1904 there were in the United States 76 factories, which together produced over 20 million barrels of Portland cement. Germany produces about 15 millions per year, England 9 millions, and other countries 11 millions, making the total yearly product of the world approximately 55 million barrels.

The materials for Portland cement are (1) calcareous, as limestone, chalk or marl, and (2) silicious, as clay, shale or slag. It is essential that the mixed raw materials shall contain a certain exact percentage of carbonate of lime and of silicious matter; this proportion differs slightly with different materials, but is generally about 75 per cent of carbonate of lime to 20 per cent of anhydrous clay. Limestones containing clay are of frequent occurrence, and if a uniform deposit containing just the right amount of clay could be found, Portland cement could be made from it simply by burning and grinding. No such deposits are known or likely to be discovered; true Portland cement is therefore always made from an artificial mixture of materials. A near approach to a correct cement mixture is found in Belgium, where a small quantity of inferior "natural Portland" is made, and in the Lehigh Valley region in eastern Pennsylvania and western New Jersey, where two thirds of the Portland cement made in the United States is manufactured. The rock used in that section belongs to the Trenton formation, and contains generally about 70 per cent of carbonate of lime, the balance being chiefly silicious matter of the composition of clay. At the mills in the Lehigh Valley region this "cement rock" is ground with a small amount of purer limestone to bring it to correct composition. In other parts of the country, pure limestone, or marl,—a finely-divided, soft form of carbonate of lime deposited from fresh water lakes—and clay, shale or slag are the materials used. Marl is employed at most of the factories in Michigan, northern Ohio and northern Indiana, while factories using limestone occur in nearly every State in the Union. In England, northern France, western Germany, and Denmark, chalk, a soft and nearly pure form of carbonate of lime, is the calcareous material employed. Marl is used at a few German factories, and limestone, generally more or less clay-bearing, at most other works in Europe.

Material for Portland cement must be comparatively free from magnesia, as more than 5 or 6 per cent of this impurity is claimed to cause cement to lose strength and disintegrate at long periods. Dolomitic or magnesian limestones are therefore not considered suitable. The clay or shale must be silicious, preferably containing 2.5 to 3 times as much silica as of alumina plus iron oxide. Aluminous clays give an inconveniently fusible clinker and generally a too quick-setting cement.

In preparing the mixture, the proportions must be correct and uniform. It is found that best results are obtained with mixtures in which the

$$\frac{\text{lime — alumina}}{\text{silica}} = 2.6 \text{ to } 2.8$$





Photograph by William H. Rau.

RIVER FRONT OF PORTLAND.







PORTLAND CEMENT

With more lime than the above maximum the cement is liable to be unsound, and to show expansion and cracking. With less lime than the minimum the clinker will be too fusible and the cement liable to be quick-setting. With highly silicious materials, however, somewhat greater latitude is allowable.

The following tables show the composition of typical materials and finished cements:

and dried, an operation involving much labor. In 1885, Ransome patented in England a process of burning cement material in the form of powder in revolving kilns heated by a flame of gas. The invention was a failure in Europe, but was taken up and developed by American engineers and found to be especially adapted to conditions in this country, where fuel is comparatively cheap and labor dear. Petroleum was

PORTLAND CEMENT MATERIALS.

	Cement rock Belgium	Cement rock Martin's Creek, Pa.	Chalk North Hants England	Limestone Glens Falls, N. Y.	Marl Sandusky Ohio	Clay Sandusky Ohio	Shale Alpena, Mich.
Carbonate of lime.....	76.96	75.76	97.09	93.12	91.77	1.43	2.14
Carbonate of magnesia.....	1.03	5.60	0.53	3.32	0.53	3.80	1.55
Silica .....	15.75	12.03	2.04	3.30	0.22	63.90	55.95
Alumina .....	3.95	5.00	} 0.55	1.30	1.72	15.92	17.43
Iron oxide.....	1.00	1.25				6.24	7.67
Alkalies .....						4.69	2.86

COMMERCIAL PORTLAND CEMENTS.

	Folkstone England	Biebrich Germany	North- ampton, Pa.	Nazareth, Pa.	Vulcanite N. J.	South Chicago Ill.	Sandusky Ohio
Silica .....	22.25	20.02	20.94	20.60	21.70	22.06	23.66
Alumina .....	8.87	8.38	7.19	7.00	6.73	7.58	6.54
Iron oxide.....	5.00	3.28	2.29	3.10	2.49	2.72	2.52
Lime .....	61.35	62.66	61.64	63.50	62.74	62.10	64.00
Magnesia .....	0.67	2.10	2.62	2.85	2.57	2.68	0.95
Sulph. anhyd.....	0.89	1.05	1.09	1.40	1.26	1.68	1.27
Loss on ignition.....	....	1.64	2.84	1.40	1.48	....	0.60

Chemical analysis of cements throws but little light on their character, owing to the impurities introduced by the ash of the fuel, and to the general practice of adding one to two per cent. of gypsum, after burning, to regulate the setting.

In the manufacture of Portland cement the first essential is to mix the materials in correct proportion and grind the mixture to extreme fineness. Failure to produce cement of good quality results more often from neglect of the latter precaution than from all other causes combined. In England, the mixture of chalk and clay is generally made by the wet process, in which the materials are stirred with water in wash-mills and the slurry allowed to settle in large reservoirs until firm enough to be cut into blocks and dried by the waste heat of the burning-kilns. The dry process is generally used in case of limestone and cement rock, both in Europe and America. In this the materials are crushed, dried, and finely ground together in tube-mills, which consist of revolving cylinders partly filled with rounded pebbles. Marl and clay are usually treated by a semi-wet process, in which the materials are mixed as taken from the beds and ground in tube-mills with sufficient water to make a thick slurry.

The burning of Portland cement was formerly done in simple intermittent vertical kilns, similar to lime-kilns, or in ring-kilns of the Hoffman type, consisting of a number of chambers connected to a central stack, into which the fuel is introduced through openings in the roof. Later, continuous kilns of the Dietzsch and Shöfer type were adopted, in which the bricks of dried slurry and the fuel are fed in at the top and the clinker periodically withdrawn at the bottom. These three classes of kiln require the material to be molded into bricks

first used as fuel, and later this gave place to powdered coal, blown in by a blast of air. The rotary process was found to yield cement superior, in some respects, to the product of the older types of kiln, and to be adapted to the burning of cement mixture in the form of dry powder or wet slurry, without previous molding into bricks. With the advantage of the rotary kiln the American Portland cement industry began about 1890 a career of wonderful expansion and development, which is still in active progress. At the present time there are more than 600 kilns of this type in operation in the United States, and within the past two or three years many have been built after American designs in the leading factories of Europe.

The modern rotary kiln consists of a steel cylinder, generally 60 to 100 feet in length and 6 to 7 feet in diameter, slightly inclined and so mounted as to revolve upon rollers. It is lined with fire-brick and heated by a blast of coal-dust and air which enters through a hood at the lower end. The cement mixture, in powder or as wet slurry, is continually fed in at the upper end, and as it travels downward becomes dried (if wet) and is gradually brought to the white heat of the hottest zone, issuing finally in the form of black, rounded grains of clinker at the lower end of the kiln. The passage of the material through the kiln takes from one to two hours. The product from each kiln is from 150 to 250 barrels per day.

The clinker is cooled by a blast of air in towers or revolving cylinders, and ground to fine powder, usually in Griffin mills of the pendulum type or in tube-mills. About two per cent of gypsum is ground with the clinker to overcome any quick-setting tendency of the cement. The fineness of grinding is generally such that at least 92 per cent of the product



## PORTLAND STONE — PORTO RICO

will pass a sieve of 100 meshes to the linear inch.

Portland cement is a gray powder weighing about 110 pounds per cubic foot. Mixed with water to a paste, it sets slowly, resisting pressure of the finger-nail after several hours. After setting it gains rapidly in hardness, and briquettes of neat cement of one square inch section show a tensile strength at 7 days of at least 500 pounds, and 700 pounds or over at 28 days. With three parts sand the strength is generally 200 to 300 pounds in 7 days and 300 to 400 pounds in 28 days. The increase in strength continues through a long period of years.

In testing Portland cement the most important qualities to be observed are fineness, time of setting, tensile and compression strength, and soundness. Fineness is determined by sifting through standard sieves of correct number of meshes and gauge of wire. The time of setting is observed by filling a conical ring with a soft paste of the cement and from time to time bringing in contact with the surface a needle of 1 millimetre (.039 inch) diameter loaded to weigh 300 grams (10.58 ounces). When the needle ceases to pass through the mass the initial set is said to have taken place, and when it makes no appreciable mark on the surface the cement is said to have its final set. For tensile strength, briquettes one square inch in smallest section are made by filling standard molds with plastic paste of cement or cement and sand; these are kept 24 hours in moist air, then immersed in water, and broken on a testing machine at the age of 7 and 28 days, 1 year, and longer periods. Soundness or constancy of volume is tested by making pats of cement, with thin edges, on plates of glass, keeping them in moist air 24 hours, and then immersing in water. After long periods these pats should show no cracks or curvature. A more severe and expeditious method is the boiling test, in which the pats, after setting 24 hours in moist air, are exposed for three hours to steam over boiling water. Failure in either of these tests shows the cement to be unsound and liable to expand and crack in use, perhaps after several years.

Although Portland cement was almost unknown in the United States less than a generation ago, its use has been taken up by architects and engineers with such ingenuity and inventive ability that this country now leads the world in the variety and extent of its applications. Within the past few years, stone, brick and timber have been replaced more and more extensively by cement concrete, and new uses for this material are discovered almost daily. There is good reason to believe that the opening of the 20th century marks the beginning of a cement age. See CEMENT.

S. B. NEWBERRY,

*Sandusky Portland Cement Co., Sandusky, Ohio.*

**Portland Stone**, (1) in England, a limestone of the Upper Oölite, located between the Purbeck Beds, the highest of the Jurassic Epoch, and the Kimmeridge Clay. It is so named from the Isle of Portland, where it is found in greatest abundance. It was once an important building stone in England, having been used, for instance, in the construction of Saint Paul's Cathedral. (2) In the United States, the name is

applied to the brownstone, much used as a building stone in New York, quarried at Portland, Conn. This belongs to the New Red Sandstone of the Triassic Epoch.

**Portland Vase**, a beautiful specimen of Greek art found in a marble sarcophagus at Monte del Grano, near Rome, during the pontificate of Urban VIII. (1622-44). It is formed of glass of a dark-blue color, and is ornamented with relieved figures in white enamel. It is 10 inches high, 7 in diameter at the broadest part, and is furnished with a handle on each side. It was placed in the Barberini Palace, where it remained till 1770, when it was purchased by Sir William Hamilton, from whose possession it passed into that of the Duchess of Portland. In 1810 the Duke of Portland gave it on loan to the British Museum, of which he was a trustee. In 1845 a stupidly malicious fellow, or more probably a lunatic, who had been admitted to the museum as a visitor, deliberately smashed it with a stone. It was skilfully repaired, however, and is exhibited to visitors.

**Porto Alegre**, pōr'too ä-lä'grā, Brazil, capital city of the state of Rio Grande do Sul, about 710 miles from Rio Janeiro, on the left bank and near the mouth of the Jacuhy River, and northwest of the Lagoa dos Patos, on railroads connecting it with the interior. The streets are broad and clean with handsome squares. The charm of the city and its surroundings gave it the Portuguese name of "Smiling Harbor" (Porto Alegre). A hospital, theatre, and cathedral are the main public buildings. There are good schools and a large colony of Germans, who handle most of the city's commerce. This consists chiefly of the produce of the rich agricultural and grazing lands. It has several steamboat lines, to Rio Janeiro, to the German colony of São Leopoldo, etc. The imports are mostly English and German wares. Porto Alegre was founded in 1742 by colonists from the Azores. Pop. (1900, est.) 100,000.

**Porto Cabello**, pōr'tō ka-bēl'ō, or **Puerto Cabello**, pwār'tō kā-bāl'yō, Venezuela, town, on the Caribbean Sea; about 60 miles west of Caracas. A part of the town is on a small island, which is connected with the mainland by a bridge. There is a large and safe harbor; and steamer connections with La Guayra, the port of Caracas, and railroad connection with Caracas. There is considerable trade in fruit and grain. Pop. 10,000.

**Porto Maurizio**, Italy, the capital and chief town of the Province of Porto Maurizio. It is situated on a promontory projecting into the Ligurian Sea, 14 miles from San Remo, 58 miles by rail southwest of Genoa, and 41 miles by rail east by north of Nice. The harbor is formed by two moles and is entered from the south-southwest. Olives are produced in considerable quantities, and there is an extensive shipping trade in fish, agricultural produce, and olive-oil. The town consists of an old section on a hill and a new section near the sea, the latter containing a fine church, a theatre, a technical school, a school of navigation, and a library. Porto Maurizio is a popular winter resort. Pop. over 7,000. Pop. of province about 145,000.

**Porto Rico**, pōr'tō rē'kō, or **Puerto-Rico**, an island of the West Indies and a possession of the United States; the easternmost and smallest

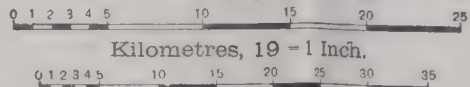




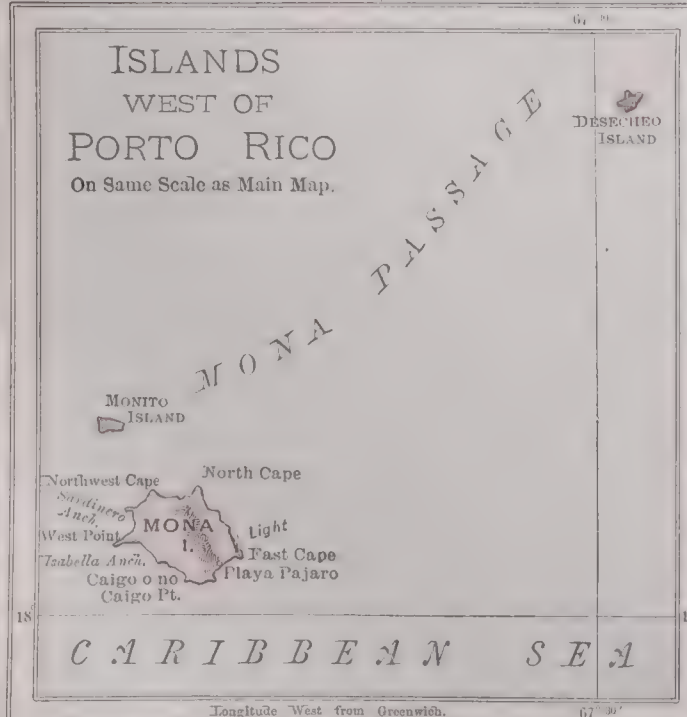
# PORTO RICO

## SCALES.

Statute Miles, 12 = 1 inch.



Rand, McNally & Co.'s 11x14 New Map of Porto Rico.  
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Copyright, 1899, by Rand, McNally & Co.



EXPLANATION:  
Railroads ———  
Roads ———







## PORTO RICO

of the group of Greater Antilles; about 1,400 miles from New York, 1,000 miles from Havana, and less than 1,000 miles from Colón, Republic of Panama; lying between lat.  $17^{\circ} 50'$  and  $18^{\circ} 30'$  N. and lon.  $65^{\circ} 30'$  and  $67^{\circ} 15'$  W. The estimate of its area commonly accepted is 3,668 square miles, or, without Vieques, 3,550. Adjacent and subject to the same jurisdiction are the small islands Vieques and Culebra, in the passage between Porto Rico and the Virgin group; Mona, between Porto Rico and Santo Domingo, and a few other islets.

*Topography, Climate, and Hydrography.*—A chain of mountains, the summits of which are ranged in two nearly parallel lines with intervening tablelands and high valleys, crosses the island from west to east, culminating in the peak called El Yunque (3,609 feet) in the northeast. Lower transverse ridges, running northward and southward from the principal chain, sink into the wide plains which border the coasts, forming a large number of pretty scenes and valleys. The eastern and northern slopes, valleys, and plains receive an abundant rainfall through all the year, while the regions on the other side of the mountains are often parched by drought. The mean temperature at San Juan ranges in different years from  $78^{\circ}$  to  $82^{\circ}$  F., the maximum on record being  $99^{\circ}$  and the minimum  $57^{\circ}$  F. The climate of the highlands, where the mean annual temperature is  $72^{\circ}$  F. or less, is very agreeable all the year, although it contains an excess of moisture at some points. (See also paragraph *History* for statement in regard to hurricanes.) The island is well watered. Streams are uncommonly numerous, and some of them are navigable for small craft near their mouths. On the north coast 17 rivers flow into the sea; on the east coast, 9; west of Cape Mala Pascua on the south coast, 16; on the west coast three, beside the outlets of several freshwater lakes. There are several falls of considerable size, the largest being Comerio and Rio Blanco falls. Harbors are those of San Juan, Culebra, in the Island of Culebra (at both of which United States naval stations are established), Guánica, Hobos or Jovos, Guayanilla and Ensenada Honda.

*Mineral Resources.*—It is certain that large quantities of gold were found in the alluvium deposits during the early years of Spanish occupation; it seems probable, therefore, that lodes of gold-bearing quartz or conglomerate will be discovered in the central range from which the streams issue. A systematic geological and mineralogical survey is required. Casual explorations have shown the presence, in several places, of magnetic and specular iron in large quantity, especially in the eastern part of the island; copper, agate of good quality, garnet, malachite, manganite, etc. Here, as throughout the Antillean regions (see CUBA and CENTRAL AMERICA), the older metamorphic rock and conglomerates, even on the summits of the mountains, are covered with limestone formations.

*Flora and Fauna.*—The island was once covered with a beautiful virgin forest, but unfortunately "Forestry regulations," according to Robert T. Hill, "have not been more wisely observed in Porto Rico than elsewhere in the West Indies;" however, in the highlands the conditions, both in soils and climate, are favorable to

vegetation. The trees which are noteworthy on account of their size or beauty, are the several species of palms and tree-ferns, tillandsia, *Coccoloba macrophylla*, lobelia, etc. Useful woods are the ausubo, cedar, aceitillo, mahogany, laurel, West Indian sandalwood, ebony, and willow and a large variety of dyeing wood. Trees producing edible fruits and plants valuable medicinally are especially numerous. The fauna includes no indigenous quadrupeds; there are no beasts of prey or wild animals of any kind, and unlike the Caribbees, or the tropical continent, Porto Rico is not infested by poisonous snakes and other noxious reptiles, though centipedes and the tarántula are not unknown. There is a large variety of bees. Birds are multitudinous and are noted both for their fine singing and beauty of their plumage; they include the canary-bird, humming-bird, nightingale, parrots, and doves. The tortoises of the island are said to be closely allied to those of the Galapágos Islands (*q.v.*). Some of the rivers are well stocked with fish, and the fisheries, on the north coast especially, are valuable.

*Agriculture, Commerce, and Manufactures.*—Compared with that of the other West Indian islands, Porto Rico's agriculture is remarkably diversified, the chief products being coffee, annual yield about 60,000,000 pounds; sugar nearly 205,000 tons; tobacco about 1,500,000 pounds; cotton; tropical fruits, such as oranges and pineapples, which are grown for export in increasing quantities; rice, of the upland variety; and such vegetables and nutritious fruits as are required for the consumption of the inhabitants. Coffee, once the main industry of the island, is now stagnant. Probably one half of the estates that were damaged or destroyed by the hurricane of 1899 have not been restored, and many of those that were restored are badly handicapped by heavy mortgages at high rate of interest, the price obtained for the product not being sufficient to pay the debts. The acreage dedicated to the coffee culture is gradually decreasing, as no new trees are planted. Unless protection is secured for this industry it will disappear altogether from the island. When the Americans occupied the island there were 250 sugar mills and about 20 centrals. The latter have been increased in number as well as in capacity, due to the protection enjoyed by Porto Rican sugar in the United States markets, while the old-fashioned mills are gradually disappearing by their constant conversion into modern centrals. There are some very large alcohol distilleries in the island. Next to sugar the tobacco industry takes the lead. But although the number of acres of land dedicated to tobacco has increased by tenfold during the last quinquennium, and the quality has been much improved, it may be safely stated that the industry has not yet attained its full development. The cocoanut industry is also very promising; the farmers dedicate more land to it steadily, and better attention is paid to the selection of seed. Five years ago no cotton was raised on the island, although it was well known that the soil is well adapted to the culture of the sea-island quality. At present there are over 2,500 acres dedicated to cotton, and much effort is being made by merchants of San Juan to encourage farmers to increase the acreage as well as im-



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prove the quality. There is a ginney in San Juan. Before the American occupation the oranges and pineapples of Porto Rico were famous for their flavor and sweetness, but they grew wild and in such small quantity that seldom were they exported. Since then, however, the fruit industry has undergone such a favorable change, that while the number of acres dedicated to oranges or pineapples has not been exactly estimated, yet the former are now shipped to the States in large quantity, and in 1907 more than 150,000 boxes of pineapples will leave the port of San Juan. It may be safely asserted that the fruit industry will be the future industry of this island, as roads are built and better transportation facilities are offered to shippers. Rice, corn, bananas, and beans are also raised, but not in sufficient quantity for export trade. Cattle-raising is an important industry, the best pastures lying on the northern and eastern slopes. Exports to the United States in 1903 were valued at \$10,152,923; imports from the United States at \$11,819,895. The total value of exports in 1903 was given as \$14,548,765; of imports from all countries as \$13,939,418. In the fiscal year ending 30 June 1906, the total trade of the island was \$45,085,195. Manufactures are: sugar, rum, cigars, cigarettes, straw hats, preserved fruits, articles of wood, etc. The salt works of the island produce about 10,000,000 pounds annually.

*Railways and Roads.*—The undertaking to encircle the Island with a railway dates from 1888. By 1892 there had actually been built 119 miles. Since that time the lines have been extended to 292 miles; but the system is still inadequate. It is supplemented by highways, some of which are excellent.

*Finance.*—The annual budget of the Island has varied from three to four millions of pesos, aside from city budgets. This budget included from 1,250,000 pesos to 1,500,000 pesos which the Island contributed to the national expense, under the subheads of Ministries of Colonies, War, and Navy. In the year 1897-98 the expenditures were 3,536,342 pesos, and the income 3,939,500 pesos.

The budget for 1898-99 (the first year under the home rule system) showed expenditures of 4,446,952 pesos, and income of 4,782,500 pesos. The first budget under the civil government established by the Foraker Act was about \$2,000,000 (expenditure); that of the year 1906 about \$2,500,000 (expenditure). The main source of income under the Spanish rule was from custom duties on imports and exports, especially on sugar, as up to 1901 there was no regular system of taxation in the Island. Porto Rico, however, was always able to meet its budget and besides have a surplus in its treasury. It is from this surplus that Spain drew \$2,000,000 to fight the Cubans in 1895-96. This money was lost to the Island. The taxable property of the Island at present is valued at \$100,000,000.

Porto Rico has had several currencies. The macuquina, which was introduced in the Island as early as 1800 from Venezuela, was the legal tender up to 1857. This currency was very imperfect; it consisted of pieces of solid silver and copper, irregularly cut, bearing a poor imitation of the Spanish coat of arms, and had a discount of 12½ per cent, on the Spanish national currency. To withdraw the macuquina money the

Spanish Government sent to the Island 1,350,000 Spanish pesos, the Island losing 215,466 pesos, which was necessary to cover the difference in value. In 1867 the Island of Santo Domingo having gained its independence, its money, known as calderilla, was brought to Porto Rico. The same year a Royal Decree allowed the free circulation of foreign money in the Island, fixing a relative value on the basis of the Spanish legal tender. This measure brought abundance of money into the Island. In 1879 a Royal Order made the Mexican peso the official currency, giving it a value of 95 cents American money; and another Royal Order in 1881 authorized its free circulation. In 1895 the government ordered the exchange of the Mexican money for what was called the "special currency:" 6,426,393 pesos were thus exchanged, at a cost to the Island of \$1,210,000 for recoinage, transportation expense, etc. This special provincial money was finally exchanged for the American legal standard at a discount of 66⅛ per cent.

*Banks.*—These institutions were unknown in Porto Rico up to 1888, in which year the Spanish Bank (known now as the Porto Rico Bank) was organized, but not opening its doors until February 1890; capital 1,500,000 pesos, 750,000 paid up; in 1898 it had issued notes to the extent of \$2,587,444½; head office in San Juan. The Banco Territorial-Agricola (Agricultural Bank) was established in July 1894; capital 2,400,000 pesos; head office in San Juan. The Banco Popular was also organized in 1894 with a capital stock of \$18,000; head office in San Juan. The Crédito y Ahorro Ponceño (a savings bank) was organized in November 1894, with a capital stock of \$200,000; head office in Ponce. American Colonial Bank was established in 1899 with a capital stock of \$400,000; head office in San Juan. National Bank, branch in San Juan, Porto Rico, opened in 1902 with a capital stock of \$100,000. Union Bank of Halifax, in San Juan, with a capital stock of \$1,500,000, was established in August 1906.

*Population and Education.*—On 10 Nov. 1899 the number of inhabitants was 953,243 (whites, 589,426; mulattoes, 304,352; negroes, 59,390; Chinese, 75). It is to be observed that while the census taken in 1887 shows a black population of 76,985, and that taken in 1897 reduces the figure to 75,824, the census of 1899 further reduces the figure to 59,390. If this decrease should continue for a number of years, the black race would eventually disappear from Porto Rico, unless there is an immigration of that race from the other West Indian Islands in the future. This is the only Island in all the West Indies where the white population is so overwhelmingly in the majority. The populations of the chief towns in 1899 were: San Juan, the capital, 32,048; Ponce, 27,952; and Mayaguez, 15,187. The white population was divided into three classes: (1) the aristocracy of the country, not seldom colonial branches of excellent families of Spain; (2) trades-people in the towns; (3) a peasantry plagued with anæmia, the so-called *jibaros*, of whom Mr. van Middeldyk says: "intellectually the *jibaro* is as poor as he is physically. His illiteracy is complete." But the *jibaro*, it must be admitted, has had hard luck. The descendants of the early Spanish Colonists and in the majority of cases of the Indians, they retained the superstition of the former and a little of the



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natural timidity and reserve of the latter. These atavic traits, added to the fact that they have been robbed and deceived by the Spanish merchants, who took advantage of their ignorance, reducing them to a sort of serfdom worse than slavery, have made them what they are to-day, a physically degenerated class with no ambition whatever. They are, however, naturally bright and generous, and once you have gained their confidence, dispelled their mistrust, they are most hospitable and loyal. Above all they love peace and fear the law. Education, which they never had a chance of getting, and the development of the interior, will improve their way of living, awake their dormant intellect, and redeem them from their present debased condition.

The members of the first class who were rich and could receive a liberal education went to Europe or the United States, where they would become lawyers, physicians, engineers, etc., and return to their country to practice their profession. Those who were poor were compelled to remain home, contented with what knowledge could be acquired in a very reduced number of public schools, a normal school, and a high school in San Juan (where the degree of bachelor of arts could be obtained); the second and third classes did not receive any education at all, except in rare cases, no efforts being made by the government to raise the standard of education either by making it compulsory or by furnishing sufficient public schools, the number never exceeding 124 and the system being extremely antiquated. In 1899 only 16 or 17 out of 100 Porto Ricans could read and write. Under the new government the number of schools was increased to 1,104; local authorities were required to provide suitable school buildings; primary instruction was made compulsory; and existing institutions of higher education were supplemented by normal, trades, and high schools.

*History and Government.*—On 19 Nov. 1493 Columbus landed on the western coast, and named the island San Juan Bautista. On 14 Aug. 1509 Juan Ponce de Leon, who had discovered gold on the island, was appointed governor by King Ferdinand. The natives, who called their island Borinquén, and had chiefs of their own, were enslaved and forced to work the placer deposits. In June 1511 the Indians slaughtered about one-half of the Spanish force, but were reduced to submission. The aboriginal population at that time probably numbered from 80,000 to 100,000 (not 600,000—an estimate often repeated, but resting upon a wholly unwarranted statement in Friar Abbad's 'Historia'); on 27 April 1515 Counselor Sancho Velasquez wrote to the king that, excepting the Indians assigned to the royal estate and those of the crown officers, "there are not 4,000 left." The greater number of the natives perished; some poisoned themselves; others emigrated to the neighboring islands—so cruelly were they treated—and the rest gradually blended with the invaders. About this time it became customary to refer to the capital as "Puerto Rico," instead of Caparra. Thus modern usage precisely reverses the original intent; for the name Columbus gave to the island is applied only to its chief town, while the name by which Ferdinand designated the settlement on the northern "port" has supplanted both "Borinquén" and "San Juan Bautista." On 26 Feb. 1521 Ponce de Leon sailed

on his second expedition to Florida. Again disappointed and repulsed, he did not return to Porto Rico, but sought refuge in Cuba, where he died. On 18 April 1533 the authorities of the capital petitioned the empress against the further introduction of African slaves. It appears from a letter written by Governor Lando to the emperor in 1534, that very few negroes had been sent to the island up to that time; but a few years later they arrived in large numbers, taking the place of the Indian laborers. Palm Sunday 1554, the principal settlement on the south coast was destroyed by a landing party from three French ships. On 22-25 Nov. 1595 Sir Francis Drake, commanding a strong fleet, attacked San Juan. That port was well defended and the English withdrew. Two years later a large body of English troops, under the Duke of Cumberland, occupied San Juan, then garrisoned by a small body of troops, for a few months. From 25 Sept. to 2 Nov. 1625 San Juan was besieged by a Dutch fleet; landing was effected, but the besiegers were compelled to withdraw with heavy losses. The city was under the command of Don Juan de Haro. From 1640 to 1780 expeditions were equipped in Porto Rico for the long struggle with the buccaneers. In 1702 some English troops landed at Arecibo, but were defeated by a body of militia under Captain Correa. On 17 April 1797 an English fleet, 15 ships and several transports, under Admiral Harvey, with troops commanded by Sir Ralph Abercromby, numbering over 6,000 strong, appeared before San Juan; the city was under the command of Don Ramón de Castro, who gathered with him among regulars, militia, and volunteers, about 4,000 men. The forts were manned by Frenchmen, then the allies of the Spaniards. The invading force landed back of the city by the place known as Cangrejo, and marched on to the city, but before they came to the San Antonio bridge, they met such strong resistance, both from the infantry and artillery on the forts, that they were compelled to re-embark, apprehending an attack from the rear, with great losses both in war materials and men. The ineffectual siege was maintained only 15 days. This attack and that made by the Dutch in 1625 are perhaps the most important events in the history of the Island since the conquest from a military standpoint. To the city, as a reward for gallant resistance at this time, was granted the privilege of adding the words "very noble and very loyal" to its coat-of-arms. Loyalty was strikingly evinced early in the following century. On 20 Dec. 1819, in February 1825, and November 1829 expeditions from Colombia landed in Porto Rico, to encourage the inhabitants to rebel against Spain; they were not welcomed. Nevertheless, in 1837 Porto Rico was deprived of the right of representation in the Spanish Cortes, which she had since 1808, as a result of the advent of Ferdinand VII. to the throne. During half a century the captains-general as a rule favored a systematic demoralization of the common people. "While they dance and gamble, they will not conspire," said one of these pernicious governors. Another means by which the Government encouraged the demoralization was by promoting and giving good offices to those of the natives who would be traitors to their country by denouncing imaginary conspir-



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acies and revolutions. But one fact about this little people is that, while they feel proud of their Spanish ancestry, yet neither money nor threats could ever win an intellectual Porto Rican to serve the cause of tyranny. On 20 Sept. 1868 the "insurrection of Lares" broke out—an insignificant rising, quickly suppressed. The plan was to follow Cuba, which Island was then struggling to throw off the Spanish yoke. Dr. Betances, the leader of this movement, escaped to the neighboring Island, and then went to live in exile in Paris, where he died some 30 years later, never forgetting his little Island, and never forgotten by those whom he once dreamed he could free. As one result of the revolution of that year in Spain and the subsequent establishment of the Republic, Porto Rico was again permitted to send representatives to the Cortes. On 22 March 1873 the slaves in Porto Rico were manumitted, 31,000 receiving freedom in a single day. The slaveholders were paid in government bonds, which a foreign syndicate bought up at 15 per cent. Then followed a period of political unrest with the restoration of the Monarchy, marked by abuses of all kinds committed by the officials sent by Spain. By this time, 1873-4, political parties were organized following the line of the Cuban reform party and later (1886) the Home Rule party. This movement on the part of the Porto Rican patriots brought about in 1887, under General Palacios, what is called the "Componte" era, when the people were tortured by the mounted police (*Guardia Civil*), and the most honorable citizens were thrown into the dungeons of "El Morro" and barely escaped being shot. This is perhaps one of the darkest periods of the colonial history of the Island. By the end of 1896 the Porto Ricans again began to feel the influence of the Cuban ideas, and the western part of the Island showed a disposition to revolt, and might have done so if some one of the Porto Ricans who had gained honor and renown in the Cuban war had landed to lead them. But as a rule the Porto Ricans are a peace-loving people; they at all times preferred to gain what liberties they could bargain from Spain by means of the press and other means of propaganda, rather than resort to arms. It was about this time that some prominent citizens from Camuy were imprisoned and tortured, and everything indicated that the horrible scenes under General Palacios were to be once more repeated under General Sabás Marín. It was now however too late for this, for although the Spaniards never doubted that they would ultimately come out victoriously from a conflict with the United States, nevertheless a little apprehension as to the future made them more humane and cautious in their treatment of defenseless Porto Ricans. On 25 Nov. 1897 the royal degree conceding autonomy to Porto Rico was signed.

After 400 years of a military government of a most absolute character, Porto Rico finally secured what is called an Autonomic Constitution, which gave the Island a Parliament consisting of a senate of 15 members, eight of whom were elected by the people and seven appointed by the Crown; and a lower house, consisting of one representative for every 25,000 inhabitants. The system also provided for a body of five ministers,—minister of Justice and State (Gracia,

Justicia, y Gobernacion) of Finance, of Education, Public Works and Roads, and of Agriculture, Industry, and Commerce,—appointed by the Governor, thus practically providing for the separation of the three powers. The power of veto was retained by the Government at Madrid. It has been asserted by the natives that this measure of home rule fully satisfied their ambition. Notwithstanding it has often been set up against this law that it was not in good faith, and was not to stay, being only a measure of war and a trick of Spain to induce the Cubans to lay down their arms. It is probable that the law was so intended; those, however, who so speculate seem to forget that colonizing nations never granted any degree of liberty to their colonies, except they were compelled to by the force of circumstances; but no one will question the fact that once Spain had granted to her colonies in America a liberal form of government, she could have never been able to restore on this side of the ocean her 16th century régime. This self-government however was of short duration, for a few months after the elections, 21 April 1898, Governor-General Macias suspended the constitutional guarantees and declared the Island in a state of war. On that day war began between the United States and Spain, though not formally declared until the 25th. On 12 May 1898, the capital was bombarded by Admiral Sampson, only a few buildings being damaged and probably a dozen casualties. On 25 July 1898 American forces occupied Guanica; three days later Ponce; on 10 August skirmishes took place at Hormigueros and Guamani, on the west and southeast parts of the island, and on 12 August at Las Marias, on the west, and near the Asomante, on the Ponce road. On 12 Aug. 1898 the protocol was signed providing for the cession of Porto Rico, etc., to the United States; 18 Oct. 1898 the last of the Spanish troops to sail embarked for the Peninsula; the forces of the United States occupied San Juan, Maj.-Gen. John R. Brooke taking up the duties of military governor. His successors in that office were: on 6 Dec. 1898, Maj.-Gen. Guy V. Henry, and 18 May 1899, Brig.-Gen. George W. Davis. This government is noted in the history of Porto Rico for its mildness and wisdom. On 8 Aug. 1899 a hurricane, accompanied by excessive rainfall, devastated the island, 3,369 persons being killed outright, while thousands died from starvation. The army distributed 32,000,000 rations to the sufferers. Disasters of this nature have befallen Porto Rico, although probably never so severe, more than 20 times since the year 1515, occurring most commonly in July, August, and September. On 12 April 1900 an act of Congress required that there should be established for Porto Rico a modified territorial form of government, consisting of executive, legislative, and judicial branches. For the benefit of such government a tariff of 15 per cent. was imposed on imports from the United States into Porto Rico, and *vice versa*. On 1 May 1900 civil government was inaugurated, having the following general features: Governor, appointed by the President of the United States; Legislative Assembly, consisting of an Executive Council or Senate appointed by the President (six Americans and five Porto Ricans), and a House of Delegates (35 members elected by the people); judiciary,



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SAN JUAN.







## PORTO RICO EXPEDITION — PORTOBELLO

including supreme and United States district courts. The first governor was Hon. Charles H. Allen. His successor, 15 September 1901, Hon. William H. Hunt; 25 July 1901 the President proclaimed cessation of tariff duties between Porto Rico and the United States. On 2 Dec. 1901 the Supreme Court of the United States decided that Porto Ricans are not *ipso facto* citizens of the United States. In December 1902 the insular treasury had on hand a considerable balance from revenues produced by the system of local taxation enacted by the Legislative Assembly. On 4 July 1904 Beekman Winthrop took the oath of office as Governor of Porto Rico.

There are two political parties in Porto Rico, both working to change the status of the Island; one, which is called the Republican party, with a marked tendency for Americanization, wants the Island to become a State of the Union, and the other, the Unionist party, with a platform advocating either home-rule under a colonial government, statehood, or independence. In one point both parties agree, and that is that the upper house, which is now appointive, should be elective, at least a majority of it.

*Literature, History, Arts.*—Porto Rico has a considerable literature. It is not very intense or varied, but it has originality. *Poets*: The natural beauty of the country, its exuberance, and the despotism to which it has been subjected, have fostered poetic production, the genre of literature more successfully cultivated. Among the poets who flourished between the years 1860 and 1880 are José Gauthier Benitez, of exquisite sensibility, a Lamartinean melancholy, and a rare sense of beauty; and José G. Padilla, better known as the "Caribe," a brave heart, who gave vent to his patriotic indignation in vigorous and well-rhymed stanzas. After the death of these two poets decadence set in. There are however some younger poets of considerable talents, among who may be mentioned J. de Diego, Lola Tio, R. del Valle, J. Gordil, Negrón Sanjurjo, F. Cestero, E. del Toro, Negrón Flores, and F. G. Marín, who was killed in Cuba fighting for the cause of liberty. *Historians* (local): By the middle of the 19th century Alejandro Tapia published his 'Biblioteca Historica de Puerto Rico'; later J. Julian Acosta published a revised and commented edition of the 'History of Porto Rico' by Fray Iñigo Abbad; and among the contemporary authors we have Salvador Brau and Drs. Stahl and Coll. *Orators*: Manuel Corchado, who died while still young (1840-1884), has been perhaps the most eloquent orator produced by Porto Rico. His brilliant speeches in behalf of the liberties of his country are still remembered. He was also a poet and writer. Among the orators of the day are J. Hernández López and R. Matienzo Cintrón, both powerful and brilliant, good specimens of the best parliamentary speakers, and Álvarez Neva, a powerful forensic orator. *Journalism*: This was the means chosen by the Porto Ricans to contest the Spanish oppression from the middle of the 19th century. This journalism, however, is not as it is understood in the United States; it is more of doctrinal and polemic character; but reporting is gradually creeping in, and we may say that the influence of modern ideas in Porto Rico is nowhere better manifested than in the field of journalism. Among the ablest news-

paper men of the day are L. Muñoz Rivera, Dr. Zeno Gandoa, Manuel Rossy, and Matos Bernier. *Music*: The higher order of music is not cultivated in the island, so far as production is concerned; there are, however, some clever composers of "danza," a dancing piece, a sort of a rondo, andante, which, being exceedingly graceful and melodious, evinces better than anything Porto Rican the nature and sensibility of this people. *Painters*: Campeche and F. Oller.

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M. OLMEDO,  
*Secretary of the Porto Rico Board of Trade.*

**Porto Rico Expedition, Military and Naval Society of the**, an association projected at Caguas, Porto Rico, 11 Oct. 1898, and formed at Columbus, Ohio, 5 June 1900, to bring into permanent relationship the men connected with the military and naval operations during the Spanish-American War which led to the acquisition of Porto Rico by the United States. There are three classes of members, active, associate, and honorary. The active members comprise those officers and enlisted men in any branch of the United States service who accompanied the Porto Rico expedition and were on the island on or before 18 Oct. 1900, the day when the American flag was raised over the Capitol at San Juan. The associate members are those soldiers or sailors of good reputation who were attached to organizations or vessels which composed the expedition but who, through sickness, disability, or by assignment to other duties, were detained in the United States and failed to actively participate in the expedition. Members of the Red Cross Society, volunteer nurses, and others who served with the army in Porto Rico may also become associate members. The membership is about 500.

**Porto Santo**, pōr'too sän'too, an island northeast of the Madeira Islands about 40 miles, and a dependency of Madeira (q.v.). Its area is about 20 square miles. It is 6 to 8 miles in length, 2 to 3 in breadth, and not more than 500 ft. above sea-level, though the surface is rugged and hilly. It is of volcanic origin, and almost destitute of trees. The soil is poor: the only productions are limestone, maize, barley, vegetables, a few fruits, and a poor kind of wine. Its cap., Porto Santo, on a handsome bay with a good harbor, protected by a battery, is frequented by vessels going to and from the Cape of Good Hope. Pop. of island about 1,600.

**Portobello**, pōr-tō-bě'l'ō, Scotland, a suburban watering-place of Edinburgh, three miles to the east, on the Firth of Forth. Its first house was built in 1742 by one of Admiral Vernon's officers, in the expedition against Puerto Bello, whence its name, but its progress dates like that of its east extension, Joppa, from 1804. It has some manufactures of glass, pottery, bricks, etc., and is fully equipped with the



## PORTOVIEJO — PORTSMOUTH

usual accompaniments of a popular summer sea-bathing resort. Pop. (1901) 9,189.

**Portoviejo**, pōr''tō-vē-ā-hō, Ecuador, the administrative seat of Manabi Province, 100 miles north of Guayaquil. It was founded in 1534, and was frequently captured and destroyed by buccaneers. It has manufactures of straw hats. Pop. 10,000.

**Por'traiture.** See PAINTING, PHOTOGRAPHY.

**Portsea**, pōrt'sē, England. See PORTSMOUTH.

**Portsmouth**, pōrts'mūth, England, the principal naval station of Great Britain, a seaport town and municipal countyship, in Hampshire, on the southwest extremity of Portsea, 68 miles southwest of London by rail.

The island of Portsea is bounded on the east by Langston Harbor, on the west by Portsmouth Harbor, and on the south by the roadstead or channel of Spithead, across which is the Isle of Wight; it is separated from the mainland by a narrow creek called Portbridge Canal. The county borough comprises Portsmouth proper, Portsea, and several suburbs, these being now more extensive than the towns to which they belong. Both towns, united so as to form a fortress, are protected by one of the most extensive modern systems of fortifications, which have replaced the former moats, walls, and ramparts, entered by four gates, one of them designed by Inigo Jones. The suburbs consist of Landport and Kingston adjacent to Portsea on the north, and of Southsea, on the east side of the town of Portsmouth. The two first named districts are for the most part occupied by artisans connected with the royal naval dockyard in Portsea. A fine park, the Victoria, is in a conveniently central situation. Southsea is one of the favorite English seaside resorts. Its situation commands fine views of the anchorage at Spithead, and of the Isle of Wight. Southsea common, which extends down to the beach, forms a fine public recreation ground, and on it troops from the neighboring garrisons are often assembled for field days and reviews. Southsea Castle with its adjacent earthworks, the batteries of the Gosport side, and the circular forts in the roadstead, command the entrance to Portsmouth Harbor. The town of Gosport on the opposite side of the harbor entrance is connected with Portsmouth by a floating bridge ferry.

The best street in Portsmouth is the High Street, which divides the town into two nearly equal parts, and contains the principal shops, hotels, and places of business. The prominent public buildings include Government House; the splendid new town-hall opened in 1890; the post-office, the Grammar School, Athenæum, theatre, hospital, Sailors' Home, Central Railway Station; the parish church (St. Thomas à Becket's), built about 1170; the Roman Catholic Cathedral with schools adjacent; the Presbyterian Church; the Independent Chapel in King Street; and numerous other places of worship.

The royal dockyard, which has recently been extended by the addition of new docks and basins, covers an area of about 500 acres. It is enclosed by a wall 14 feet high, and entered by a lofty gateway. It includes vast storehouses, machine-shops, extensive slips and docks, ranges of handsome residences for the port-admiral and other officials, etc. Outside the

dockyard an area of 14 acres contains the gun-wharf, where vast numbers of guns and other ordnance stores are kept; and there is an armory with 25,000 stand of small arms.

Portsmouth has no important manufactures except those connected with its naval establishments, and a few large breweries. Its trade, both coasting and foreign, is of considerable extent; the former consisting chiefly of coals from the Welsh and Newcastle coal fields, cattle and sheep from the Isle of Wight and the west of England, and large quantities of corn and provisions from Ireland; and the latter of wine from different parts of the continent, eggs from France, and timber from the Baltic.

Portsmouth is mentioned in the Saxon Chronicle as existing in 501. It appears to have taken the place of Porchester, which as *Portus Magnus* had been selected by the Romans for a naval station, but became unfit for that purpose in consequence of the silting of the harbor. During the reign of Alfred a fleet of nine ships fitted at the port defeated the Danes, who had long infested the coast; and immediately before the Conquest a large fleet was fitted out here to intercept the Norman armament. About 1256 Henry III. assembled an army here for the invasion of France. In 1377 Portsmouth was attacked by the French, who succeeded in burning a part of the town. This disaster appears to have shown the necessity of fortifying the place, and the works, commenced by Edward IV., were much improved and extended during succeeding reigns. The town was taken by the Parliamentarians in 1642. The Royal George battleship in 1792 heeled over and sank in Portsmouth harbor, drowning nearly 1,000 persons. Pop. (1901) 189,160.

**Portsmouth**, N. H., city, one of the county-seats of Rockingham County; on the Piscataqua River near its mouth, and on the Boston & Maine railroad; 60 miles north of Boston. It was first settled in 1623 by a company under the direction of Fernando Gorges, and was under the jurisdiction of Massachusetts until 1679, when New Hampshire became a separate colony. It was incorporated as a town in 1653, when it received the name of Portsmouth, and became a city in 1849. It was the capital of the State for some time, and is now alternately with Concord the seat of the sessions of the United States district court of New Hampshire. It is built on a peninsula, and has an excellent harbor, deep, well sheltered, and always free from ice; it is the only seaport in the State, yet has practically no foreign commerce, but a considerable coasting trade, particularly in coal. The harbor is protected by earthworks at Jaffrey's Point and Gerrish's Island. The manufacturing establishments are important; they include breweries, boot and shoe factories, cotton mills and marble works; shipbuilding was formerly an important industry, and small vessels are still built. It has railroad and trolley connection with York Beach, Hampton Beach, and other popular summer resorts; and, in the summer, daily steamboat connection with the Isles of Shoals. It is a quiet city and old-fashioned in appearance, containing many colonial houses of historic interest; chief among these are the Wentworth house and the Langdon house. Other buildings of note are the Saint John's Church, the Federal custom-house and



## PORTSMOUTH

the Athenæum. The latter has a library of about 25,000 volumes (1904), and there is also a public library of over 16,000 volumes. The city contains a Home for Indigent Women, a Home for Children and other charitable institutions. The navy yard, which is officially known as the Portsmouth navy yard, is situated on an island of the Piscataqua (formerly known as Fernald's Island), within the limits of the township of Kittery, Maine. It has a large dry dock, and in the days of wooden ships many were built here. For many years the historic frigate *Constitution* was kept at this navy yard, until taken to Charleston. In 1898, the Spanish prisoners from Cervera's fleet were brought here and given comfortable quarters on a small island connected with the navy yard island.

The city government is vested in a mayor, who holds office for a year, and a legislative council with two branches. The police commissioners are appointed by the State. The waterworks are under municipal management. Pop. (1890) 9,827; (1900) 10,637.

**Portsmouth, Ohio**, city, county-seat of Scioto County; at the confluence of the Scioto and Ohio rivers, at the southern terminus of the Ohio Canal, and on the Chesapeake & O., the Baltimore, O. & S., and the Norfolk & W. R.R.'s; about 80 miles in a direct line south of Columbus and 95 miles east by south of Cincinnati. It has steamboat connection with all the Ohio River ports. It was settled in 1803 and in 1814 was incorporated. It is in an agricultural region, and in the vicinity are valuable deposits of fire-clay. It is the commercial centre of an extensive mining and manufacturing section. The chief manufactures of the city are foundry and machine-shop products, paving and building brick, fire-brick, cars, lumber products, stoves, ranges, beer, rectified spirits, paper boxes, wagons, carriages, furniture, veneer factory products, and boots and shoes. In 1901 the invested capital in manufacturing plants was nearly \$5,000,000; and the value of the products for the same year was about \$8,000,000. The principal public buildings are the Government building, county court-house, municipal buildings, some of the business blocks, the church and educational buildings. It has a city hospital, homes for old ladies, and orphanages. The educational institutions are the public and parish schools, several private schools, a public library, and the Hamilton Peebles Reading Room. The principal parks are Athletic, Grandview, York, Millbrook, and Tracy. In the vicinity are interesting remains of the Mound Builders.

The government is vested in a mayor, who holds office two years, and a council. The administrative officials who are chosen by popular vote are the members of the school board, the justices of the peace, the board of public service, the assessors, city treasurer, city solicitor, and city auditor. The business management of the city is in charge of the board of public service. Other subordinate officials are appointed by the mayor, subject to approval by the council, or are elected by the council. The city owns and operates the electric light plant and the waterworks. Pop. (1890) 12,394; (1900) 17,870.

**Portsmouth, Va.**, city, county-seat of Norfolk County; on the Elizabeth River, and on

the Atlantic Coast Line, the Seaboard Air Line, and the Southern R.R.'s; opposite Norfolk, with which it is connected by ferry. It was settled in 1752 and in 1858 was chartered as a city. The site of the present navy yard was occupied by a British shipyard prior to the Revolution. The harbor is one of the best on the coast. There is a steamer line to Baltimore, and regular steamer connections with the chief Atlantic coast cities. The city is better known for its commercial interests than for its manufacturing industries; but it has a number of industrial establishments, chief of which are railroad shops, cotton mills, storage-plants, and lumber yards. It exports large quantities of lumber, cotton and cotton products, naval stores, pig-iron, fruits, and vegetables. It has a United States navy yard, which has a plant for constructing steel ships, and two dry docks. It has also a United States Navy Hospital, and in the northern part of the city, a public park. Trinity Church (P. E.) is of historical interest. The first building on the present site was erected in 1762. A portion of the city is reserved for a residential section, and many of the business men of Norfolk have their homes in Portsmouth. In 1901 the customs district of Norfolk and Portsmouth had a foreign commerce of nearly \$11,000,000. The government is administered under a revised charter of 1893, which provides for a mayor, who holds office four years, and a council. The members of the board of health and the school board are elected by the council. Pop. (1890) 13,268; (1900) 17,427.

**Portsmouth, Treaty of.** After nearly 16 months of war between Russia and Japan (see MANCHURIA) President Roosevelt in the early part of May 1905 made known his sincere belief that the time had come for the two belligerents to end the war and conclude peace. In accordance with these proposals Russia and Japan named their plenipotentiaries, who were sent to the Portsmouth, N. H., Navy Yard, which had been selected as the place of conference, and on 10 August the negotiations were begun. On 29 August an accord was brought about, the treaty signed by the plenipotentiaries on 5 September, and approved by the Emperor of Japan and the Czar of Russia on 14 October to take effect on the 16th. The full text is as follows:

The Emperor of Japan, on one part, and the Emperor of All the Russias, on the other part, animated by a desire to restore the blessings of peace to their countries, have resolved to conclude a treaty of peace, and have for this purpose named plenipotentiaries, that is to say, for His Majesty the Emperor of Japan, Baron Komura Jutarō Jusami, Grand Cordon of the Imperial Order of the Rising Sun, his Minister for Foreign Affairs, and his Excellency Takahira Kogoro, Imperial Order of the Sacred Treasure, his Minister to the United States, and for His Majesty the Emperor of All the Russias, his Excellency Serge Witte, his Secretary of State and President of the Committee of Ministers of the Empire of Russia, and his Excellency Baron Roman Rosen, Master of the Imperial Court of Russia, His Majesty's Ambassador to the United States, who, after having exchanged their full powers, which were found to be in good and due form, have concluded the following articles:



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*Article 1.* There shall henceforth be peace and amity between their Majesties the Emperor of Japan and the Emperor of All the Russias and between their respective States and subjects.

*Article 2.* The Imperial Russian Government, acknowledging that Japan possesses in Korea paramount political, military, and economical interests, engages neither to obstruct nor interfere with measures for the guidance, protection, and control which the Imperial Government of Japan may find necessary to take in Korea.

It is understood that Russian subjects in Korea shall be treated in exactly the same manner as the subjects and citizens of other foreign powers; that is to say, they shall be placed on the same footing as the subjects and citizens of the most favored nation.

It is also agreed that in order to avoid causes of misunderstanding that the two high contracting parties will abstain on the Russian-Korean frontier from taking any military measure which may menace the security of Russian or Korean territory.

*Article 3.* Japan and Russia mutually engage:

First. To evacuate completely and simultaneously Manchuria except the territory affected by the lease of the Liaotung Peninsula in conformity with the provisions of the additional Article I. annexed to the treaty, and

Second. To restore entirely and completely to the exclusive administration of China all the portions of Manchuria now in occupation or under the control of the Japanese or Russian troops with the exception of the territory above mentioned.

The Imperial Government of Russia declare that they have not in Manchuria any territorial advantages or preferential or exclusive concessions in the impairment of Chinese sovereignty or inconsistent with the principle of equal opportunity.

*Article 4.* Japan and Russia reciprocally engage not to obstruct any general measures, common to all countries which China may take for the development of the commerce or industry of Manchuria.

*Article 5.* The Imperial Russian Government transfer and assign to the Imperial Government of Japan, with the consent of the Government of China, the lease of Port Arthur, Ta-Lien, and the adjacent territory and territorial waters and all rights, privileges, and concessions connected with or forming part of such lease, and they also transfer and assign to the Imperial Government of Japan all public works and properties in the territory affected by the above mentioned lease.

The two contracting parties mutually engage to obtain the consent of the Chinese Government mentioned in the foregoing stipulation.

The Imperial Government of Japan on their part undertake that the proprietary rights of Russian subjects in the territory above referred to shall be perfectly respected.

*Article 6.* The Imperial Russian Government engage to transfer and assign to the Imperial Government of Japan without compensation and with the consent of the Chinese Government the railway between Chang-chun-fu and Kuan-chang-tsu and Port Arthur, and all the branches together with all the rights, privileges, and properties appertaining thereto in that region, as well

as all the coal mines in said region belonging to or worked for the benefit of the railway. The two high contracting parties mutually engage to obtain the consent of the Government of China mentioned in the foregoing stipulation.

*Article 7.* Japan and Russia engage to exploit their respective railways in Manchuria exclusively for commercial and industrial purposes and nowise for strategic purposes. It is understood that this restriction does not apply to the railway in territory affected by the lease of the Liao-Tung Peninsula.

*Article 8.* The Imperial Governments of Japan and Russia, with the view to promote and facilitate intercourse and traffic, will so soon as possible conclude a separate convention for the regulation of their connecting railway services in Manchuria.

*Article 9.* The Imperial Russian Government cede to the Imperial Government of Japan in perpetuity and full sovereignty the southern portion of the Island of Sakhalin and all the islands adjacent thereto and the public works and properties thereon. The fiftieth degree of north latitude is adopted as the northern boundary of the ceded territory. The exact alignment of such territory shall be determined in accordance with the provisions of the additional Article XI. annexed to this treaty.

Japan and Russia mutually agree not to construct in their respective possessions on the Island of Sakhalin or the adjacent islands any fortifications or other similar military works. They also respectively engage not to take any military measures which may impede the free navigation of the Strait of La Perouse and the Strait of Tartary.

*Article 10.* It is reserved to Russian subjects, inhabitants of the territory ceded to Japan, to sell their real property and retire to their country, but if they prefer to remain in the ceded territory they will be maintained and protected in the full exercise of their industries and rights of property on condition of submitting to the Japanese laws and jurisdiction. Japan shall have full liberty to withdraw the right of residence in or to deport from such territory any inhabitants who labor under political or administrative disability. She engages, however, that the proprietary rights of such inhabitants shall be fully respected.

*Article 11.* Russia engages to arrange with Japan for granting to Japanese subjects rights of fishery along the coasts of the Russian possessions in the Japan, Okhotsk, and Bering Seas.

It is agreed that the foregoing engagement shall not affect rights already belonging to Russian or foreign subjects in those regions.

*Article 12.* The treaty of commerce and navigation between Japan and Russia having been annulled by the war the Imperial Governments of Japan and Russia engage to adopt as a basis for their commercial relations, pending the conclusion of a new treaty of commerce and navigation, the basis of the treaty which was in force previous to the present war, the system of reciprocal treatment on the footing of the most favored nation in which are included import and export duties, customs formalities, transit and tonnage dues, and the admission and treatment of agents, subjects, and vessels of one country in the territories of the other.

*Article 13.* So soon as possible after the present treaty comes in force all prisoners of war shall be reciprocally restored. The Imperial Governments of Japan and Russia shall each appoint a



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Special Commissioner to take charge of the prisoners. All prisoners in the hands of one Government shall be delivered to and received by the Commissioner of the other Government or by his duly authorized representative in such convenient numbers and such convenient ports of the delivering State as such delivering State shall notify in advance to the Commissioner of the receiving State.

The Governments of Japan and Russia shall present each other so soon as possible after the delivery of the prisoners is completed with a statement of the direct expenditures respectively incurred by them for the care and maintenance of the prisoners from the date of capture or surrender and up to the time of death or delivery. Russia engages to repay to Japan so soon as possible after the exchange of statement as above provided the difference between the actual amount so expended by Japan and the actual amount similarly disbursed by Russia.

*Article 14.* The present treaty shall be ratified by their Majesties, the Emperor of Japan and the Emperor of All the Russias. Such ratification shall be with as little delay as possible, and in any case no later than fifty days from the date of the signature of the treaty, to be announced to the Imperial Governments of Japan and Russia respectively through the French Minister at Tokio and the Ambassador of the United States at St. Petersburg, and from the date of the later of such announcements this treaty shall in all its parts come into full force. The formal exchange of ratifications shall take place at Washington so soon as possible.

*Article 15.* The present treaty shall be signed in duplicate in both the English and French languages. The texts are in absolute conformity, but in case of a discrepancy in the interpretation the French text shall prevail.

In conformity with the provisions of Articles 3 and 9 of the treaty of peace between Japan and Russia of this date the undersigned plenipotentiaries have concluded the following additional articles:

*Sub-Article to Article 3.* The Imperial Governments of Japan and Russia mutually engage to commence the withdrawal of their military forces from the territory of Manchuria simultaneously and immediately after the treaty of peace comes into operation, and within a period of eighteen months after that date the armies of the two countries shall be completely withdrawn from Manchuria except from the leased territory of the Liao-tung Peninsula. The forces of the two countries occupying the front positions shall first be withdrawn.

The high contracting parties reserve to themselves the right to maintain guards to protect their respective railway lines in Manchuria. The number of such guards shall not exceed fifteen per kilometer, and within that maximum number the commanders of the Japanese and Russian Armies shall by common accord fix the number of such guards to be employed as small as possible while having in view the actual requirements.

The commanders of the Japanese and Russian forces in Manchuria shall agree upon the details of the evacuation in conformity with the above principles, and shall take by common accord the measures necessary to carry out the evacuation so soon as possible, and in any case no later than the period of eighteen months.

*Sub-Article to Article 9.* So soon as possible

after the present treaty comes into force a commission of delimitation, composed of an equal number of members, is to be appointed, respectively, by the two high contracting parties, which shall on the spot mark in a permanent manner the exact boundary between the Japanese and Russian possessions on the island of Sakhalin. The commission shall be bound, so far as topographical considerations permit, to follow the fiftieth parallel of north latitude as the boundary line, and in case any deflections from that line at any points are found to be necessary, compensation will be made by correlative deflections at other points. It shall also be the duty of said commission to prepare a list and a description of the adjacent islands included in the cession, and, finally, the commission shall prepare and sign maps showing the boundaries of the ceded territory. The work of the commission shall be subject to the approval of the high contracting parties.

The foregoing additional articles are to be considered ratified with the ratification of the treaty of peace to which they are annexed.

Portsmouth, the fifth day of the ninth month of the thirty-eighth year of Meiji, corresponding to the twenty-third of August, 1905, (Sept. 5, 1905.)

In witness whereof the respective plenipotentiaries have signed and affixed seals to the present treaty of peace.

Done at Portsmouth, New Hampshire, this fifth day of the ninth month of the thirty-eighth year of the Meiji, corresponding to the twenty-third day of August, one thousand nine hundred and five.

**Portugal**, pōr'tū-gal (Port. pōr-too-gäl'), the southwesternmost kingdom of Europe, on the Iberian or Pyrenean Peninsula, between Spain and the Atlantic Ocean. No natural boundaries separate Portugal from Spain, except on a small part of the frontier, the Minho River forming part of the northwest boundary, and the Guadiana River part of the southeastern. The shape of Portugal is nearly that of a parallelogram. Its greatest length, north to south, is 345 miles, greatest breadth 140 miles, extending respectively between latitudes 36° 55' to 42° 7' N., longitudes 6° 15' to 9° 30' W. The area is 34,502 square miles, divided into the six provinces of Minho, 2,807 square miles; Tras-os-Montes, 4,291 square miles; Beira, 9,244 square miles; Estremadura, 6,872 square miles; Alentejo, 9,416 square miles; Algarve, 1,872 square miles; and, with the insular province comprising the Azores 922 square miles, and Madeira, 313 square miles, gives a total area of 35,737 square miles for the kingdom. The only large towns are Lisbon (q.v.), the capital, and Oporto (q.v.), the chief port. Braga, Setubal, and Coimbra have each over 18,000 population.

*Topography and Physical Features.*—The coast-line, of great length in proportion to the extent of the whole surface, curves from the north in a south-southwesterly direction, till it reaches Cabo da Roca, the most westerly point of the peninsula and of continental Europe. Here it becomes somewhat irregular, forms two bays—that of Lisbon and that of Setubal—by the interjection of the remarkable promontory which terminates in Cape Espichel, and again curves round in a south-southwesterly direction till it reaches Cape St. Vincent, where it suddenly turns east. This direction it retains to its termination at the mouth of the Guadiana. It



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is occasionally bold, and rises to a great height, particularly at Cabo da Roca, where it presents a range of precipitous cliffs; but for the greater part is low and marshy, and not unfrequently lined by sands and reefs, which make navigation dangerous. It is indented by some twenty-one harbors; the only ones of importance, either from their excellence or the trade carried on at them, are those of Lisbon, Oporto, Setubal, Faro, Figueira, Aveiro, and Vianna. The interior is generally mountainous, a number of ranges stretching across the country, either in west, southwest, or south-southwest directions, forming a succession of independent river basins, while their ramifications, penetrating in all directions, form the watersheds of numerous subsidiary streams, and enclose many wild and beautiful valleys. The loftiest range is the Serra da Estrella, which may be considered as a continuation of the central chain which stretches across Spain between Old and New Castile, and between Leon and Estremadura. Near the town of Guarda it forms a sort of fork, one limb of which proceeds north, and another southeast, while the main chain, running southwest, attains its culminating point of 6,537 feet about five miles west of the town of Covilhão, and ultimately terminates in the lofty cliffs of Cabo da Roca. Nearly parallel to this chain, and at no great distance from it, are on the north the Serra de Alcoba, and on the south the Serra Moradal. In the north branches or continuations of the Spanish mountains enter Portugal, and attain heights of 4,740 feet in Peneda, and of 5,180 in Larouco. At the opposite extremity the Serra Monchique, stretching across the country at a short distance behind the south shore, attains, at its western extremity in Mount Foia, the height of nearly 3,000 feet. The rugged nature of the surface makes the plains both few in number and of limited extent, but many valleys equally remarkable for beauty and fertility occur. The chief plains are those of Almedia and the Terra de Braganza, the former in the province of Beira, and the latter in that of Tras-os-Montes; the chief valleys, those of Chaves, Villarica, and Besteiros.

*Hydrography.*—No rivers of importance take their rise in Portugal, and yet few countries in proportion to their extent are better supplied with large and navigable streams. The Minho in the north, forming the boundary between Spain and Portugal in the lower part of its course; the Douro, first skirting the east frontier, and then pursuing its course west to its mouth at Oporto; and the Tagus, all flow east to west; the Guadiana is the only large river of Portugal which deviates from the general west direction, and flows mainly south. In addition to these rivers, for which Portugal is indebted to Spain, the purely local rivers are the Vouga, Mondego, and Sado. Numerous small lakes are scattered over the plains and among the mountains and valleys.

*Geology and Mineral Resources.*—The nucleus of the mountains is usually granite, overlain in the north by micaceous schist and other metamorphic rocks. Crystalline rocks and Palæozoic formations (especially Silurian) occupy about two thirds of the surface, but the Jurassic, the Cretaceous, and various Tertiary formations are also represented in the more southerly parts of the country. Volcanic for-

mations are very apparent in the Serra de Caldeirão, forming a continuation of that of Monchique. The mineralogical treasures seem more remarkable for their variety than for their value, though some are, and many more, it is supposed, might be, worked to advantage. They include argentiferous lead, copper, iron, cobalt, bismuth, antimony, fine marble, slate, saltpeter, lithographic stones, mill-stones, and porcelain earth. Some gold also is washed from the sands of the Douro, Mondego, and other streams, and in several serras, particularly those of Estrella and Gerez-Larouco; and many valuable pebbles and rock-crystals are found in a great number of places. Large quantities of salt are formed in bays along the coast by natural evaporation; there are numerous salt marshes; and over 200 mineral springs, mostly impregnated with sulphur.

*Climate.*—The climate is greatly modified by the proximity of the sea and the height of the mountains, the former tempering the excessive heat of summer by refreshing breezes, and the latter making the winter more rigorous than usual in countries under the same latitude. In general, however, winter is both short and mild, and in some places never completely interrupts the course of vegetation. In consequence of this many parts of Portugal enjoy the benefit of a double spring. Early in February vegetation is in full vigor; the plants shoot forth rapidly, attain maturity, and either wither away, or if of economical value are gathered and harvested. During the month of July the heat is often extreme, and, rain seldom falling, the whole country, particularly at its lower levels and along the coast, assumes a very parched appearance. The drought generally continues throughout August and far into September; but at last the sky, which had previously been serene, becomes overcast, and copious showers descend. The second spring now begins, and the fields again become covered with flowers and verdure. Winter begins at the end of November. In the mountainous districts the loftier summits obtain a covering of snow, and retain it for a greater or less period according to their altitude; but in all the country south of the Douro, and at a moderate elevation, snow generally soon melts away. Deluges of rain, however, continue to fall, with occasional violent hurricanes and thunderstorms. Shocks of earthquake are sometimes felt, particularly in the vicinity of the metropolis, where those of 1755 were overwhelmingly disastrous.

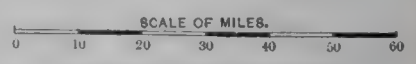
*Forestry, Flora, and Fauna.*—Many of the mountains are clothed with fine forests, chiefly of hardwood, among which the oak, both the ordinary species, or *Quercus robur*, and the cork-tree, or *Quercus suber*, are conspicuous. In the central provinces, at a moderate elevation, magnificent chestnuts are very prevalent. In the south, in the province of Algarve, both the date and the American aloe are not uncommon. There are few countries with a more varied flora than Portugal. The number of species has been estimated to exceed 4,000, and of these more than 3,000 are phanerogamous. Both the flora and fauna of the kingdom are similar to those of Spain (q.v.). The fisheries, especially those of sardine and tunny, are of considerable commercial importance.

*Land Tenure, Agriculture, and Stock-raising.*—The common forms of land tenure are peasant





# SPAIN AND PORTUGAL



Population of places is indicated by different lettering, thus:  
150,000 and over ----- MADRID  
50,000 to 150,000 ----- Oporto  
25,000 to 50,000 ----- Almeria  
5,000 to 25,000 ----- Trujillo  
Smaller Places ----- Burguillos  
Railroads -----







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proprietorship, tenant farming, *métayage*, and *emphyteusis*. Large estates and tenant farming are common in the south; peasant proprietorship and *emphyteusis* prevail in the north. Agriculture, properly so called, is at a low ebb, and Portugal fails in ordinary years to raise cereals in sufficient quantity to meet its own consumption. Barley and rye are important crops in the north, elsewhere wheat and maize are of more importance. In swampy localities some rice is grown. Fruits of excellent quality are common in every quarter, though it is only in the warmer and better-sheltered districts that the orange, lemon, and olive are cultivated with success on an extensive scale. The mulberry is admirably adapted to the climate, and by means of it a good deal of excellent silk is obtained; and a large extent of country is devoted to vine culture, caused partly by the demand for Portuguese wines in Britain. Among domestic animals the first place is due to the mule, of which very superior breeds have long been possessed and are carefully preserved. Sheep, goats, and hogs are numerous, but little attention is paid to their improvement. Cattle are of comparatively less importance.

*Manufactures and Commerce.*—Manufactures are still limited, although they have been rapidly increasing of late years, and cotton goods are now exported. Among the articles made to some extent on a wholesale or commercial footing are: textiles at Lisbon; woolen cloth and other woolen stuffs at Portalegre, Covilhão, etc.; porcelain at Vista Alegre; delft and ordinary earthenware at Lisbon, Oporto, Coimbra, Beja, Estremoz, etc.; cottons at Oporto; prints and lace at Lisbon and Oporto; cotton-twist at Thomar; silks at Braganza, Chacim, Oporto, etc.; copper and tin ware at Lisbon and other places; corks, ribbons, embroidery, hats, confectionery, fine soap, jewelry and cut gems, glass, paper, wicker-work, and tobacco. Ship-building is carried on to some extent, vessels being constructed at Lisbon, Figueira, Oporto, and elsewhere. The principal exports besides wine are cork, cattle, cottons, olive-oil, sardines and tunny fish, fruits, iron and copper pyrites, and horses; the principal imports are cereals, colonial produce, woolen, cotton, linen, and silk tissues, iron, steel, and various other metals, machinery, cured fish, coal, petroleum, timber, dyes, and drugs, etc. In 1900 the value of the exports was over \$35,000,000 (wine \$11,800,000), imports \$66,000,000. The bulk of the trade is with Great Britain and France, and the chief export to the former is wine. The value of the wine sent to Great Britain annually is over \$5,000,000. In the import trade Germany and the United States follow after Great Britain. Coal and cotton goods have the highest value among the exports from Great Britain to Portugal, with a considerable amount in iron (wrought and unwrought) and machinery.

*Shipping and Navigation.*—The mercantile shipping of the kingdom in 1902 comprised 238 sailing vessels with an aggregate of 56,588 tons, and 44 steamers of 29,443 tons. In 1901, 6,493 vessels of 10,414,793 tons entered, and 6,516 vessels of 10,395,615 tons cleared the ports of Portugal.

*Communications.*—The length of sea-coast, with the harbors found upon it, and the number of rivers, furnish great facilities for trade, but

all the other means of internal communication are defective. There are nearly 9,000 miles of public roads; in 1901, 1,464 miles of railway were open for traffic, of which 507 miles were owned by the state; in the same year there were over 5,180 miles of telegraphic line in operation.

*Money, Weights, and Measures.*—Accounts are kept in reis, milreis, or 1,000 reis, and contos de reis or 1,000,000 reis. The value of the rea is so minute that the milreis is worth only about \$1.08. Paper and silver are the chief media of circulation. The French metric system of weights and measures was introduced into Portugal between 1860 and 1863. The Portuguese *libra* was 1.012 pound averdupois, the *arroba* was 32 libras, the *quintal* 4 arrobas. The chief linear measures were the *legoa*, or league of 18 to the degree; the *milha*, or common geographical mile; the *braça*, or fathom = 7.4 feet; the *vara*, or yard, one half of the former; and *pe*, or foot = about 13 inches. For dry measure the *moyo* = 22 bushels; and for liquids the *almudo* = from 3.7 to 5.6 gallons, were used.

*Banking.*—Including the savings banks there are 35 banks on the continent, the financial status of which is approximately cash in hand \$19,000,000, bills \$27,000,000, loans on security \$25,000,000, deposits \$33,000,000, note circulation \$60,000,000. The Ultramarine Bank issues notes for the colonies, but only the notes of the Bank of Portugal circulate in the kingdom. On 17 Dec. 1902 the status of the Bank of Portugal was approximately metallic stock \$11,000,000, note circulation \$69,000,000, deposits \$3,000,000, commercial account \$18,000,000, advances \$4,000,000, balance against treasury \$27,000,000. On 31 Dec. 1901 the deposits in the State Savings Bank and the Monte Rio Geral amounted to about \$18,000,000; the monthly deposits in the banks of Lisbon and Oporto averaged during the year about \$22,000,000.

*Government.*—The Carta Constitutional of King Pedro IV., granted 29 April 1826, and amended at various times, is the fundamental law of the kingdom. The crown is hereditary both in the male and female line, but with preference of the male. The constitution recognizes four powers in the state—the legislative, executive, judicial, and moderating. The last, which is equivalent to the royal prerogative, is vested in the sovereign. There are two chambers, the Camara dos Pares and the Camara dos Deputados. The two are called the Cortes Gerães. The peers are nominated by the sovereign, who also nominates the president and vice-president of the chamber. The peerage is hereditary in the direct line, but the law of 1885 provided for the gradual abolition of hereditary peerages. To get a vote for the chamber of deputies one must be at least 21 years old, and pay a tax of at least 500 reis, or be able to read and write. A deputy must have 400 milreis per annum. A new parliament is convened without interval on the dissolution of the old. All laws relating to the army and taxation must originate in the chamber of deputies. The revenue now amounts to about \$55,000,000; for a long time it was exceeded by the expenditure. The debt amounts to nearly \$600,000,000. The financial condition has somewhat improved, since the reorganization of the public debt in 1891.

*Army and Navy.*—The army consists of about



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33,000 men on the peace footing, and 175,000 on a war footing. Compulsory service was introduced in 1895, and all above 21, with certain exceptions, are liable to serve three years with the flag, five in the first reserve, and seven in the second. The navy consists of 1 ironclad, 10 corvettes and screw-steamers, 21 gunboats and transports, 5 torpedo boats, 13 sailing-vessels, and 7 training and coast-guard ships, the whole manned by 2,850 sailors and 250 officers.

*Colonies.*—The colonial possessions of Portugal consist of—in Asia—Goa, Damão, and Diu, all in India, Macao, and possessions in the Indian Archipelago, having together an area estimated at 7,708 square miles, and a population estimated at 900,000; in Africa—Cape Verd, St. Thomas, and Prince's Islands, Bissagos, Guinea, Angola, and Portuguese East Africa, with an aggregate area of 820,686 square miles, and an estimated population of 14,000,000. A large part of the Portuguese possessions in Africa, however, are only nominally under their rule.

*Ethnology.*—The Portuguese are a mixed race—originally Iberian or Basque, with later Celtic admixture. Galician blood (derived from the ancient Gallaici, presumably Gallic invaders) predominates in the north; Jewish and Arabic blood are strongly present in the centre, and African in the south. The Portuguese differ essentially from their Spanish brethren, whom they regard with inveterate hatred and jealousy, mainly on account of their past attempts to subvert the independence of Portugal. The opinions of observers differ as to the national traits of the people. They are, however, generally sober, good-natured, obliging, and patriotic, but shiftless and not over-clean.

*Population.*—The population of continental Portugal in 1900 was 5,021,657 and, including the insular province of the Azores and Madeira, 5,428,659, or a density of 150.6 per square mile, as compared with 4,660,095 and 5,049,729 in 1891. There were 2,597,270 males and 2,831,389 females, or 109 females to every hundred males. The rate of illegitimate births is 12.5 per cent of the total births.

*Religion, Education.*—The state religion is that of the Catholic Church, but toleration is extended to all other creeds. There are three ecclesiastical provinces presided over by the cardinal patriarch of Lisbon, the archbishop of Braga, who is primate of the kingdom, and the archbishop of Evora; these dignitaries rule over 14 bishops. The monasteries were dissolved in 1834, their properties, yielding about one million sterling annually, being appropriated by the state. Their books were collected, and form a library of 30,000 volumes at Lisbon. There are only about 500 Protestants, mostly foreigners. Education is superintended by a council, at the head of which is the minister of the interior, and is entirely free from the supervision and control of the Church. Compulsory education was enacted in 1844, but is far from being fully enforced, consequently Portugal lags behind in education and general intelligence. There are nearly 4,000 elementary schools, with 180,000 pupils; 22 lyceums, with 8,260 pupils; numerous private schools; polytechnic academies at Lisbon and Oporto; and clerical, medical, agricultural, naval, and military training-schools. The one university at Coimbra (1300), one of the oldest in Europe, has five faculties, 75 professors, and

about 900 students. Schools for training in the industrial arts are in great favor; there are 28 in the country, headed by larger institutes at Lisbon and Oporto.

*Judiciary and Local Government.*—For judicial purposes Portugal is divided into comarcas, each having a court of first instance. There are appeal courts at Lisbon, Oporto, and Ponta Delgada (in the Azores); and a supreme court at Lisbon. For the purposes of local government the six provinces of continental Portugal are subdivided into 17 districts, and the insular province into four, the Azores three, and Madeira one.

*History.*—Portugal forms the greater part of ancient Lusitania. It was subjugated by the Romans, in the time of Augustus, and was constituted into a province. In the 5th century, on the overthrow of the Roman supremacy, Portugal was invaded by the Alans and Visigoths, and suffered with Spain, of which it was then a part, all the troubles and vicissitudes endured by the inhabitants of the peninsula till the 8th century, at which time the Arabs, called indifferently Saracens or Moors, possessed themselves of the whole of Portugal, and kept absolute dominion for nearly 400 years. When the gallant Spaniards of the Christian kingdoms of Castile and Leon finally wrested the country between the Minho and the Douro from Moorish hands, they placed counts or governors over this region. Henry the Younger of Burgundy, whose grandfather Robert I., duke of Burgundy, was grandson of the French king Hugh Capet, came into Spain about 1090, to seek his fortune in the wars against the Moors. Alfonso VI., king of Castile and Leon, gave him the hand of his daughter, and appointed him (1095) count and governor of the conquered districts, which comprised the provinces Entre Minho e Douro, Tras os Montes, and a part of Beira, and the harbors of Oporto (Portus Calle), from which Portugal is said to have derived its name. The count resided at Guimaraens, owed feudal service to the Castilian kings, but was permitted to hold in his own right whatever conquests he should make from the Moors beyond the Tagus (1112). Under his widow, Theresa (1114–28) the country acquired a sense of national unity and a certain measure of independence. Their son, Alfonso I., made Portugal an independent kingdom (1143)—through the victory of a picked body of Portuguese knights over a picked body of Castilian knights in a tournament—and gained signal advantages over the Arabs, whom he fought for 25 years, his greatest exploits being the victory in the plain of Ourique, in Alemtejo, in 1139, when he was saluted king of Portugal on the battle-field, the capture (with the help of English crusaders) of Lisbon in 1147, and of Alcacer do Sal in 1158. The Burgundian House, which continued in possession of the throne for 440 years, gave to Portugal some of its best kings. The immediate successors of Alfonso I. were engaged in incessant wars against the Moslems and in severe struggles with the clergy and nobles, who were always ready to combine against the sovereign; but, although often baffled in their attempts to uphold the independence of the crown, the dignity of the kingdom was, on the whole, well maintained by the representatives of this family, who were, moreover, distinguished as the promoters and



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champions of the maritime glory of Portugal. Prominent among these was Diniz or Denis (1279-1325), son of Alfonso III. He encouraged agriculture, manufactures, navigation, and commerce. He admitted the representatives of towns to the Cortes. He liberally patronized learning, and founded a university at Lisbon, which in 1308 he transferred to Coimbra. By these and other acts of a wise and beneficent administration he earned the title of "Father of his County." Among his other epithets the most frequently applied is the "Farmer." He was succeeded by Alfonso IV. In conjunction with Alfonso II. of Castile he defeated the Moors at Salado in 1340. He murdered Inez de Castro, the wife of his son Pedro, in 1355. (See CASTRO, INEZ DE.) He was succeeded by his son Pedro I., who exhumed the body of Inez, and caused her to be crowned along with him (1361). He died in 1367, and was succeeded by Ferdinand, on whose death in 1383 the male line of the Burgundian princes became extinct. In 1385 the king of Castile laid claim to the crown, but was opposed by Don John, the illegitimate brother of Ferdinand, who ascended the vacant throne and ruled his subjects with justice and prudence. Under this wise and enlightened sovereign the Portuguese first directed their attention to those maritime adventures which subsequently placed Portugal at the head of all European nations. Under John I. the Portuguese first projected those Atlantic discoveries on the African coast, fraught with such territorial and commercial advantages to the nation; and, under John II. and Emanuel, between 1481 and 1521, Vasco da Gama explored the Indian Ocean; the riches of the East began to pour into Europe; Goa became a prosperous possession, and Brazil was added to the possessions of the crown of Portugal. The latter monarch, Emanuel, has been regarded as the greatest and best man who ever sat on a throne. Under his wise, just, and benevolent reign, distress was banished from the kingdom, and his subjects rendered rich and happy. Sebastian III., fired with a holy zeal to exterminate the infidels from his country, commenced a sanguinary crusade against the Moors, which he carried on through such repeated defeats that he eventually lost both his crown and life in the struggle. With Henry the Cardinal, his uncle, an old man of 70 who died after a reign of two years, the male line terminated, after enduring for 460 years. Spain once more laid claim to the vacant throne, and Portugal again became a dependency of the Spanish crown, the nation suffering all the injustice, exactions, and tyranny usually inflicted on a conquered country by its haughty masters. After enduring 60 years of intolerable hardships and exactions, a Portuguese nobleman named John, duke of Braganza, pitying his unfortunate countrymen, excited a revolution, which again broke the Spanish fetters, while the people hailed their deliverer as their king, who, being crowned as John IV., commenced the dynasty of the House of Braganza, a family whose descendants still sway the destinies of Portugal. During the 18th century, as an ally of Great Britain, Portugal became rather a commercial dependent, especially after the Methuen Treaty (q.v.) of 1703.

When Napoleon, in 1807, entered the country, and declared the family of Braganza had ceased

to reign, the royal family of Portugal, consisting of Pedro, the old king, and his imbecile wife, Maria Frances Isabella, queen-regent, the prince-regent, and all the court, set sail from the Tagus to Brazil, transferring the capital to Rio de Janeiro. On the death of the queen-regent, John VI. ascended the throne of Portugal and Brazil. After the downfall of Napoleon, the history of Portugal is composed of a long succession of political disturbances. The Inquisition introduced in 1536 was abolished in the Portuguese dominions in 1815, and the Jesuits, established in 1540 and banished in 1759, were refused admission. The Jews, at the request of the pope in 1817, were allowed the same privileges which they enjoyed in the Roman States. The absence of the court was viewed with dislike by the nation; the military were dissatisfied with the British influence of Marshal Beresford, and the general feeling required some fundamental changes in the administration and constitution of government. A revolution in favor of constitutional government was effected without bloodshed (1820), and the king invited to return home. Before landing in Portugal he swore to observe the constitution which had been adopted. A counter-revolution of the nobles and clergy was vigorously repressed by the Cortes (February 1823); but the queen, a Spanish infanta, who exercised great influence over her son, Dom Miguel, gained the colonels of several regiments; a new reactionary movement was organized; and the Cortes, being overpowered, dissolved itself after a solemn protest on 2 June 1823. In 1822 Brazil threw off the yoke of Portugal, and proclaimed Dom Pedro, son of John VI., emperor. Her independence was recognized in 1825. John VI. died 10 March 1826, having named the Infanta Isabella Maria regent. She governed in the name of the Emperor of Brazil, Dom Pedro IV. of Portugal, who granted a constitution with two chambers, modeled on the French, 23 April 1826. In May he abdicated in favor of his daughter Maria da Gloria. He imposed on her the condition of marrying her uncle Dom Miguel, who was entrusted with the government as regent; but the Absolutist party in Portugal set up the claim of Dom Miguel to an unlimited sovereignty, and a revolution in his favor, notwithstanding the intervention of England, placed him on the throne in 1828. In 1831 Dom Pedro resigned the Brazilian crown, and returning to Europe, with the aid of English partisans, succeeded in overthrowing Dom Miguel, and restoring the crown to Maria in 1833. In 1836 a successful revolution took place in favor of the restoration of the constitution of 1820, and in 1842 another in favor of that of 1842. Maria died in 1853. Her husband, Ferdinand of Saxe-Coburg, brother of Prince Albert of Britain, became regent for her son Pedro V. He placed the government on a purely constitutional basis, which was maintained by his son Pedro, who died in 1861, and by Louis I., who succeeded him, and who died in 1889. The abolition of monopolies, the improvement of finances, the formation of railways, and the cadastral survey of the country, are among the measures which distinguished his reign. Slavery was abolished in 1868 in the Portuguese dependencies. The present king, Carlos I., ascended the throne in 1889. His



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reign has been marked by serious colonial, financial, social, and political troubles. The month following his accession witnessed the successful revolution of the republicans in Brazil and the expulsion of the emperor, and the following year a rupture with Great Britain seemed likely in regard to Portuguese East Africa. Consult: Baedeker, 'Spain and Portugal'; Cartailhac, 'Les Ages préhistoriques de l'Espagne et du Portugal' (1886); Crawford, 'Portugal: Old and New' (1880), and 'Round the Calendar in Portugal' (1890); Martins, 'Historia de Portugal' (1880), and 'Portugal contemporaneo' (1881); M'Murdo, 'History of Portugal' (1888); Salisbury, 'Portugal and its People' (1893); Morse Stephens, 'Portugal' (1891).

**Portugal, Orders and Decorations.** See ORDERS, ROYAL.

**Portuguese and Brazilian Literature.** See PORTUGUESE LANGUAGE, LITERATURE, AND ART.

**Portuguese** (pōr'tū-gēs, or -gēz) **East Africa, or Mozambique.** See EAST AFRICA, PORTUGUESE, and MOZAMBIQUE.

**Portuguese East India Company.** See EAST INDIA COMPANIES.

**Portuguese Guinea**, a northwest African colony on the Atlantic coast, extending from the Cacheo River southward to Katafine, and eastward to lon. 13° W., its boundaries on all its land sides, fixed by the convention of 12 May 1886, being the French Senegambian possessions. The Bissagos archipelago with other islands off the coast belong to the colony, which has an area of 4,440 square miles. The capital and chief port is Bulama on Bulama Island; other trading ports are Bissao, Bubah, Geba, and Cacheo. The coast is indented by the estuary of the Rio Grande River with its numerous deltaic islands; the colony from the eastern mountains westward lies on both sides of the river, and is mainly an alluvial plain covered with tropical forests and vegetation. Rice and millet are cultivated. The chief commercial products, largely controlled by the French, are rubber, ivory, hides, oil-seed, and wax; the annual exports amount to about \$300,000; the imports to a little over \$1,000,000. Outside coasting trade, 150 vessels with an aggregate of 57,007 tons, entered the ports in 1900. The colony is administered by a Portuguese governor and council. The military force numbers 247 men, including 143 natives. The colony is non-supporting, the revenue being over one third less than the expenditure. The United States in 1870 as umpire settled the long-standing disputes between Great Britain and Portugal over this territory in favor of the latter. Pop. 820,000.

**Portuguese Language, Literature, and Art.** The nature of the language of ancient Lusitania is unknown. Words of Greek, Phœnician, Iberian, Celtic, and Carthaginian origin are found in Portuguese as in Spanish, indicating the relations into which commerce or conquest had brought the early inhabitants of the country. Apart from these local peculiarities the Portuguese is one of the Romance family of languages formed by the junction of the Latin-speaking Celts with the Teutonic races. The Moorish occupation has further infused into it a Semitic element. Under the early kings of Portugal all docu-

ments were written in Latin; judicial sentences were written in Latin till a comparatively recent time; it is still used in seals, coins, and monumental inscriptions. It was only under Alfonso III. and Diniz that Portuguese began to be generally used in documents. The differences between Portuguese and Spanish are comparatively of modern origin, the two languages being very nearly alike in the time of Alfonso I. These differences are due partly to the different spheres of activity of the two peoples. The relations of Spain were with France, Italy, Austria, and the Low Countries: those of the Portuguese were almost exclusively with the Spaniards themselves, or with peoples removed from European civilization. The dialect of Spanish spoken in Portugal at the beginning of the monarchy, moreover, was the Galician, which was also that of the court of Leon; but that court subsequently adopted the Castilian, which became the dominant language of Spain. The decline of the Galician dialect in Spain and the formation of the Portuguese language through the influences peculiar to the people finally determined the separation of Spanish and Portuguese, and from cognate dialects made them distinct languages. Early French introduced by Henry of Burgundy and his suite also constituted an element in the formation of the Portuguese language, and old French words which have fallen into desuetude are still to be found in Portuguese. The heraldic devices of the oldest Portuguese families are in French, while in modern times the Portuguese have shown a strong tendency to imitate the French in everything, and the language has been considerably modified by the introduction of French expressions and grammatical forms.

The 16th century is the classical age of Portuguese literature, and the Royal Academy of Sciences has begun a dictionary in which all doubtful points in regard to the language are referred to quotations from the writers of that age. There is no determined orthography except that which the rules of printers have made prevalent in printed books. Royal edicts and other public documents were formerly cited as models of language, but in later times they were far from being distinguished by accuracy.

The Portuguese language has by means of colonization and emigration been pretty widely spread. It is spoken in Portugal, the Azores, Brazil, the Portuguese colonies in Asia, Africa, and America, and among the Portuguese Jews scattered over Europe, particularly in Hamburg and Amsterdam. The Portuguese possesses the richness and conciseness of the dialects founded on the Latin tongue. It appears to have derived from French the *j* sound and the nasal syllables, and it wants the strong aspirations and guttural sounds of the Spanish. It has less dignity than the Spanish, but is superior to it in flexibility. In popular songs it displays a delicacy and variety of expression which have made the Spaniards call it the language of flowers. It makes free use of augmentives and diminutives. It is soft and sonorous in sound, but the too frequent occurrence of the nasal *ão* somewhat mars its harmony. The words are systematically grouped, every substantive having in general an adjective, a verb, and an adverb corresponding to it. Latin terms are preserved in Portuguese which are found in no



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other language in Europe; but these, as well as its other Latin elements, are more radically changed than elsewhere, so that it is often extremely difficult to trace the derivation of Portuguese words. Medial consonants, such as *l* and *n*, are frequently suppressed, *doler* becomes *dor*; *populus*, *povo*; *ponere*, *pôr* (Italian *porre*). The dialects of Portuguese differ only slightly from each other. Those of Minho, Algarve, the Azores in Europe, and of Goa, Macao, Kongo, Mozambique, and Brazil are farthest from the written. The *lingoa geral* spoken on the eastern and western coasts of Africa, as well as in some parts of India and Ceylon, which bears an analogy to the *lingua franca* of the Mediterranean, may be regarded as a dialect founded on Portuguese, and as containing reminiscences of the ancient maritime power of the people.

*Literature*.—The earliest productions of Portuguese literature do not go back further than 1125, from which date the poetical compositions of Egaz Moniz Coelho and of Gonzales Hermiguez. These are written in the Galician dialect. This dialect closely resembled the Provençal, and the Provençal bards who were received at the court of the kings of Portugal just missed assimilating the Portuguese as well as other languages of southern Europe to their own. The Provençal literature in fact for some time absorbed all the efforts directed toward the cultivation of the higher arts of writing, and in Portugal, as elsewhere, it retarded the development of the native literature. During the 12th and 13th centuries the Portuguese native literature could boast of nothing more than a collection of popular songs (*chacras*), remarkable for freshness and vigor. The first Portuguese collection of poetry (*cancioneiro*) was made by King Diniz. It consisted of a selection of the court lays composed about this time by the Portuguese, Provençal, and Galician bards. The manuscript of this collection, discovered in the Vatican by Ferdinand Wolf, has been published in Paris and Lisbon (1847) under the title of 'Cancioneiro del Rey Dom Diniz.' To Dom Pedro, Count of Barcellos, son of Diniz, is attributed a 'Cancioneiro do Real Collegio dos Nobres.' His half-brothers, Alfonso IV. and Affonso Sanchez, were likewise poets. Some of the Portuguese poets of this time wrote in Castilian, and are reckoned among Spanish writers. Some poems on the death of his wife, one of which is in Castilian, are attributed to Pedro I., husband of Inez de Castro. There is also a prose chronicle of Pedro's reign by Fernão Lopez, from which are derived the chief particulars of his vengeance on the abettors of the murder. In the 15th century the court was still the centre and source of the national literature. The sons and grandsons of John I. were poets and patrons of the troubadours. Galician, Castilian, and Provençal were still cultivated as well as the native language. Garcia de Resende, a poet of some merit, who lived under Emanuel, has collected in a *Cancioneiro* (Lisbon, 1516) the principal poetical works of this age. Bernardim Ribeiro wrote pastoral poems and romances in imitation of the Italians and Spanish. Sà da Miranda, who succeeded him in the same line, marks the transition from the 15th to the 16th century and the separation of the Portuguese from the other Spanish dialects and from

the language of the troubadours. This progress is also observable in the prose chronicles which record the current history of the day. The reign of King John, the discovery and conquest of Guinea, the career of Prince Henry, and the first voyage of Columbus are among the subjects dealt with by the chroniclers. Literature still continued to be patronized by the royal family. King Edward (Duarte) wrote a book of morals for the use of his sons, and two works, 'The Art of the Cavalier' and 'The Loyal Councillor,' which have been republished in France. There is also a treatise on military art by Alfonso V. The 16th century is the classic era of Portuguese literature. Pastoral poetry, the epic, and the chivalric romance flourished in an especial manner. The chief names are Sà da Miranda, Antonio Ferreira, Camoens, Diego, Bernardes, Andrade, Caminha, and Alvares do Oriente. Their compositions are distinguished by elegance and variety, but like other modern pastorals, exhibit rather a tedious affectation of rusticity than a life-like representation of rural life. Sà da Miranda has also written epistles, sonnets, hymns, and other compositions. In his hymns he has employed for the first time the hendecasyllabic verse, which has become the chief instrument of Portuguese poetry. The numerous hymns, odes, elegies, and sonnets of Camoens are equally distinguished for elegance, but are marred by numerous conceits according to the taste of the period. The principal epic and the greatest poem in the Portuguese literature, almost the only one which has acquired a European reputation, is 'Os Lusíadas' ('The Portuguese') of Camoens, which has placed its writer in the rank of the few great poets of the highest class whose genius is universally recognized by the whole world. (See CAMOENS.) After Camoens as an epic writer comes Cortereal, who has celebrated the siege of Diú and the shipwreck of Sepulveda. Like Camoens he shows himself a great painter of nature.

The Portuguese romance writers claim to be the originators of the character of Amadis, but the question remains undecided between them and the Spaniards. Vasco de Lobeiro, Francisco Moraes, and Bernardim Ribeiro are among the leading romance writers. Lopez de Castanheda has written a *Libro de Caballeria*. The drama also began to be cultivated in the 16th century. The first *autos* and rustic dialogues were probably composed for the festivities of Christmas; a few rude comedies also preceded the classic period. Sà da Miranda studied and imitated Plautus. Ferreira, who followed his example, composed the first regular tragedy, *Ines de Castro*, only a few years after *Sofonisba* was produced at Rome by Trissino. Camoens wrote several theatrical pieces, among which are 'Amphitryon' and 'Seleucus.' *Autos*, *farsas*, and *comedias magicas* were far more numerous than regular pieces.

The chronicles in the same age expanded into history. The events of their own day in which their country played so large a part afforded ample matter of inspiration for historians as well as poets. Barros, also a romance writer, is esteemed the Livy of Portugal. He wrote the 'History of the Conquest of India' in an elegant, pure, and energetic style. The 'Commentaries of Alphonso d'Albuquerque,' by a



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nephew of the conqueror; the 'Chronicle of King Manuel and of Prince John,' by Damian de Goes, a Portuguese ambassador; the 'History of the Discovery and Conquest of the Indies,' by Lopès de Castanheda; the 'Chronicle of King Sebastian,' by Diego Bernardo Cruz, are all works of great merit. Narrations of voyages are fewer than might have been expected, but there are a few of great interest — 'A Letter to the King of Portugal on the Discovery of Brazil,' by Vas de Caminha, companion of Cabral; the 'Voyages of Magellan,' narrated by some of his comrades; and the 'Voyages of Pinto,' who visited China, Tartary, Arabia, and other countries. This work is one of the classics of the 16th century.

The opening of the 17th century is distinguished by the crowd of imitative epics which naturally followed the success of the *Lusiad*. Quevedo de Castro, Mascurenhos, and Brandam are among the principal authors of these works, the most noticeable feature of which is the national patriotism they continue to display after the loss of the political independence of Portugal. This century is also distinguished by great historical compilations. It was the period of repose after an epoch of great activity, and the absorption of the Portuguese nationality in the more powerful monarchy of Spain naturally turned all eyes to the recent period of its glory. The 'Monarchia Lusitana' (1597-1690), Bernardo Brito's 'Eulogy of the Kings of Portugal,' Faria de Souza's 'Europa Portuguesa' (1667), 'Asia Portuguesa' (1666-75), 'Africa Portuguesa' (1680), 'America Portuguesa' (left in manuscript), the historical works of Nunez de Laio, Manoel de Mello, and others belong to this epoch. Antonio Vieira, a Jesuit preacher, is one of the most vigorous prose writers of this century. The letters of Alcofarrada are also among its notable productions. But the most prolific writer of all was the padre Macedo, who composed a number of epic poems, besides 110 odes and numerous dissertations. He wrote chiefly in Latin, Spanish, and Italian.

The Portuguese drama was nearly extinguished during this century by the predominance of the Spanish, to which even Portuguese writers contributed. Cocho Rebello has collected a number of the minor indigenous productions of the art, 'A Musa Entretenida de Varios Entremeses' (Coimbra, 1658).

In the 18th century the influence of the French writers of the age of Louis XIV. so completely dominated Portuguese literature that it became almost entirely imitative. Translations from and imitations of the French formed the staple of its products in every department, and the nation that gave birth to the *Lusiad* condescended to copy the *Henriade* and the *Lutrin*. Scholarship in this age made greater progress than literature. The academy called the Arcadia was founded in 1757 by Antonio Diniz da Cruze Silva, the Portuguese Boileau, and other promoters of the revival of learning. It became extinct in 1776, and was replaced in 1779 by the Royal Academy of Sciences of Lisbon. Toward the close of this century two writers appeared who have formed schools, Francisco Manoel do Nascimento (1734-1829), an elegant lyrist, and Barbosa du Bocage, who introduced an affected and hyperbolic style of

writing, which has been called, from the signature Elmano, which he adopted, *Elmanism*.

In the 19th century the classic school was represented by the followers of Manoel do Nascimento, Domingo Maximiano Torres, and Ribeiro do Santos. Among poets of the century possessing some claim to originality are Roque, Carvalho Moreira, Mouzinho de Albuquerque, Feliciano de Castilho, Herculano de Carvalho, Almeida Garret, João de Lemos, Antonio de Serpa, and Palmeirim. Through the efforts of these and others Portuguese literature has again begun to assume an aspect of native vigor. The drama has also been revived by J. B. Gomez, Pimenta de Aguiar, Mendes Leal, and A. Herculano. Alexandre Herculano and Rebello da Silva are also writers of history and historic romance. Castello Branco is a novelist. To the Coimbra School, which found inspiration in the leading writers of modern France and Germany, belong the lyric poet João de Deus, the historian Theophilo Braga, the philologist Coelho, and other less-known writers. Science, law, and political economy are likewise well represented.

Portuguese literature is also cultivated with considerable independence and success in Brazil. The principal names in poetry are F. V. Barboza, De Barros, Da Cunha Barboza, A. T. de Macedo, Gonçalves Diaz, Porto-Alegre, M. de Macedo, Teixeira e Souza, and Magelhaens, the most national of them all; in history, Varnhagen, author of the 'Historia Geral de Brazil,' and P. da Silva, author of the 'Brazilian Plutarch,' and the epigrammatist Fonseca.

*Art.*—The principal architectural monuments which Portugal possesses are due to the Goths and Moors. There are also numerous architectural relics of the Roman dominion, such as the ruins of an amphitheatre at Lisbon, those of a Corinthian temple dedicated to Diana at Evora, and a round tower named after Sertorius. The cathedrals of Coimbra and Braga and the church of Cedofeita at Oporto are due to the Goths. The châteaux of Pombal, Feira, Alcobaça, etc., were palaces inhabited by the Saracen princes. There are no native works of any importance. Although the art has been well patronized Portuguese painters are few and have never formed a school; the same may be said of native sculpture.

*Bibliography.*—For language, consult: Coelho, 'Diccionario da Lingua Portuguesa' (1890); Ribiero, 'Grammatica Portuguesa' (1889); Reinhardtstöttner, 'Grammatik der Portugiesischen Sprache' (1897); among Portuguese-English dictionaries are Vieyra (1873-5; also an abridged edition); Lacerda (1866-71); Michalis (1893); and Portuguese-English grammars include D'Orsey, Elwes, and Vieyra. For literature consult Acanha, 'Diccionario Bibliografico Portuguez' (12 vols. 1858-85); Bouterwerk, 'History of Spanish and Portuguese Literature' (1823); Braga, 'Historia da Litteratura Portuguesa' (14 vols. 1870-80), his 'Curso' (1886), and his 'Antologia' (1876); Romero, 'Historia da Litteratura brasileira' (1888); Varnhagen, 'Florilegio da Poesia brasileira' (1850-3); Wolf, 'Le Brésil littéraire' (1863).

**Portuguese Man-of-War**, the familiar name of certain beautiful oceanic organisms, usually found floating in tropical seas, but in



## PORTUGUESE POSSESSIONS IN AFRICA — POSEIDONIUS

the latter part of summer often seen off the southern coast of New England. The float is an oblong, crested bladder, flattened on the lower side, from which are pendent the various individuals of the colony. The long filaments, sometimes trailing out to a distance of fully 20 feet, have batteries of nettle-cells numerous and powerful enough to paralyze fishes, and cause much discomfort to human beings, even when the organisms in question are dead on the beach. See SIPHONOPHORES.

**Portuguese Possessions in Africa** comprise the Cape Verde Islands, Guinea, Prince's and Saint Thomas' Islands, Angola, and Portuguese East Africa (qq.v.). Total area, 792,040 square miles; population, 8,248,527.

**Portulaca**, a genus of annual and perennial herbs of the order *Portulacaceæ*. The species, of which about 20 have been described, are natives of warm and temperate climates and are mostly American. They are often trailing, have fleshy stems, usually thick leaves, and generally terminal flowers followed by small conical capsules containing numerous tiny seeds. The flowers open in sunshine but close in shade. The two best known species are *P. grandiflora* and *P. oleracea*. The former is widely cultivated in gardens for its very showy but ephemeral flowers which have a wide range of color. The hottest, driest, sunniest places, and light soils suit the plant well. It is a native of Brazil. The other species is said to be a native of Persia, where it was used as a potherb more than 2,000 years ago. It is also said to be indigenous in the southwestern United States. Popularly known as pusley and purslane, it is one of the commonest weeds in warm and temperate climates upon light loamy and sandy soils, but rarely upon heavy. It has several improved varieties which are cultivated, especially by the French, for greens.

**Portunus**, pôr-tû'nûs, or **Portumnus**, Roman god of harbors. He corresponds to the Melicerta or Palæmon of the Greeks and was originally the god of doors, symbolized his representation with a key in his hand. He had a temple on the Tiber, where his festival, the Portunalia, was annually celebrated on 17 August.

**Po'rus**, king of India: d. 317 B.C. He was of ancient and noble lineage and his kingdom occupied the north of India between the Hydaspes and Acesines. When Alexander invaded India in 326 B.C. he found the army of Porus barring his further passage at the Hydaspes. After considerable delay Alexander succeeded in fording the river higher up in its course, but was met by Porus and a terrific battle ensued, in which the Indian king was wounded and taken prisoner. Brought before Alexander his noble bearing aroused the admiration of the conqueror and they became friends and allies. Alexander extended the kingdom of Porus to the Hyphasis and when he retired from India left him as ruler of the enlarged kingdom. Porus seems to have extended his domain still further after the death of Alexander, but in 317 B.C. was assassinated by the satrap Eudemus.

There appear to have been two other Indian rulers of the same name. One of these was a nephew and an enemy of the great king, and the other a king of Madura, on friendly terms

with the Emperor Augustus. Consult McCrindle, 'Invasion of India by Alexander the Great' (1896).

**Pory**, pör'ī, **John**, English colonist: b. England about 1570; d. there before October 1635. He was graduated from Gonville and Caius College, Oxford, in 1592, studied under Hakluyt and in 1619-21 was secretary to Sir George Yeardley in Virginia. His accounts of his excursions among the Indians are published in Smith's 'Generall Historie.' He returned to England in 1621, but in 1623 was appointed commissioner of the privy council, resided in Virginia for another year, and the remainder of his life appears to have been spent in England. His letters are in the British Museum. He translated 'Geographical Historie of Africa written in Arabicke and Italian by John Leo, a More.'

**Poseidon**, pō-sī'dōn, in Greek mythology, the lord of the sea, identified by the Romans with the Italian deity Neptune. He was a son of Cronus and Rhea, and hence a brother of Zeus, Hades, Hera, Hestia, and Demeter. His usual residence was in the depths of the sea near Ægæ, in Eubœa, where he had a palace, and kept his horses with brazen hoofs and golden manes. He is called the earth-holder or earth-encompasser, as the sea surrounds the earth, and the earth-shaker, as the earth is shaken by the waves of the sea beating on the shore. He is the ruler of all other marine deities and of all animals that live in the sea. He gathers clouds, and raises storms and allays them. In several myths he is represented as contending with some land divinity for the possession of particular spots of earth. The horse, and more particularly the war-horse, was sacred to Poseidon, and one of the symbols of his power. The dedication of this animal to the seagod was probably due to the resemblance which the Greeks detected between the swift springing movement of the horse and the advance of a wave, or between the curve of a wave about to break and the arch of a spirited horse's neck. The other well-known symbol of his power is the trident, or three-pronged sceptre. During the Trojan war Poseidon was the constant enemy of Troy. The cause of this enmity was the ingratitude shown him by Laomedon, the second king of Troy, and the builder of the walls of the city. Poseidon had numerous offspring by mothers divine and human. The worship of Poseidon was common throughout Greece and the Greek colonies, but especially prevailed, as is natural, in the maritime towns. The animals sacrificed to him were horses and bulls, sometimes also wild boars and rams. The Isthmian games, and the Panionia or festival of all the Ionians, celebrated near Mycale, were held in his honor. In works of art Poseidon is represented with features resembling those of Zeus, but he has not the calm majesty of the supreme god, although he is more powerfully built. When represented standing he always bears the trident in his right hand and a dolphin in his left.

**Poseidonius**, pō-sī-dō'nī-ŭs, Greek Stoic philosopher: b. Apamea, Syria, about 135 B.C.; d. after 51 B.C. He studied at Athens under Panætius of Rhodes, after whose death in 112 he presently established himself as a teacher



at Rhodes, whence he is called the Rhodian. He taught the Stoic philosophy with great applause, was at the same time a statesman and one of the Prytanes, and went at 50 as an ambassador to Rome. The most distinguished Romans were his scholars, and Cicero was initiated by him into the Stoic philosophy. He wrote many works on history, astronomy, and geography, now lost. In his physical investigations he was more nearly a follower of Aristotle than of the Stoic school, the members of which he greatly excelled in this department of knowledge. Fragments of his writings were edited by Bake (1814), and by C. Müller in 'Fragmenta Historica Græcorum' (1849).

**Posen**, pō'zēn, Germany, (1) a fortified town in Prussia, capital of the province and government of the same name, on the river Warthe, 149 miles east by south of Berlin. Fort Winjary, adjoining the town, serves as the citadel. Of its public edifices the chief are the Roman Catholic cathedral and the parish church, the former having the splendid "golden chapel" attached; the archiepiscopal palace; the town-hall, a Renaissance building mostly of the 16th century; the Raczyński library; the Mielzynski museum, the archæological museum and library, the real-gymnasium, and two other gymnasia (one Protestant and one Roman Catholic), normal and other schools, hospital, a theatre, and some elegant private mansions. The manufactures consist chiefly of agricultural and other machines, carriages, artificial manures, etc. There are also several breweries and distilleries. Posen is the see of an archbishop, the residence of a provincial governor, and the seat of important courts and numerous public offices. It was one of the oldest and most important towns of Poland, and its inhabitants still largely consist of Poles. It was at one time allied with the Hanseatic League. Pop. (1900) 117,014. (2) An eastern grand-duchy and province of Prussia, bounded north by West Prussia, east by Russian Poland, south by Silesia, and west by Brandenburg; area, 11,186 square miles. The surface is generally flat, and extensively occupied by lakes and marshes. A small portion belongs to the basin of the Vistula, which touches it on the northeast; the rest belongs to the basin of the Oder, which receives its drainage through the Warthe in the south and centre, and the Netze in the north. The soil is for the most part light and sandy, and considerable tracts are covered with heath; many parts are covered with a rich alluvium or vegetable mold, yielding all the ordinary species of grain, millet, flax, hemp, tobacco, and hops. The pastures are extensive, and feed numerous herds of cattle, horses, and swine; considerable attention is paid to the rearing of poultry, particularly geese, and also to the rearing of bees. The minerals, comparatively unimportant, include bog iron-ore, saltpeter, limestone, and building-stone. The manufactures consist chiefly of spirituous liquors, woolen stuffs, linen, and leather. The trade in these articles, and in horses and swine is considerable; other exports are corn, cattle, tallow, leather, honey, wax, goose-feathers, and hogs'-lard. The inhabitants include a considerable mixture of Germans and Jews, but the great majority are Poles, Posen being one of the acquisitions which Prussia made by the dismemberment of Poland. It is divided into the

two governments of Posen and Bromberg and has been subjected to a repressive rule to overcome disaffection. It is represented in the Imperial Reichstag by 15 members and in the Prussian Landtag by 29 delegates in the lower and 19 in the upper chamber. Total pop. (1900) 1,888,055. As part of Poland, Posen was divided into the palatinates of Poznań, Gnesen, and Inowrocław. At the first partition of Poland in 1772 the district of the Netze fell to Prussia, and the remainder in the second partition of 1793. Between 1807 and 1815 Posen formed part of the grand-duchy of Warsaw, but in the latter year reverted to Prussia.

**Posey**, pō'zī, **Thomas**, American soldier: b. eastern Virginia 9 July 1750; d. Shawneetown Ill., 19 March 1818. He was as quartermaster in Lord Dunmore's expedition against the Ohio Indians and was engaged in the battle at Mount Pleasant in 1774. In 1775 he was a member of the Virginia committee of correspondence and raised a company of which he became captain for the 7th Virginia Continental regiment. He assisted in defeating Lord Dunmore at Gwynn's Island in 1776; in 1777 joined the Continental army at Middlebrook, N. J., and with his company was transferred to Morgan's renowned rifle-corps, where he played a conspicuous part in the engagement at Piscataway, N. J. He served with great gallantry under Gates at the battles of Bemis Heights and Stillwater, and in 1778 was promoted major and had charge of the expedition against the Indians of Wyoming Valley in that year. In 1779 he commanded a battery under Gen. Wayne at Stony Point and was one of the leaders in the assault which carried the enemy's works. He was present at the surrender of Yorktown, organized a regiment of which he was given command with the rank of lieutenant-colonel, and served under Gen. Wayne in Georgia until the surrender of Savannah, where he routed the Indians under Gueristorsigo. After the war he lived in Spottsylvania County, Va., until 1793, when he was appointed brigadier-general and served under Gen. Wayne in his campaign against the Indians in the Northwest. He resigned in 1794, settled in Kentucky, entered the State Senate, and was *ex-officio* lieutenant-governor. He raised a company of which he was for a time captain in the War of 1812, and in 1812-13 he served as United States Senator from Louisiana. He was governor of Indiana Territory from 1813 until her admission into the Union as a State and from 1816 until his death was Indian agent.

**Posilipo**, pō-sē-lē'pō, or **Pausilippo**, pōw-sē-lē'pō (Latin, *Pausilipona*), Italy, a hill and grotto to the southwest of Naples, the grotto furnishing a passage from that city to Pozzuoli. This grotto, or tunnel, leads directly to the village of Fuorigrotta; its height is about 70 feet, and the breadth, 21 feet. It was long supposed that it was earlier than the time of the Romans, but it is now supposed to date from the time of Augustus or Tiberius. It was widened in 1442 by Alphonso I., plastered by Pietro of Toledo, and again repaired in 1754 by Charles III. Since 1885 there has been a second "grotto," about 150 feet longer, which is more commonly used, as is also a road over the mountain built in 1822. On the hill above the grotto



## POSITIVE — POSITIVISM

is the famous Tomb of Virgil. The town of Posilippo on the hill has about 4,500 inhabitants.

**Positive**, in photography, a picture obtained by printing from a negative, in which the lights and shades are rendered as they are in nature. See PHOTOGRAPHY.

**Positive Eye-Piece**, the form of eye-piece generally used in microscopes and telescopes. It is well adapted for use with micrometers, its focus being outside the combination of lenses. It consists of two plano-convex lenses of equal focal length, the convex sides turned inward, the distance asunder being two thirds of the focal length of either. See MICROSCOPE.

**Positive Philosophy.** See POSITIVISM.

**Positive Society, The**, a society founded in Paris in 1848, by Comte, in the hope that it might exert as powerful an influence over the revolution as the Jacobin Club had exerted in 1789. In this he was disappointed, but the disciples who gathered around him were the germ of the Positivist Church.

**Positivism**, pōz'ī-tīv-izm, originally denotes any theory that takes the affirmative side and states its tenets in positive terms. In this sense one speaks of positive Christianity or positive theology, as synonymous with dogmatism, indicating thereby that liberal religion which rejects belief in miracles, or a special revelation, or the traditional church doctrines, is negative.

The term was appropriated by August Comte to denote a philosophy that would limit itself to the positive sciences and exclude all metaphysical speculation. Comte propounded positivism as the ultimate aim of the evolution of knowledge, which (as Turgot had indicated) necessarily passed through three stages, the theological, the metaphysical, and the positive. In the theological stage, the classified phenomena of nature are personified as gods,—a view based upon a mythological interpretation of nature which reaches its climax in monotheism and leads to the metaphysical stage in which the laws of nature are conceived as impersonal essences or powers. The highest and last stage is attained when the scientist is satisfied simply to describe the facts and leave out all metaphysical speculation.

Comte felt that there was something wrong with metaphysics, and he eliminated it from the domain of philosophy, but instead of solving the problem, he ignored it on the plea that it was unsolvable. His great work 'Philosophie Positive' (consisting of six volumes) contains simply a recapitulation of the whole range of human knowledge, the systematic arrangement of which he called the hierarchy of the sciences. Comte does not deny the existence of something metaphysical, but only maintains that research in this domain is fruitless.

Eugen Dühring, a German philosopher of great acumen, rightly criticizes Comte's positivism in saying that "its main contents, strangely enough, consist in negativism," and "a hierarchy of the sciences offering a digest of knowledge cannot pretend to be philosophy" (Krit. Gesch. d. Phil. p. 486).

In a more advanced stage of his life, Comte felt the need of going beyond the standpoint of the positive sciences. In response to this need of his nature he invented a religion of

mankind which should be based on science, replacing the idea of God by the conception of ideal mankind.

Comte's conception of a scientific religion is worthy of a great genius, but the rituals which he prescribes are too artificial and proved acceptable only to a very limited circle of his admirers.

Littre, the well-known author of the best French dictionary, disavowed Comte's religion as fantastic, but he accepted his philosophy which in the last number of the positivist periodical, 'La Science,' he formulated as follows:

"The domain that lies beyond refers to the things that cannot be known. Positive science proposes neither to deny nor to affirm them. In a word, it does not know the Unknowable, but it recognizes its existence. This is the highest philosophy. To go beyond is chimerical, to go not so far is to miss the mark."

The most prominent English representative of Comtean positivism, George Henry Lewes, sums up the tenets of positivism in this sentence:

"Our province is to study her (nature's) laws, to trace her processes, and, thankful that we can so far penetrate the divine significance of the universe, be content—as Locke wisely and modestly says—to sit down in quiet ignorance of all *transcendent* subjects."

The present representative of Comte's positivism in England, averring both his philosophy and his religion, is Frederick Harrison, president of the English Positivist Committee.

In spite of the shortcomings of Comte's philosophy, the conception of positivism is a great and recommendable ideal; but positivism in order to fulfil its purpose should be truly positive. Genuine positivism would be a philosophy based upon the facts of experience. Whether or not metaphysics is wrong, depends entirely upon the definition of the word. If "the metaphysical" is a mysterious essence or power behind nature, the scientist should not merely ignore it but deny its existence; but if, after the precedence of Aristotle, we understand by metaphysics "the science of first principles," we must grant that its study, far from being fruitless, is indispensable for every scientist.

The aim of a positive philosophy should be to understand the methods and general spirit of science, to systematize the results of the totality of human knowledge and to apply them to practical life. Accordingly, philosophy will serve three purposes: it will be (1) the propædæutics of science, (2) a synopsis of all knowledge, and (3) ethics, or the science of moral conduct. The first branch of philosophy includes logic, epistemology, and methodology, that is, the sciences which are equally needed as intellectual tools, in all the several branches of inquiry. The second part, a synopsis of all knowledge, cannot be a mere compendium or a hierarchy of the sciences, but must be worked out into a systematic world-conception, not a mere sum of the sciences but their product, which might be called "ontology," that is, the science of existence, or "cosmonomy," the science of the world constitution. Ontology in the old sense is an *a priori* construction of a system of abstract thought; in the new sense it would be a methodical arrangement of the facts of experience, a monistic or consistent system of



## POSSE COMITATUS—POST AND POSTAGE

knowledge. Cosmonomy explains the prevalence of uniformities and their formulation as general rules, called laws of nature, etc. It points out the permanent background of existence, the eternal conditions of becoming from which world-systems originate, and, above all, defines man's position toward the whole of existence, toward his fellows, and especially toward those factors that determine his destiny—in religious nomenclature called "God." The third part of philosophy would be a practical application of the second, resulting in what has been called philosophy proper, world-wisdom, or, broadly speaking, ethics.

PAUL CARUS,  
*Editor of 'The Monist.'*

**Posse Comitatus**, pös'ē kōm-ī-tā'tūs, in law, the force of able-bodied male citizens whom the sheriff by the common law is authorized to call to his assistance in case of invasion, rebellion, riot, breach of the peace, forcible resistance to process, etc., in the county or district in which he holds office. All persons included in the posse comitatus are bound, under penalty of indictment, to assist the sheriff when lawfully called upon, and are justified in killing a person in case of resistance. Unnecessary violence on their part, however, is punishable.

**Possession**, the detention and enjoyment of a thing which one holds and exercises by oneself or through another in his name. There are two requisites to complete possession: first, occupancy, and second, the taking with intent to possess,—hence persons who are without legal wills—as children, idiots, etc., cannot acquire possession; however, a child of sufficient understanding may legally acquire possession of a thing.

One is said to be in actual possession when the thing is in immediate occupancy, and constructive possession when one claims to hold by virtue of a title without actual occupancy; possession may be enjoyed by the proprietor of a thing—thus the proprietor of a house possessing it by his tenant.

To acquire possession of a property it is requisite that there be intention of possessing as owner, and also the possession of the thing.

Possession is lost when one transfers a property to another with the intention of divesting himself of the title, or when he does some act which manifests his intention of abandoning possession. Though, of course, no proof of ownership or title to property or a thing, the possession is a fact in evidence of it, and it is sufficient evidence against anyone who cannot show a better claim.

Continuous possession of land for a time, which varies in the statutes of various jurisdictions, usually 20 years, will give the occupant title by adverse possession.

**Possession Theory**, a superstitious belief or theory prevailing among races and individuals of low culture that disease, whether bodily or mental, is due to the presence of a malevolent spirit.

**Post, Alfred Charles**, American surgeon: b. New York 13 Jan. 1806; d. there 7 Feb. 1886. He was graduated from Columbia in 1822 and from the College of Physicians and Surgeons in 1827. After two years' further study in Europe he established a practice in New York, in

1831–5 was demonstrator of anatomy in the College of Physicians and Surgeons, in 1836 became an attending surgeon at the New York Hospital, and throughout his life continued his connection there, occupying at his death the office of consulting surgeon. He was appointed professor of ophthalmic surgery at Castleton Medical College, Vt., in 1843, and of surgery in the following year. In 1851–75 he was professor of surgery in the University of the City of New York, vice-president of the New York Academy of Medicine in 1861–6, and its president in 1867–8, president of the Pathological Society, and for many years was connected with Saint Luke's, the Presbyterian, and the Women's Hospitals. He conducted a weekly clinic at the University Medical College, in New York, for many years, was the first surgeon in the United States to perform an operation for the cure of stammering, and was the inventor of several valuable surgical instruments and appliances. Besides numerous medical papers contributed to scientific journals, he published 'Strabismus and Stammering' (1840).

**Post, Charles Cyrel**, American politician: b. Shiawassee, Mich., 16 May 1846. He studied at Hiram and Oberlin Colleges, Ohio; was admitted to the bar in 1874, but did not practise and soon took up journalism. He was prominent in the Greenback movement and furthered the Anti-Monopoly movement whose supporters nominated Gen. Butler for President. He removed to Georgia in 1885 and to Florida in 1892, and in 1899 founded the School of Scientific Philosophic and Psychic Research. He has published: 'Metaphysical Essays' (1896); 'Men and Gods' (1898); 'From Wabash to Rio Grande' (1880); etc.

**Post, Melville Davison**, American lawyer and novelist: b. Harrison County, W. Va., 19 April 1871. He was graduated from the University of West Virginia and has since practised law in Grafton, W. Va. He has published: 'The Strange Schemes of Randolph Mason' (1896); 'The Man of Last Resort' (1897); 'Dwellers in the Hills' (1901).

**Post, Waldron Kintzing**, American lawyer and author: b. New York 7 July 1868. He was graduated from Harvard in 1890, was admitted to the bar in 1895, and is the author of 'Harvard Stories' (1893); 'Smith Brunt' (1899).

**Post, Wright**, American surgeon: b. North Hempstead, N. Y., 19 Feb. 1766; d. Throgg's Neck, N. Y., 14 June 1828. He received his medical education in New York and London and in 1786 established a practice in New York. In 1792 he was appointed professor of surgery at Columbia, where he later occupied the chair of anatomy and physiology, afterward holding the same chair in the Medical School of New York. For 35 years he was consulting surgeon in the New York Hospital, president of the College of Physicians and Surgeons in 1821–6, and was prominently connected with numerous medical societies. He made himself famous by his surgical achievements, many of which were departures from the old school.

**Post and Postage**. The word post is derived from the Latin *positus*, meaning "placed," because horses were put or placed at certain distances to transport letters or travelers. From this ancient beginning, the post has developed



## POST AND POSTAGE

into one of the most effective instruments of civilization. In the Old Testament are frequent references to the posts. In 2 Chron. one will find: "So the posts went with the letters," and "So the posts passed from city to city." In Esther, also, and in Job and Jeremiah one will find other allusions to the posts. But they were never for the use of the common people. The first recorded postal system was in the Persian Empire. According to Xenophon, Cyrus the Elder caused couriers, with saddled horses, to stand ready at different stations throughout the empire, situated one day's journey from each other, in order to receive reports from the provinces without delay. In the time of Julius Cæsar the service of couriers in the parts of the Roman dominions under his government was so well organized that of two letters which he wrote from Britain to Cicero at Rome, the one reached its destination in 26, and the other in 28 days. Such services, however, were only established by governments or persons in authority for their own use. Private persons, in their intercourse with one another, had to em-

transmission of their own correspondence. During the reign of Louis XIII., the French system of posts received a more regular form from the establishment of a comptroller-general of posts.

In Germany the first post was established in Tyrol in the latter half of the 15th century, by Roger I., county of Thurn, Taxis, and Valsassina. His son established another from Brussels to Vienna in 1516, by the wish of the Emperor Maximilian I. In 1522 a post was established between Vienna and Nuremberg, and Charles V., anxious to have news as quickly as possible, on account of the vastness of his states, caused Leonard of Thurn and Taxis to establish a permanent riding-post from the Netherlands through Liège, Trèves, Spire, and Rheingausen, through Würtemberg, Augsburg, and Tyrol to Italy.

The postal system of Italy began in Piedmont. Until 1561 the transmission of letters was in the hands of the communes or private persons, who were authorized by the state to charge for the service a sum which varied ac-



Earliest British Postal Envelope (1840).

ploy slaves to convey their letters to their destination, or to trust to the chance of finding some person who was going to the place to which the letter was addressed, and was willing to undertake the delivery of it. The Emperor Diocletian, at the end of the 3d century, appears to have been the first to establish a postal system for the benefit of private persons. At later dates Theodoric the Great, Charlemagne, and others had well-organized services for communication with all parts of their empire.

*Early History of the Public Post.*—The earliest postal system was established in France by the University of Paris. From the end of the 13th century this institution maintained couriers, who at certain times took charge of letters and money for the students collected in that city from almost all parts of Europe. Louis XI. established for his own use mounted messengers, and by an edict of 19 June 1464 instituted post stations on the chief roads of France. This system was continued under the following reign, and ultimately private persons began to make use of the royal couriers for the

cording to circumstances. In the year mentioned the posts were farmed out by Emmanuel Philibert, duke of Savoy, to a postmaster-general. This arrangement continued until 1697, when Duke Victor Amadeus II. added the proceeds of the post-office to the revenue of the state, an indemnity being paid to the postmaster, who had the contract for them. From 1710 downward the post-office was administered directly by the state.

*The British Post.*—There were private posts in England from the time of Edward III. In 1635 a public post was established between London and Edinburgh. In 1644 Edmund Prideaux, then a member of the House of Commons, was appointed master of the posts, and first established a weekly conveyance of letters into all parts of the nation. In 1683 a penny post was set up in the metropolis. During the government of William III. acts of Parliament were passed which regulated the internal postal system of Scotland; and, by the ninth act of Queen Anne, the postal system of England was arranged on an improved footing. A general



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post-office was instituted at London for the British dominions with chief offices at Edinburgh, Dublin, and other places, while the whole system was placed under the control of a postmaster-general with power to appoint deputies for the chief offices. At this time the letter rate of postage was 8 cents for 15 miles or under, with a rising scale to 25 cents for 300 miles. In 1837 Sir Rowland Hill inaugurated a movement for reform in the postal service. Penny postage resulted in 1839, and on 6 May 1840 the first postage stamp, designed by W. Mulready, was first brought into use. In the same year the money-order system was adopted and in 1848 the book post was established. In 1855 pillar letter-boxes were introduced, and London was divided into 10 districts, for greater facility in the distribution of city letters. The British post-office system developed rapidly after 1860 and now includes a parcels post and banking and telegraph systems. The service is under the immediate control of the postmaster-general, assisted by the chief secretary of the post-office in London. There are also chief officers in Edinburgh and Dublin. The postmaster-general is a member of the privy council, and sometimes a cabinet minister. In 1901 there were 22,189 post-offices in the United Kingdom and 33,590 road and pillar letter-boxes. The total number of letters delivered during the year was 2,323,600,000.

*The Colonial Post in America.*—In the American colonies the post-office made its first appearance in Massachusetts in 1639, when the General Court of that colony issued the following: "It is ordered that notice be given that Richard Fairbanks, his house in Boston, is the place appointed for all letters, which are brought from beyond the seas, or are sent thither, to be left with him, and he is to take care that they are to be delivered or sent according to direction: and he is allowed for every letter a penny, and he must answer all messages through his neglect of this kind." In 1657 a postal service was established in Virginia. The colonial law required every planter to provide a messenger to convey the despatches, as they arrived, to the next plantation, and so on, on pain of forfeiting a hogshead of tobacco for default. In 1672 the government of New York established a mail "to go monthly" between New York and Boston. In 1674 the General Court at Hartford enacted laws to regulate the postal services in the colony. In July 1683 William Penn established a post-office in Philadelphia, with weekly mails to various places near the city, and about the same time opened mail routes between Philadelphia and the larger towns of Pennsylvania and Maryland. These represent the several colonial enactments in relation to postal communication. Of a regular post outside these efforts, no trace can be found in the archives of either the State or the Post-office Department.

*Neale's American Post.*—The beginning of the American post proper dates with the signing of a patent 17 Feb. 1691 vesting in Thomas Neale the American post. On 4 April following Neale and the Royal Postmaster-General appointed Andrew Hamilton Postmaster-General of America. Hamilton undertook the arduous duty of establishing an intercolonial post. He visited all the colonies, was trusted implicitly, and satisfied each colony of his ability and re-

sources in the new venture. The co-operation of all the colonies except Virginia having been secured, service began on 1 May 1693, and consisted of a weekly post from Portsmouth, N. H., to Boston, Saybrook, New York, Philadelphia, Maryland and Virginia. Five riders were engaged to cover each of the five stages twice a week. In winter service was performed fortnightly. Hamilton died in 1703, and his son, John Hamilton, succeeded him. In 1707 the Crown purchased the good-will of the American post-office and continued John Hamilton as postmaster-general. From 1707 to the year before the Revolution the General Post-Office in London controlled the service in America. In 1711 there was a weekly mail operation between Boston and Maine and a fortnightly exchange between Boston and New York. In 1717 the mail ran weekly between New York and Williamsburg, Va., and 10 years later there was a fortnightly mail between Philadelphia and Annapolis, Md. The period of activity in the establishment of postal facilities began when Benjamin Franklin was appointed postmaster at Philadelphia in 1737. At the request of the deputy postmaster-general for the colonies, he assisted him in the regulation and management of the various post-offices then established, and when that official died, in 1753, Franklin, in company with William Hunter, was appointed to succeed him. In consequence of some difficulty with Governor Hutchinson of Massachusetts, Franklin was removed in 1774.

*The United States Post.*—The Continental Congress met at its second session, in Philadelphia on 26 July 1775, and its members resolved to have a post-office system of their own, and Franklin was elected to carry on the work. A salary of \$1,000 a year was voted him. However, Franklin's great diplomatic talents secured him soon afterward a transfer to a wider field, and in 1776 his son-in-law, Richard Bache, was appointed to succeed him. Mr. Bache was succeeded in 1782 by Ebenezer Hazard, who had, in 1775, been the "constitutional postmaster" of New York, so termed to distinguish him from the British deputy at that place. The Colonial Congress in 1782 passed an act authorizing the postmaster-general to establish a line of posts between New Hampshire and Georgia and to such other places as Congress might direct and to appoint the necessary deputies, for whose faithfulness and honesty he was to be held accountable. On 8 May 1794 the Congress passed the first law for the proper management of the postal service. In 1799 the postal laws were revised, and flogging substituted for the death penalty for robbing the mails. This law, however, was repealed by a subsequent enactment, and imprisonment for a term of years made the penalty. The office of Second Assistant Postmaster-General was created in Madison's administration, and the scale of postage changed. Single letters—that is, containing one piece—were charged from 8 to 25 cents, according to distance. The Sunday delivery at post-offices began in 1810, bringing forth vigorous remonstrances from various religious bodies, and the strife was kept up in Congress, and occupied the attention of the Department for 20 years. In 1813 the mails were first conveyed in steamboats from one post town to another. The postal laws of 1816 made a change in the postage, which lasted until 1845.



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The new scale charged for letters, consisting of one piece of paper, not going over 30 miles, 6 cents; not over 80 miles, 10 cents; not over 150 miles, 12½ cents; and not over 400 miles, 18¾ cents; and for greater distances, 25 cents. The postage stamp was adopted in Great Britain in 1840, and the United States introduced stamps of the 5 and 10 cent denominations, with the faces of Franklin and Washington respectively in 1847. Previously the postage was collected entirely in money, its prepayment being in all cases optional. On 1 July 1851 a new series of stamps was adopted, consisting at first of denominations of 1 and 3 cents, but afterward of larger amounts. Stamped envelopes were first used in 1853. The registration system was instituted in 1854, during the administration of President Pierce. The first fee was 5 cents; the price was raised in 1863 to 20 cents. It is now 8 cents. In the administration of President Lincoln the free delivery service was established. As early as 1825 provision was made by Congress for the delivery of letters by carriers at a cost of 2 cents each to the persons receiving them. In 1836 this was further amended by allowing newspapers and pamphlets to be delivered at half a cent each. In 1863 Postmaster-General Blair introduced the free delivery system, beginning the practice in cities of 50,000 population. Receiving boxes were also put up and deliveries provided for as often as the public convenience demanded.

*The Railway Post-office.*—The idea of a railway post-office was first brought officially to the notice of the department by First Assistant Postmaster General Hobbie, who, in 1847, had been in Europe, and in his report gave his impressions of the traveling post-office in England. Under Postmaster-General Holt, in July 1862, the first railway post-office was introduced in this country. In 1864 the leading railroads were induced to alter the cars for the purpose of the railway post-office, and from that time this service has grown, until now it is a model institution of its kind. On 30 June 1903 there were 1,400 lines of traveling post-offices, covering 189,298 miles in length; the number of employees in the service was 10,555; the annual distance traveled by clerks in cars and boats, 235,114,604 miles. To accomplish this 4,039 cars and apartments were used on the steam roads, besides 20 cars on electric lines under the supervision of the railway mail service, and 87 apartments on steamboats. It is estimated that these clerks handled 15,999,802,630 pieces of ordinary mail and 29,397,063 packages and cases of registered mail. The errors by clerks in handling the mail as reported indicate but one error for every 11,530 pieces correctly distributed. There were 373 casualties to mail cars in 1903, in which either clerks or mail or both were injured. There were killed 18 clerks, 1 substitute, and 3 mail weighers; and there were 78 clerks seriously and 398 slightly injured. Congress made provision in 1902 and 1903 appropriation bills for the payment of \$1,000 to the legal representatives of every clerk killed in the line of duty.

*Money-order System.*—The money-order system was established in 1864, under the administration of Postmaster-General Blair. In order to accommodate soldiers and others wishing to transmit small sums of money, he advised the

incorporation of this idea in our postal system. At its beginning only 138 offices were allowed to issue orders. The number has increased to 34,547, which during 1903 issued 45,941,681 domestic money-orders.

*Rural Free Delivery.*—The rural free delivery service is the last adjunct to the postal service, but, notwithstanding its youth, it promises to outgrow some of the older branches of the department. It was established under President McKinley, in 1897. That year 44 routes were put in operation. The service has grown to such an extent that for the fiscal year ended June 1903 Congress appropriated for the maintenance of this branch of the postal supply the enormous sum of \$8,054,400. There were 15,119 routes in operation, with 11,700 petitions pending.

*Dead Letter Office.*—The dead letter office dates back to 1825. An act of Congress made it the duty of postmasters to publish quarterly, or oftener, whenever the Postmaster-General might direct, a list of letters remaining in their offices, and once every quarter to forward those that could not be delivered to the department at Washington. Here in 1903 there were received 6,855,983 pieces of mail matter. Of this number there were 4,903,700 ordinary unclaimed letters; 593,194 which originated in foreign countries; 367,469 misdirected letters and parcels; 71,919 without address, inclusive of envelopes containing money found loose in the mails; 294,739 domestic hotel letters; 167,675 unclaimed parcels and photographs. There were restored to owners unopened 756,013 letters and parcels; 6,101,590 letters and parcels were opened. Of these, there were returned to senders 25,016 letters containing money to the amount of \$27,409.16; 32,033 letters containing draft notes, and other valuable enclosures of the face value of \$1,022,838.77; 1,772,464 ordinary letters without valuable enclosures; 71,248 parcels of merchandise, books, etc.; 38,998 letters containing miscellaneous papers, etc.; 167,608 containing postage stamps; and 36,532 containing photographs. Over 45,000 unclaimed and undelivered parcels of merchandise, books, etc., were disposed of at public auction, and 580,366 unclaimed foreign letters and parcels were returned to countries of origin.

*The Postal Union.*—Under the terms of a treaty concluded at Berne, 9 Oct. 1874, the object of which was to secure uniformity in the treatment of correspondence, and the simplification of accounts, as well as the reduction of rates within certain limits, and whose provisions were carried into operation generally 1 July 1875, the whole of Europe, the United States, Egypt, British India, and all the colonies of France were at the outset, or shortly thereafter, included in the union, and many other countries and colonies have since joined it. The international accounts in respect of postages are based on a month's return of correspondence taken every third year.

*The Post-office Department.*—This is the official title of one of the executive departments of the government; established in 1794. It is under the management of the Postmaster-General, who since the time of Andrew Jackson, has been a member of the President's Cabinet. He is appointed by the President and confirmed by the Senate. The department is divided into



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four great bureaus each under the immediate charge of an assistant postmaster-general. The first assistant's bureau has charge of the large clerical and carrier forces and all the matters of actual management. It supervises an annual expenditure of more than \$40,000,000. The bureau of the second assistant has the immense task of providing for the transportation of the mails at a yearly cost of \$35,000,000. That of the third assistant looks after the financial side, furnishes the stamps, and keeps the accounts. The fourth assistant has charge of the appointment of 75,000 postmasters and directs the force of inspectors.

*Post-office Statistics.*—In the United States in 1789 there were only 75 post-offices established, the length of the post routes being 2,275 miles and the gross revenue of the department being only \$7,510. The expenditures for the same year were \$7,560 and of this only \$1,657 were paid in salaries to postmasters. There were in 1901, 76,594 post-offices in operation, 511,808 miles of post routes, 466,246,059 miles of mail service performed. The gross revenues of the department were \$111,631,193, the expenditures \$115,039,607, and \$19,113,590 were paid as compensation to postmasters. From June 1847 to June 1851, 4,603,200 postage stamps were issued, while in the single year 1901, 4,329,273,396 stamps were used by the people of the United States. In 1853, the year in which stamped envelopes were first issued, 5,000,000 were used, while in 1901, the total was 772,839,000. The first year's issue of postal cards—1873—numbered 31,094,000, while in 1901, 659,614,800 were issued. The registry system was started in 1854, and in that year the registered pieces numbered 629,322. In 1901 they numbered 20,814,501. In 1865 money-orders to the amount of \$1,360,122 were issued, while in 1901 the total amounted to \$274,546,067. The number of pieces of matter of all kinds mailed increased from 500,000 in 1790 to 7,424,390,329 in 1901. See also PHILATELY; POSTAL SERVICE IN COMMERCE.

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**Post-nuptial Contract.** See LAW OF HUSBAND AND WIFE.

**Post-o'bit Bond,** a mode of contracting loans, often resorted to by heirs and others who expect a legacy on the death of some third party. The condition in the bond is, that the sum borrowed shall not be exigible till that party's death; and hence, not only in consequence of the uncertainty of the event, but also sometimes in consequence of the uncertainty of the succession itself, which may be contingent, and perhaps never be realized, the creditor usually makes very exorbitant terms. Many cases have figured in the courts of law in which the sum advanced was not a tenth of that stipulated to be repaid.

**Post-office.** See POST AND POSTAGE.

**Post-office Clerks, United National Association of,** an association formed in 1890, for the purpose of securing, through legislation and other means, the classification of post-office clerks with a view toward securing more equitable salary rates, regulation of hours of labor, and other similar objects. The organization also issues death benefit insurance policies.

**Post-office Department, United States.** See POST AND POSTAGE.

**Post-Pliocene,** applied to that division of geologic time and the strata laid down in it which follows immediately after the Pliocene. The term has been used as designating all that period from the end of the Pliocene till now, in which sense it is equivalent to Quaternary (q.v.) or, by some geologists, as applied only to the earlier portion of this period in this sense being equivalent to Pleistocene (q.v.).

**Post-Renaissance Painting,** painting as practised in Europe after the middle of the 15th century.

*Seventeenth Century.*—The great color school of monumental and decorative painting which was the glory of Venice was one of the last to disappear (see RENAISSANCE PAINTING). Paris Bordone (q.v.), a pupil of Titian, did little to maintain it, but a much more vigorous and original talent was that of Giacomo Robusti (q.v.) (1518–94), called Il Tintoretto from his father's occupation as a dyer, and also surnamed Il Furioso from his manner of working. The number of his paintings was very great, and their merit very unequal. From the school of Verona, which had been for some time rising in importance, and even in the 15th century had produced some painters of note, came another illustrious artist to add to the fame of Venice, Paolo Cagliari (q.v.), called Paolo Veronese (1532–88), one of the most brilliant of all decorative painters. The school of Bologna was founded by Lodovico Carracci, aided by his two cousins, Agostino and Annibale, in 1589, at the period of the rise of the Eclectic school, protesting against the Mannerists, and of the *naturalisti*, rejecting all tradition and professing to study nature directly. In Naples appeared an Hispano-Neapolitan school, of which the chief was Jusepe Ribera, called Lo Spagnoletto. Spain produced a number of native painters in the 15th, and at the beginning of the 16th century; and the influence of Italian art became more predominant toward the middle and at the close of the latter. But the authority of the Inquisition was strongly restrictive. Francisco de Zurbaran (q.v.) (1598–1662?) was preeminently a painter of monks. The three great names in Spanish art are Alonzo Cano (q.v.) (1601–67), a pupil of Francisco Pacheco, the master and also the father-in-law of Velasquez; Diego Rodriguez de Silva y Velasquez (q.v.) (1599–1660); and Bartolome Estéban Murillo (q.v.) (1618–82). The name of Velasquez has been raised by modern criticism to the summit of the art of painting. In Germany, no painter attained the eminence of Dürer and Holbein for more than two centuries; after them, a baleful imitation of the mannerisms of the Italians suppressed any assertion of national individuality, and the so-called inspiration from Michelangelo affected even foreign painters visiting in Germany,—as the Hollanders Goltzius, Hubert and Hendrick. The works of Adam Elzheimer (1578–1620), though he visited Italy and died in Rome, displayed a curious and original talent, both in figures and landscape, unusual at this period.

But it was to the Netherlands that the chief seat of the art of painting was transferred in the 17th century, made illustrious by the great development of all the resources of the art; the influence of Peter Paul Rubens (q.v.) (1577–1640) not only revolutionized the schools



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of painting of his era but is still felt in those of our day. One of the most celebrated of his pupils was Anton Van Dyck (q.v.) (1599-1641), whose portraits constitute his chief title to eminence; another was David Teniers the elder (q.v.) (1582-1649), instructor of his still more famous son of the same name. In the works of the latter, and of a number of the painters of Holland, Adrian Brauwer (q.v.), Adrian Van Ostade (q.v.), Jan Steen (q.v.), Gérard Terburg (q.v.), Gabriel Metz (q.v.), Gérard Dow (q.v.), is carried to the highest point the genre painting of contemporary life, the *extériorité*, which so strongly differentiates this Northern art from that of Italy. In the painting of landscapes, animals, marines, and even still-life, this excellence of technique was also maintained, reaching its supreme development in the genius of Rembrandt (q.v.) (1607-69), the greatest master of light and darkness of any school of painters. Under François I., a number of Italian painters were induced to visit France, many of them being employed in the decorating of the palace of Fontainebleau, and their influence prevailed strongly for nearly two centuries. The art of the 17th century was largely the official art of Louis XIV. and of his court painter, Charles Lebrun (q.v.); one of the most important events was the establishment of the Academy of Painting and Sculpture at Paris in 1648. A much more graceful and idyllic art was introduced by Nicholas Poussin (q.v.); and the classic landscape by Claude Lorraine, called Claude Lorrain (q.v.). In England, also, foreign artists, in this case French, Flemish and even Greek, were largely employed before the reign of Henry VII. (1485-1509), in painting miniatures on glass, enamels, etc. The example of Henry VIII. in encouraging the great Holbein was followed by his successors,—Mary Tudor employed Antonio de More (Antonio Moro); Elizabeth, Lucas de Heere and Federico Zuccari; Charles I., Rubens and Van Dyck; Charles II., Peter Lely, of Soest in Westphalia, and Godfrey Kneller of Lübeck. The only English names that assume any importance in these annals are those of Isaac Oliver, his son Peter, Samuel Cooper, a pupil of Van Dyck, Robert Streater, Henry Anderton, and Peter Monamy.

*Eighteenth Century.*—During the 18th century the art of the Netherlands passed into an eclipse, recognized, and deplored, by the national historians, and that of Germany into another, which was long hailed as a "revival." Belgium, the battle-ground of Europe for so many years, exhausted and ravaged under its constantly changing rulers, could furnish no encouragement to the arts, and the painters, like those of Holland, with a very few exceptions, abandoned their own initiative and the study of native art for the servile imitation of the works of their predecessors,—the portraitists and the figure painters, such as Rubens and Lebrun; the landscapists, like Poussin; the battle painters, like Philips Wouwerman (q.v.), etc. In Germany, the revolt against the general decline was called the Classic Movement, the first of the three great epochs into which this revival is divided, and which is dated from the arrival of Raphael Mengs (q.v.) in Rome, in 1741. The future leaders in the second phase of this move-

ment, Cornelius, Overbeck, Veit, Schadow, etc., were all born in the very last years of the century. Great Britain and France, on the contrary, developed, in a number of distinct schools each, fresh evidences of a national and original art, in practically all the branches of painting. In portraiture, the British record the names of Reynolds, Gainsborough, Romney and Raeburn; in genre, not always satiric, Hogarth—one of the most preeminently national of all artists, and Wilkie; in landscape, Gainsborough, Old Crome, Constable and Turner. In academical and historic art, the Americans, Copley and West, rose to international eminence. In France, the last days of the monarchy were made illustrious by the delicate and graceful courtly art of Watteau (q.v.), Pater, Lancret and Fragonard, the frail idylism of Greuze (q.v.), and the admirable naturalism of Chardin (q.v.)—to be succeeded in their turn by the pedantic "classicism" of David and the Empire. This century is distinguished also by the growing recognition of the popular interest in art, encouraged by the opening of royal galleries and the dissemination of engravings. Three female painters appear, whose graceful talents entitle them to recognition,—in Venice, Rosalba Carriera (q.v.) (1675-1757); in Germany, Angelica Kauffmann (q.v.) (1741-1807); and in France, Mme. Vigée-Lebrun (q.v.) (1755-1842). In Italy, the last glories of the Venetian school flamed up in the daring and truly decorative work of Giambattista Tiepolo (q.v.) (1696-1770).

*Nineteenth Century.*—During the 19th century the supremacy in painting and sculpture was transferred to France; Paris, with its annual, official, Salons, became the recognized capital of the fine arts for Europe and America. French art in this century has been considered to have passed through three great periods, corresponding closely with changes in the national government,—Classicism, Romanticism, and the third period, dating from 1848, the schools of the Second Empire and the Third Republic. All these have naturally had many sub-divisions. The classicism of Louis David (q.v.), with its sacrifice of everything in painting to the outline and to what was considered to be an imitation of the antique, was obliged to yield gradually to the Napoleonic art, representations of battles and of state ceremonies, and to genre painting,—the last not being officially recognized till 1816. Classical painting, which dominated in Europe for 50 years, was almost exclusively figure painting; its rigid formalism gave way to a greater sympathy with nature even in the works of David's immediate pupils and followers, Regnault (q.v.), Picot (q.v.), Baron Gérard (q.v.), Gros (q.v.), and Ingres (q.v.). A much more living and sympathetic classic taste than David's was that of Prud'hon (q.v.). Romanticism found its first expression in painting in the works of Géricault (q.v.), though Delacroix (q.v.), more emotional and more of a colorist, is considered to have been the leader. The essential narrowness of this form of art was also gradually tempered by naturalism, so that its range became wider,—as in the very different art of Decamps (q.v.), first of the Orientalists, and of Ary Scheffer (q.v.) and Paul Delaroche (q.v.). Landscape painting began to assume that great importance



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which it has ever since maintained in modern art, and the way was opened for the famous Fontainebleau school of Corot (q.v.), Rousseau (q.v.), Troyon (q.v.), Diaz (q.v.), Daubigny (q.v.), and Jules Dupré (q.v.), in which the painting of cattle is also raised to its highest eminence. The school of the peasant—as it might be called—which has played so large a part in contemporary painting, both of France and of all the nations whose students have imbibed French methods and conceptions, permits of such a wide range of treatment as that between the very frank realism of Courbet (q.v.) and the “hieratic gloom” of Jean-François Millet (q.v.). Somewhere between these extremes are the rural scenes of Lhermitte (q.v.) and those of Jules Bréton (q.v.), in which realism is tempered with a certain style, with a strong desire to avoid the merely commonplace.

The latter half of the 19th century saw the rise of so many and so widely differing movements and tendencies in French painting that no general classification is possible. Under the Second Empire the official art, that of the Académie and the Institut, included such celebrated names as those of Gérôme (q.v.), Jules Joseph Lefebvre (q.v.), Bonnat (q.v.), Cabanel (q.v.), Baudry (q.v.), Bouguereau (q.v.), and Henner. In genre, characterized usually by excessive delicacy and accuracy of finish, the highest place was held by Meissonier (q.v.); and but little inferior was the work of Louis Leloir and Vibert (q.v.). Something of the haunting antique influence appears in the work of Gleyre, Couture (q.v.) and Flandrin (q.v.), protesting against the rising flood of “realism”; something also in that of the so-called Neo-Grecs, of which the two most sincere and persistent were Hamon (q.v.) and Aubert. The most graceful of the Orientalists was Fromentin (q.v.), and the painters of Eastern subjects, in very varying methods, include many of the most celebrated names of this epoch, Gérôme, Henri Regnault (q.v.), Benjamin-Constant (q.v.), Belly, Boulanger, and others. Of the mystical school, uninfluenced by any conventions or traditions, the most striking example is that of Gustave Moreau (q.v.); and one of the most distinguished and honored of the older men is Hébert (q.v.), whose delicate, melancholy art has not varied since 1850. Nearly all the French figure painters are portraitists. Military subjects have been rendered with a realistic accuracy and a dramatic force never before attained, by Yvon (q.v.), Detaille (q.v.), De Neuville, Aimé Morot, Roll, and others; mural painting received a new inspiration from Puvis de Chavannes (q.v.); a warmer splendor of color than that of the Venetians was revived by Monticelli (q.v.); and the still-life of the early Dutch painters equaled by that of Desgoffe (q.v.) and Vollon (q.v.). One of the most important manifestations of this contemporary school was that of the Impressionists (q.v.), with their new theories of presenting absolute realities, and of which the most uncompromising advocates among the leaders were Manet (q.v.), Monet (q.v.), Sisley, Pissaro, Caillebotte, and others. While the influence of this innovation still lingers, the contemporary art of the Salons shows but very little trace of it. It is to be noticed that the great decline in all artistic

value of these annual Salon exhibitions, and of the national art generally, within the last ten years, has been admitted by the French themselves.

In Great Britain, the influence of the Pre-Raphaelite movement of 1851 is considered to be still very strong, especially among the younger painters, but it is certain that that of the Newlyn school, much later, and even of the Glasgow School in landscape painting, has had very much more to do with the introduction of more purely artistic conceptions and a much sounder technique. A few of these younger colorists, as La Thangue and Clausen, have been officially recognized by the Royal Academy (q.v.), and the works of a number of the others, as Edward Stott, Alfred East, Alfred Parsons, and J. M. Swan, the animal painter, appear at its annual exhibitions. Unlike the Pre-Raphaelites, who advocated the distinctly moral purpose of art,—rejecting all but the sincerity and truth-seeking methods of Raphael's predecessors, and unlike the conventional characteristic art of the day with its insistence upon details and a subject, these modern innovators paint the simplest themes with breadth and with skilful rendering of atmosphere and color. At the head of the academical school stands the name of Sir Frederick Leighton, afterward Lord Leighton (q.v.); his immediate successors in the office of president, Sir John Everett Millais (q.v.) and Sir Edward J. Poynter (q.v.), sustain intelligently the traditions of an art whose greatest defect is generally in the brush-work. All forms of painting are represented in this school, historical, decorative, portrait, genre, landscape and marine. The British water color school has long been considered to be one of the most important branches of the national art; it likewise includes all subjects in its province, and treats them with much the same seriousness of detail as the oil-painting. The most important of the official bodies after the Royal Academy are the Royal Scottish and the Royal Hibernian Academies, and there are many minor societies representing various tendencies of the art.

Unlike England or France, northern Germany has never possessed one recognized centre of the arts,—the conflicting claims of Berlin and Munich being mutually disallowed; but in Austria, the capital, Vienna, has long enjoyed this distinction,—in the 18th century, and in the 19th more particularly since the aggrandizement of the city following the razing of the outer walls in 1858. This period gave rise to a species of eclecticism in all the arts, in which a great variety of styles and influences prevailed. In Prussia and Bavaria, the second period of the great revival, led by Cornelius and Overbeck, began about 1810; and the third,—the natural reaction against the mysticisms and devoutness of these “Nazaries” (q.v.), and hence considered to be naturalistic,—about 1830. Still another regeneration is placed immediately after the close of the war of 1870–1. The development of this latter, however, was slow; the real leader in the modern movement is considered to be Franz Stuck (q.v.), who first became widely known at the exhibition in Munich in 1889. This movement was particularly directed against the



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academic formulas of the historic painters of the school of Piloty (q.v.) and the rural genre of Defregger (q.v.) and Vautier (q.v.). Much of the influence of the older men, however, still survives, and among those who escaped this general denunciation was the veteran, Menzel (q.v.). The three great "Secession" movements were those of Munich, Düsseldorf and Berlin, but the art of the latter capital is still largely official. The Secession in Austria, and the division of the painters into "the old and the new," dates from only about 1897. In Hungary, the national art, rising from the exhaustion and devastation of the numerous wars and revolutions, is considered to have taken form after the revolution of 1848.

Contemporary Continental painting may be said to have been so greatly influenced by the art of France as to have fallen into a routine in which mere technical skill very frequently takes the place of any strong national or individual assertion. This is particularly true of Italy, Spain and Portugal. In the former, the Neapolitan painters, the chief of whom are Palizzi, Morelli, and his pupil, Michetti, are the most interesting and the best known abroad; about 1887 a society of Roman painters was formed to combat the commercial art of the day, for which Fortuny (q.v.) was considered to be largely responsible. Among the few painters with international reputations, two of the most prominent are Segantini and Madame Romani-Carlesimo. In Spain, also, but few traces are left of the brilliant Roman-Spanish school (q.v.) of Fortuny, even in the genre. In much broader methods all the brilliancy of the contemporary cosmopolitan technique appears in the luminous canvases of Sorolla y Bastida (q.v.), and what are considered to be the qualities of Goya in the somewhat brutal scenes of daily life by Zuloaga. Dignified historical art is worthily represented by Pradilla (q.v.); and the small Venetian scenes painted by Rico, are widely known. Portuguese art has suffered from many national ills; the list of contemporary painters is headed by the king, Dom Carlos I.

Painting in the Netherlands has not followed common lines of development in Holland and Belgium,—in the latter, it has been susceptible to every new wind of doctrine from abroad, while the Dutch artists have remained faithful to what may be defined as the national principles for the last 30 years. This close appreciation of nature, the sense of the essential and intimate quality of things, differs from the famous national art of the 17th century, both in conception and in technical processes, but it seems to be rather an evolution than a revolution. The leaders in the movement against the indiscriminating assimilation of all other European methods, which prevailed in 1830, were Josef Israëls (q.v.) and Jacobus Maris (q.v.); the renown of the latter is shared by his two brothers, Matthys and Willem. The landscapes of Jongkind, Willy Martens, Blommers, and Anton Mauve, the marines of Mesdag, the domestic genre of Albert Neuhuys, the church interiors of Bosboom, have given this art an international renown. Among the younger painters, a not very important independent movement was set on foot within the last few years,

—that of the "New Impressionists," seeking the expression of greater vehemence, of more passion, in their works. The leaders in this were Isaac Israëls, the son of Josef, and Georges Hendrik Breitner. In strong contrast with this national art is that of a few denationalized painters who have gone abroad,—as Kaemmere, in Paris and Alma-Tadema in London. The somewhat indiscriminating revolt against all the old traditions in Belgium was inaugurated by the founding of the *Société libre des Beaux-Arts* in 1868, followed by various associations, publications, manifestations and "discoveries." So widely divergent are the principles of the modern school, however, that they include the historical paintings of Baron Leys (q.v.), the marines of Clays, the powerful and gloomy renderings of the life and labor of the poor by Constantin Meunier, and the Impressionism of Evenpoel, resembling that of the Spaniard Zuloaga. Of the mystical and imaginative painters, the most reticent and refined is Fernand Khnopff; one of the so-called realists, very hard in design and color and sacrificing all tones and values, is Léon Frédéric.

Scandinavian art, also, shows divergencies, following national characteristics,—that of Norway being ruder, somewhat more direct; that of Sweden following more faithfully the varying currents of foreign art, as does the scanty art of Finland; that of Denmark, seemingly more intimate, with comparatively little variety. The emancipation from foreign domination, mostly German and latterly French, is recent and is not yet complete, dating in Denmark from the commencement of the 19th century, under Thorwaldsen (q.v.) the sculptor and Eckersberg the painter; and in Norway from only about 1890. The sound technical training that permits of the rendering of even the distinctively northern themes, the clear, cold, impressive aspects of nature, the sincere and intimate domestic genre, has in nearly all cases been acquired in foreign schools—Norway and Finland having none of their own; and of the most brilliantly equipped of these painters, as the Swede, Zorn (q.v.) and the Norwegian, Thaulow, it is to be said that their art, like their celebrity, is cosmopolitan. Many of the artists trained in Paris have identified themselves with the contemporary French school,—the Norwegians generally excepted. Among the few painters who have remained distinctly national, one of the most original and most decorative in his work is Carl Larsson of Sweden; Gerhard Munthe of Norway, a good landscape painter, owes his international reputation to his very curious and novel renderings of ancient legends.

The art of Switzerland, like the best of all that of the minor countries, even the South American and the Danubian, reflects strongly the influence of the Parisian schools. In Basel, however, in 1897, was celebrated a double festival in honor of Holbein and Böcklin (q.v.), the latter a painter whose art was singularly free from all traditions whatever.

The art of Western Europe was first introduced into Russia by Peter the Great; before him it was barbaric, or semi-Byzantine, like the civilization. The Saint Petersburg Academy of the Arts was founded by the Empress Elizabeth in 1757. In its curriculum the imitations of the



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various European schools of painting were taken up in turn, or simultaneously, from Carracci and Guido Reni to the classicism of David and Mengs. The reaction against these has naturally developed a number of painters who strive to give expression to the sympathy with their own race or their own ideals; many of them share the depression, the pessimism, which characterizes so much of the contemporary literature. This affects strongly the landscape sentiment, even in the works of artists who have returned from studying abroad. Of these figure painters, the most important are Répin, Wasnetzoff, Serof, and some others, the first named being one of the boldest of the realists of any school or time. Verestchagin (q.v.) is well known abroad by his very numerous and very large canvases in which he has sought to depict the horrors of war. In the Russian school are included the two Finnish painters, Edelfelt, whose figures and portraits are rendered with all the excellence of Parisian technique, and Axel Gallen, whose strikingly original paintings depict weird scenes in the national legends. Of the painters of Poland, the most widely known are Matejko and Joseph Brandt (q.v.).

In the United States, painting has developed along the lines of technical excellence, rather than in any striking or inspiring development of a great distinct national art. Even in the matter of technique, some of the early portrait painters, as Gilbert Stuart (q.v.) and the wood-engraver, A. B. Durand (q.v.), remain unsurpassed. Trumbull (q.v.) and Washington Allston (q.v.) were not only portraitists but also painters of historical and imaginative compositions, the former excelling in the small heads in his large historical canvases, and the latter displaying more of a painter's feeling for tone and color. The art of Benjamin West and C. R. Leslie belongs rather to England, and is to-day quite alien. The modern landscape may be said to commence with the pictures of the visionary Thomas Cole (q.v.), and it rapidly developed in the work of the painters of the "Hudson River School," the most important of which were J. F. Kensett (q.v.), Sandford R. Gifford (q.v.), W. Whittredge (q.v.), and Jervis McEntee (q.v.). The great panoramic canvases of Albert Bierstadt (q.v.) and the far more distinguished landscape compositions of Fred. E. Church (q.v.), have no reflection in the work of to-day. This landscape art has culminated apparently in the renderings of tone and atmosphere, and the sentiment of nature in her quieter moods, in the works of such artists as George Inness (q.v.), Homer Martin (q.v.) and A. H. Wyant (q.v.), and, of the stronger moods, Winslow Homer (q.v.), a painter of the clearest insight and most truthful rendering. William Page (q.v.) and Daniel Huntington (q.v.), each in his turn President of the National Academy of Design, enjoyed very considerable reputations as portrait painters, the former devoting himself to an effort to discover the secret of the color of the Venetians. At the present day, Blakelock, Ryder, Horatio Walker, Murphy, Dewey, and Dearth represent the imaginative school of landscape; with them may be placed the more literal canvases of Tryon, Swain Gifford, Chase, Picknell, Bolton Jones and Theodore Robinson (d. 1896)—to mention only a few of a very long

list. The portrait painters are also numerous; John S. Sargent (q.v.) enjoys an international reputation as one of the greatest of any school; Whistler (q.v.) (d. 1904), who resided in England, Eastman Johnson, Brush, Chase, Alexander, Vinton, Collins (d. 1903), George Butler, Wyatt Eaton, Beckwith, Tarbell, Benson, Vonnoh, Metcalf, Wiles and Fowler at home, are among the most distinguished, as is Miss Cecilia Beaux. Most of these also paint genre, or semi-decorative figure pieces; some of them having commenced as illustrators, or still practising that art. Among the latter are Howard Pyle, A. B. Frost, W. T. Smedley and Hopkinson Smith. E. A. Abbey (q.v.), originally an illustrator, has transferred his residence to England and paints both in historical and in large mural compositions.

John La Farge (q.v.) is in a way a link between the old and the new, having been a pupil of Couture, and the first, practically, to seek color for its own sake, in oil, in his very numerous water colors, and in his later monumental work both on walls and in stained glass. Another of the older men, Robert Weir, is noted for his important figure compositions, apparently influenced by the European schools; Alden Weir renders much simpler scenes in methods somewhat more affected by wholly modern processes; Thomas Moran, mountain landscapes and Venetian scenes inspired by the English painters of the early part of the century. A number of the figure and landscape painters have established themselves in Paris, Mac Ewen, Melchers, Julius Stewart, Edwin Lord Weekes (d. 1903), Johnston, and others; Hitchcock in Holland, Ulrich in Germany, etc. The list of marine painters is also long; among the most talented are Arthur Quartley (q.v.) (d. 1886), Henry Snell, T. W. Richards, C. T. Chapman, and some others, and, among the older men, James Hamilton (d. 1878).

In figure painting there has seemed to be a lack of popular appreciation for anything more ambitious than small examples of genre, usually familiar and domestic themes, rather than for the historic or the more purely imaginative or mystical,—the most important exceptions of late years being the dignified, almost monumental, canvases of Abbot Thayer, and the Oriental interiors of Siddons Mowbray. The increasing use of large mural paintings in public and private buildings has, however, developed a school of truly decorative artists, of which the first in point of time was Wm. Morris Hunt; the living painters are Mowbray, Dewing, Simmons, Blashfield, Vedder, Turner, Frank Millet, Robert Reid, and a few others.

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## POST-TERTIARY PERIODS — POSTAL SERVICE IN COMMERCE

Saglier, Walton, 'Exposition Universelle, 1900. The Chefs-d'Œuvre' (1901).

WILLIAM WALTON,  
*Painter; Author of 'Chefs-d'Œuvre, Exposition Universelle,' Paris.*

**Post-Tertiary Periods**, the last main division of the Geological Record, and which includes all the formations accumulated from the close of the Tertiary periods down to the present day. No sharp line can be drawn at the top of the Tertiary groups of strata. On the contrary, it is often difficult, or indeed impossible, satisfactorily to decide whether a particular deposit should be classed among the younger Tertiary, or among the Post-Tertiary groups. In the latter, all the mollusks are believed to belong to still living species, and the mammals, although also mostly still of existing species, include some which have become extinct. These extinct forms are numerous in proportion to the antiquity of the deposits in which they have been preserved. Accordingly a classification of the Post-Tertiary strata has been adopted, in which the older portions, containing a good many extinct mammals, have been formed into what is termed the Pleistocene, Post-Pliocene, or Glacial group, while the younger deposits, containing few or no extinct mammals, are termed Recent.

The gradual refrigeration of climate was prolonged and intensified in Post-Tertiary time. Ultimately the northern portion of the northern hemisphere was covered with snow and ice, which extended into the heart of Europe, and descended far southward in North America. The previous denizens of land and sea were in large measure driven out, or even in many cases wholly extirpated by the cold, while northern forms advanced southward to take their places. The reindeer, for instance, roamed in great numbers across southern France, and Arctic vegetation spread all over northern and central Europe, and what is now the Temperate zone of America. After the cold had reached its climax, the ice-fields began to retreat, and the northern flora and fauna to retire before the advance of the plants and animals which had been banished by the increasingly severe temperature.

The insensible gradation of what is termed the Pleistocene into the Recent series of deposits affords a good illustration of the true relations of the successive geological formations to each other. We can trace the gradual passage because it is so recent that there has not yet been time for those geological revolutions which in the past have so often removed or concealed the evidence that would otherwise have been available to show that one period or group of formations merged insensibly into that which followed it. The Recent formations are those which have been accumulated since the present general arrangement of land and sea, and the present floras and faunas of the globe were established. They are particularly distinguished by traces of the existence of man. Hence the geological age to which these belong has been spoken of as the Human Period. But there is good evidence that man had already appeared on earth during Pleistocene time, so that the discovery of human relics does not afford certain evidence that the deposit containing them

belongs to the Recent series. Nevertheless it is in this series of the Post-Tertiary deposits that vestiges of man become abundant, and that proofs of his advancing civilization are contained.

During the Recent period the same agencies have been and are at work as those which have been in progress during the vast succession of previous periods. No trace can anywhere be detected of a break in the continuity of the evolution through which our globe has passed. See QUATERNARY PERIOD.

**Postage Stamp Collecting.** See PHILATELY.

**Postage Stamps.** See POST AND POSTAGE.

**Postal Savings Banks**, a class of savings banks established in Great Britain in connection with the money-order department of the post-office, by an act of Parliament, passed in 1861. Any sum not less than 25 cents is received, so as not to exceed \$150 in one year, or more than \$750 in all; and when the principal amounts to \$1,000, the payment of interest is to cease. Interest is paid on every complete pound at the rate of  $2\frac{1}{2}$  per cent. For the deposits the government is responsible, and they may be drawn from any post-office savings bank in the kingdom. Being exceedingly numerous, and very convenient in every way, these savings banks have been a great success, and have caused the transference to them of much of the funds formerly in the trustees' savings banks. The total amount deposited in the latter class of banks in the United Kingdom during the year 1898 was over \$60,000,000, and in the former, \$200,000,000. By an act that came into operation in 1880, any person desiring to invest in government stock any sum of from \$50 to \$500, can do so through the post-office banks at a trifling cost, and obtain the dividend free of charge.

**Postal Service in Commerce, The.** The influence of the postal service on commerce, particularly during the past half century, presents, in tremendousness of results achieved, a striking, inspiring example of creative and executive energy and skill.

The example of patriotic interest in postal progress and development set by Benjamin Franklin and his successors on this side of the Atlantic, and by Rowland Hill and those who continued his postal reform campaign in England, has since been emulated on every continent. To-day, thanks to the persistent and intelligent efforts of legislators and chief executives, the whole world, including nearly every inhabited island, is strongly entwined by links of a friendly, co-operative chain of rapid, economical and satisfying postal service.

Forty-three postmasters-general have, thus far, occupied the chair so ably filled by Franklin in 1775-76. Joseph Habersham, of Georgia, served during a lengthy period. He took office under President Washington in 1795, continued under John Adams and remained in the cabinet of Thomas Jefferson during the first eight months of the latter's term as Chief Executive. Gideon Granger, of Connecticut, a famous man of his day, held the office of Postmaster-General under Jefferson and Madison, from 1801 to 1813.

Before referring to foreign postal developments of importance, details of results brought about under the administration of the Federal officers above mentioned may be of interest.



## POSTAL SERVICE IN COMMERCE

The progress of postal service in the United States has always meant, and always will mean, at every step, the further development of interstate and international commerce through prompt transmission of business correspondence and subsequent commercial dealing, frequently of great volume, between individuals, corporations, states and countries.

*Post Offices.*—Postal service in America, ninety years before the Revolution, was deemed by the British authorities to be hardly worthy of consideration, even the West Indian Islands taking official precedence. The records show that authority was extended by the King of England, in 1692, to one Thomas Neale, residing in England, to establish postal places in North America. This authority was deputed by Neale to his representative, Thomas Hamilton, who, within six years, succeeded in creating a weekly post service aggregating 700 miles in length, covering the ground between New York and Boston, also between New York and New Castle, Pennsylvania. One shilling was the postal fee at that time for the carriage of a letter from New York to Boston. The first New York postmaster was a Mr. Sharpus. His salary was \$100 a year. He was able to supplement this largely by carrying the mail half way to Boston and the whole distance from New York to Philadelphia. There were deputy postmasters at the same period for Virginia and Maryland. There was also a "post-office keeper" or city postmaster at Philadelphia.

Under Postmaster-General Osgood, in 1789, there were but 75 post-offices in the United States. Twelve years later, the total was 1025. In 1833, during the presidency of Andrew Jackson, the number had reached over 10,000. In 1856, under President Pierce, the aggregate of post offices in the United States had passed the 25,000 mark. Fifty thousand was the total when President Cleveland took office in March, 1885. The postoffices of all classes, according to latest reports of the Postmaster-General, now aggregate over 71,000. During the whole period of one hundred and fifteen years the increase was almost invariably continuous, and the contemporaneous influence of the postal service on commerce is a matter of record in every trade, from the most important to the most trifling and insignificant. Since 1900, owing to the discontinuance of minor post-offices on substitution of Rural Free Delivery, an aggregate reduction of over 5,000 post-offices has been brought about.

*Extent of Post Routes.*—From 700 miles of post routes in 1698, the total distance was extended, during the next hundred years, to more than 16,000 miles. In 1817, the routes covered over 50,000 miles. Ten years afterward, the length of routes exceeded 105,000 miles. It took 40 years more (1867) to exceed 200,000 miles, but only 11 years thereafter (1878) to reach 300,000. The end of the next decade (1888) found the aggregates beyond the 400,000-mile mark. Twelve years were required for the next 100,000 to be added. The latest aggregate officially reported is 496,818 miles, approximating the total of 1899 and about 11,000 miles less than in 1902.

*Mail Service Performed.*—The ground actually covered in journeys by mail carriers of all kinds in the United States, 1793, was 845,468

miles. Service by rail began in 1834, over 78 miles of railroad. In 1860, mail trains began to run between New York and Boston, by way of Hartford and Springfield. During the year following, a railroad mail was started between New York and Washington, D. C. Post-sorting cars began to operate in 1864. Then followed the establishment of a regular postal car system. By 1872, there were railway post-offices on 57 lines of road. The aggregate given in the latest official reports (1904) shows the enormous total of 505,585,526 miles traveled in postal service, including the most recent developments of the rural free delivery plan. The same report shows 1,448 lines of traveling post-offices, using 4,199 cars. In 1904 this service handled 17,132,840,320 pieces of ordinary mail and 36,699,264 packages and cases of registered mail.

The mail routes now in operation include 620 miles in Alaska, 16,128 miles in Hawaii, and 3,501 miles in Porto Rico. Mails for over 41,000 miles are carried by steamboats, 5,117 on rail messenger routes, 4,945 miles by means of electric car service, and 196,907 miles are covered by railroad transportation.

*Rate of Postage.*—The year 1851 is a red letter year in the history of postal progress in its relation to commerce. Up to that time the rate for many years had been 5 cents for half ounce for a distance not exceeding 300 miles and 10 cents beyond this distance. The law was changed in 1851 making the rate 3 cents per half ounce for a distance not exceeding 3,000 miles and 10 cents exceeding that distance.

*Gross Revenue and Expenditure.*—In colonial days the men who undertook the mail contracts lost money continuously. Thomas Neale, whose deputy, Hamilton, created and developed the first route from New York to Boston and to other points, had lost over \$11,000 by the experiment, he reported, at the end of five years' service. He then offered to sell to the government his patent of the privilege for \$5,000 a year in perpetuity during his life or for the unexpired term of his service, which was about sixteen years. The offer was refused and Neale died in debt. Six years later Hamilton also died and after a lapse of four years the government undertook the administration of the routes. Receipts did not equal expenditures, however, until fifteen years after this adjustment had been made.

The gross revenue of the department in 1789 was \$7,510 and the expenditures exceeded that amount by fifty dollars. The first million dollars record of gross revenue was in 1815. Since that time it has increased steadily. The latest reports (1904) of gross receipts show \$143,582,624. Against that are gross expenditures amounting to \$152,362,116.

*Star Routes.*—The Star Route service, originally intended to transport mail and pouches between post-offices, has been vastly improved. To-day this method of distribution and collection is an important factor in the general plan of commercial and social development through liberal and rapid postal service. According to the present organization of the system the carriers on these routes, in addition to the transportation of mail in pouches, must deliver mail into boxes and collect mail from boxes. They must also carry private mail bags to and from the mail trains along the routes for all persons



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residing upon or near the routes who desire to avail themselves of such service.

*Rural Free Delivery.*—The postal Rural Free Delivery system, after numerous experiments, became, in 1902, an established fact. One-third of the country's area, available for the working out of the system, was mapped out into 11,650 routes. Among advantages claimed and admitted for this system are that the value of isolated land farms has been enhanced, and that farmers have been brought into close touch with the markets. Instances have been known where the prompt delivery to farmers of livestock quotations indicating a temporary glut in the market has, by enabling them to hold back shipments till the markets resumed a normal condition, saved to individual cattle-owners more than the total amount chargeable for a year's rural free delivery over the routes.

On the other hand, information of an advance in the prices of particular farm products has reached the grower by means of rural free delivery in time to enable him to make a much more profitable bargain with his commission merchant than he could otherwise have done.

The net advantages of the Rural Free Delivery system include (1) postal receipts increased; (2) value of farm lands enhanced; (3) farmers brought into touch with markets; (4) social and educational benefits derived in country and town by being kept in touch through the daily receipt of papers and correspondence; (5) benefits to small towns. In three, at least, of these advantages the benefit of the postal service to commerce is distinctly notable. The latest official reports show 18,743 routes in operation, covering 233,392 miles.

*Postal Money Orders.*—The large and steady growth of the postal money order system, both domestic and foreign, is believed to be the best evidence of the estimation in which it is held by business men. In 1865, there were 419 offices in operation in the United States. From those offices 74,277 orders were issued. The number of offices, according to the last official report of the Postmaster-General (1904) was 35,094. The number of orders issued reached 50,392,554. In 1865, the amount of money issued by means of domestic postal orders was \$1,360,122; in 1904, \$378,778,488.

It is held by the Post-office Department that the money-order system provides an absolutely safe and convenient means of transmitting money. Many improvements and developments have been made in the system since its introduction in 1864, notably in simplicity. The present regulation permits a money order to be drawn for any desired amount less than \$100 at any money-order office in the United States designated by the applicant.

*International Money Orders.*—Five countries are now included in the International Money Order Union. At all of the larger post-offices, those of the first, second and third classes, and at many of the smaller ones, international money orders are obtainable payable in almost any part of the world. A special foreign-country rate is now uniform when payable in Austria, the Bahamas, Belgium, Bermuda, British Guiana, Bolivia, Chile, Costa Rica, Denmark, Egypt, Hungary, Jamaica, Japan, the Leeward Islands, Liberia, Luxemburg, Mexico, Netherlands, New

Zealand, Norway, Peru, Sweden, Switzerland, Transvaal, Trinidad and the Windward Islands. For other foreign countries the rate is higher. Apart from all question of personal convenience, the domestic and foreign money-order system, as now regulated, makes an important feature in the world's commerce in many trades.

*Foreign Mail Service.*—The foreign mail service is one of the most effective of United States postal departments. Its record is worth noting here. Following the War of 1812, constantly increasing calls were made for speedier and more frequent transportation across the seas. This made the establishment of a regular service imperative. The mail packets, as they were called, ran uninterruptedly for about thirty years. These were gradually superseded by clipper ships built for greater speed. One of the record-making voyages of a clipper was that made in 1846, when one of these magnificent ocean-birds reached New York considerably ahead of a steamer traveling over the same course, and delivered in New York London newspapers giving European news from forty-two to forty-four days old. Such a length of time may seem to us, now, a good deal extended, but when the record was made it produced a great sensation, and the feat was proclaimed throughout the world as a remarkable triumph.

Impetus was given to the foreign mail service by the action of Congress, in 1845, by which government contracts were authorized for foreign mail transportation. From that time, when only a few sacks were shipped on each vessel, the foreign mail service has extended until, to-day, it has reached gigantic proportions. Letters and packages to and from foreign places now aggregate several millions each month. A further development of foreign mail service is looked for when efforts now being made to bring about ocean penny postage, so persistently and intelligently advocated by J. Henneker Heaton, the English advocate of greater postal privileges, reach a successful culmination.

*Parcels Post.*—The Parcels-Post, which, as rightfully claimed by the postal department, affords the only channel for the legitimate exchange of packages of miscellaneous merchandise by mail between different countries, has, since its inauguration, done some wonderful work toward the further development of commerce through postal service. The system gives to persons in different countries substantially the same facilities for the exchange of small parcels as is afforded in our domestic service by admission to the mails of fourth-class matter.

The movement was inaugurated in 1900, although conventions had existed for several years previously between the United States and various countries on this continent. The extension of the system into foreign lands dates from the convention in Germany, 1900. The provisions of the German convention were modified in 1903. Several countries have since shown a desire to participate actively and to encourage the system throughout their territories. Bolivia was admitted to the convention in 1902. In 1904, Hong Kong, Norway and Japan came in on the proviso that the value of any parcel be limited to fifty dollars and the weight to five pounds six ounces.

The aggregate weight of parcels sent from



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the United States by this system to foreign countries for the year ending 30 June 1903, was 346,317 pounds; 1904, 464,697 pounds.

The usual limit of weight for unsealed packages of mailable merchandise in the list of countries forming what might be termed the Parcels-Post Union is eleven pounds. The limit of length per package is three feet six inches. The greatest length and breadth combined is six feet and the rate of postage is twelve cents per pound or fraction thereof.

The exceptions to this rule are few. The entire list of countries and places having the same restrictions as given above for Hong Kong, Norway and Japan includes Germany, Belgium, Great Britain and Ireland. The instructions recently issued by the Post-office Department at Washington dealing with this subject are clear and at the same time comprehensive. Full instructions are given concerning the examination of parcels, their weight and measurement, customs declarations, registration, and all other particulars necessary to a complete understanding.

*Development of Public Utilities.*—The development of public utilities as recorded in a recent statement issued by the postal department forms one of the most interesting features of postal history. Postage stamps were first issued by a law passed on 3 March 1847. The next move toward adding to the public convenience was that of issuing stamped envelopes, the first of which appeared in June, 1853, under an act of the previous year. Nine years later the first newspaper wrappers were issued. Then followed, in 1865, special-request envelopes. The use of postal cards, which has since reached such tremendous proportions, was inaugurated on 1 May 1873. The registration of letters began in 1855 and the money-order system went into operation on 1 Nov. 1864. An extension of this order, for international purposes, was authorized by the Postal Convention of 12 Oct. 1867. The most recent postal development is that of parcels-post delivery, which began in 1900.

*Transportation Service.*—The United States postal transportation service as developed, now includes, principally, the following systems and plans of operations:

Transportation of mails on railroads, City Free Delivery System, Rural Free Delivery System, Railway Mail Service, Star Route Service, Railway Post-Office Car Service, Foreign Mail Transportation, Mail-Messenger Service, Mail Service on steamboats (transportation), Mail Service on Electric and Cable Cars, Pneumatic Tube Service, Registered Package and Mail Service, Money Order Service, Mail Box Post-Office Service, Parcels-Post Service.

*Foreign Developments.*—In 1533, when postal service started in England, the monarch alone had the privilege of using it. About seventy years later there was an official post to Dover and Plymouth; there were also separate posts to Scotland and Ireland. The Dover post, running through the county of Kent, was most in vogue. By that route continental letters were usually taken.

Even at that early day, commerce figured largely in the establishment and regulation of postal conveniences. Transactions in wool be-

tween Flemish merchants by means of correspondence were frequent and important. This commercial enterprise of wool export to the Netherlands, in its connection with the post service between the two countries, caused much wrangling. The merchants, fighting for their own privileges, and the crown seeking what were deemed legitimate fees for the Exchequer, were continually at variance. Proclamations were issued over the King's signature at short intervals. Their purport usually was to curtail privileges interfering, it was alleged, with the privileges of the English treasury. In the end, the merchants won their fight and were allowed to run their own post to Hamburg and Delft.

Much of the progress of the postal service in British dominions after the Flemish agitation had subsided was due to aggressiveness on the part of influential British merchants. During Rowland Hill's agitation in advocacy of penny postage the merchants of London stood solidly behind him. It is largely due to their determined action that a law dealing with the subject and making penny postage legal was eventually passed. Great Britain and the United States, as mentioned elsewhere, have worked together harmoniously and successfully for many years to strengthen each other's commercial influence through the facilities of cheap and rapid postal service. Furthermore their united efforts have done much toward bringing the nations of continental Europe and those of the Orient into line for postal reform.

*British Empire.*—The latest report officially issued by the British government shows that the total number of post-offices in the British Empire at the end of March, 1904, was 22,850. There were 37,521 road and pillar boxes. The aggregate of persons employed is given as 146,769 males and 39,262 females. Of these, 81,865 are in established offices, 11,092 being women. Included in the aggregate is an unestablished list of 106,166, of whom 28,170 are women.

The number of letters passing through the departments in 1900 was 1,812 millions; in 1904, 2,597 millions. In the year 1903-4 there were mailed 517 millions of postal cards, also 693 millions of book packages, 134 millions of newspapers, and 78 millions of parcels. The money-order system in the British Empire is one of the most perfect and successful institutions of its kind in the world, and a mighty factor in facilitating trade, both wholesale and retail. In 1900, 10 millions of inland orders were issued, valued at over 30 millions of pounds. In 1904, the total of inland orders had increased to 11 millions, with a value proportionately greater. During the same year postal orders for other places increased in value from 23 millions of pounds in 1895 to 30 millions of pounds in 1900-1. The total receipts of the British post-offices in 1900 amounted to £13,394,335; 1904, £15,824,394. The expenditures for 1900 were £9,683,999; 1904, £11,180,807.

*France.*—Official returns of France, 1902, show 11,282 post-offices, with total postal receipts of 282,475,164 francs. Postal and telegraph expenditures, 216,355,000 francs.

*German Empire.*—Latest official reports show that there were, in 1903, 38,610 post-offices in the German Empire. The receipts of the department for that year were 526,209,653 marks; expenditures, 464,759,672 marks.



## POSTAL UNION—POSTER ART

*Cash on Delivery System.*—By this system, which is now in operation throughout Austro-Hungary, Belgium, France, Egypt, Germany, Holland, Italy, Japan, Switzerland, New South Wales and British India, the postal authorities, railway companies or other carriers of goods undertake to act as intermediaries between the vendors and purchasers of goods by collecting from the latter on delivery the sale price of such goods. Efforts have been made to introduce this system into Great Britain, but the opposition of small retail traders has been so active and effective that legislation seems, for the present, impossible of accomplishment. The contention of retail traders is that the adoption of the proposed measure would have the effect of constituting the Government an agency for manufacturers and wholesale dealers, which would eventually bring ruin to the smaller retail tradesmen of provincial towns and country districts.

Representations have been made on several occasions to the government of Great Britain by the governments of Germany, France and other countries with a view to bringing about some plan having a purpose equivalent to the cash delivery system. In the countries where the plan is now in operation it has obtained a very firm hold on popular approval and promises to develop with rapidity. In Germany the system is considered to have achieved a striking success, no less than 16,500,000 packages having been carried on this plan during the last fiscal year.

**Postal Union, The.** See POST AND POSTAGE.

**Poster Art.** Posters, so called, are works of art designed for the purpose of advertising. The earliest example of the poster dates back to the days of Pompeian splendor. During the Middle Ages managers of theatres and officers recruiting for the army used pictorial advertisements. From these pictures, Jules Chèret of Paris (b. 1836), called the father of the modern poster, is said to have received his first suggestion of the possibility of adopting art to latter-day advertising. One of his first efforts was an announcement of a fairy play, 'La Biche au Bois,' in which Sarah Bernhardt was acting in 1867. Chèret's principles were conventionality, elimination of detail, arrangement and pure color. For a long time he was almost alone in his efforts and did not attain to the preeminence that has come in more recent years.

In order to produce a good advertising placard it must command the attention of the public. It should be attractive to the man in the street without being vulgar; sufficiently startling, but not aggressively so. Jules Chèret understands the requisites and limitations of this kind of art better than any other who has ever made any essays in it, either in his own country or elsewhere, and his works have gained for him a world-wide reputation. If there are other posters which appeal more to the artist, it is as works of art, not as art posters. It is no doubt largely owing to the example set by Chèret that so many artists have since taken up this line of work. Chèret has devoted his artistic gifts almost entirely to the production of posters, and the number that bear his signature is over 1,000. Chèret is not only a superb draftsman, but he is also infallible in compo-

sition. That he must have studied Japanese composition is clear. He understands mass-composition, and he appreciates the beauty of a blank canvas. Symmetrical and line composition are second nature to Chèret and no man knows better than he the theory of vibrating and complementary colors. Added to this is his individuality, his instinctive temperament of carnival dominating everything.

Chèret himself has defined his idea of a perfect poster as follows: "It should be as simple as possible and I consider the introduction of one figure and need I hardly say that of a lady for choice is indispensable; whenever it is possible this figure should be life-size. My own posters are never smaller than 60 centimetres (two feet), by 86 (nearly three feet), and my favorite size is 250 by 90; the figure should, of course, be elegantly and brightly dressed in some striking costume not likely to go out of fashion as long as the poster is to be in use. I always make a point of designing the lettering of the actual advertisements. I do not believe in black and white letters, but have no objection to their being very dark blue, red or violet; this produces the effect of black without giving a jarring note."

Close rivals to Chèret are Grasset and Steinlen and by some critics the two are considered to be in many respects superior to the master. Eugene Grasset, a native of Switzerland, is a decorator and architect by profession. His work is characterized by a vital principle of design, effective yet subdued. His Napoleon and Jeanne d'Arc (Bernhardt) posters are superb creations. Probably nothing superior in their way have ever been produced. They are true works of art as though they were painted in water-colors or oils. Grasset's work is always refined and harmonious, yet less bright and striking than Chèret's. There is more repose, and it appeals more to the artist than to the public. The poster of the Salon des Cent in its tenderness, its exquisite lines, and its spirituality, is worthy of Rossetti.

Of the other French artists De Feure, Guillaume, Ibels, Lautrec, Boutet de Monvel, Steinlen, Willette and Jossot are perhaps the most accomplished. Bossot is a great artist, essentially a caricaturist, who works with vagabond and artistic lines and in a morbid color-scheme—rusty greens and pale yellows. Steinlen is everywhere a charming artist. His "Lait Pur Sterilisé," a child in a red dress drinking from a bowl, envied by three eager tabby cats, is perhaps one of the most attractive posters ever made. Lautrec has not the refinement of Grasset, not the sprightliness of Chèret, yet he possesses an individuality which makes his work peculiarly interesting. His posters are generally simple in composition, and depend to a great extent for their effectiveness on the skilful arrangement of masses. Ibels is remarkably clever in drawings that are inimitably and effectively grotesque. Aristide Bruant has done some things that are strikingly forcible in their broad masses of color.

In the United States the modern poster artists include Louis J. Rhead, Will H. Bradley, Kenyon Cox, W. H. Carqueville, Edward Penfield, Ethel Reed, and others. WILL M. CLEMENS,

*Editorial Staff, 'Encyclopedia Americana.'*



## POSTING—POTASSIUM

**Posting**, in Europe, traveling by means of horses hired at different stations on the line of journey. Such a system appears to have been established by private enterprise on some of the main routes in England, at least as early as the reign of Edward II. It was afterward made a government monopoly. As letters were originally forwarded in the same manner, the name of post-office has come to be applied to the institution charging itself with the conveyance and delivering of letters. The custom still obtains in certain parts of England and in France and Spain.

**Postman Poet, The.** See CAPERN, EDWARD.

**Pos'tulant**, the canonical term for one who desires to take holy orders in the Protestant Episcopal Church of America, and whose name has been entered by the bishop upon a list of postulants, as required by Canon 2, Title 1 of the Digest. A postulant may in due course be recommended, by the Standing Committee of the diocese, to the bishop for admission as a candidate for holy orders. The term is applied in the Roman Catholic Church to those on probation before entering a religious order.

**Postula'tion**, in canon law, an appeal to a competent authority to remove a disability by which one who has been appointed to a benefice is prevented from entering upon it. The term was also applied to the method by which a bishop was translated. The canon law declared that a person once elected to one see could not be elected to another; and when an electoral college desired the bishop of another see to occupy their own, they petitioned the bishop to make the change. No postulation could be made unless the electoral college were unanimous, while in the case of an election a majority was sufficient.

**Pot-Pourri**, pŏt-poo-rē', (1) a name given foods of various kinds of meat and vegetables cooked together. (2) A mixture of rose leaves and various spices, kept in jars or other vessels as a scent. (3) A vase or bouquet of flowers used to perfume a room. (4) In music, a medley; a collection of various tunes linked together; a capriccio or fantasia on popular melodies. (5) A literary composition made up of several parts put together without any unity of plot or plan.

**Pot'amagetona'ceæ**, a family of water-plants closely associated with the *Naidaceæ* in the tribe *Helobia*. The principal fresh-water genus is *Potamageton*, whose species are commonest and among the most beautiful of the pond-weeds. The flowers have a four-pointed perianth, four sessile anthers, four ovaries, and four drupes or nuts. They protect the spawn of fish, and harbor innumerable aquatic animals, while their roots and seeds afford food to water-birds. A closely allied genus is that of the marine eel-grass (*Zostera*).

**Potamog'ale**, the generic name of a strange West African animal (*P. velox*), which might be called the insectivorous otter. It is a true insectivore, representing the family *Potamogalidæ*, is somewhat larger than a stoat, and the appearance and habits are like those of an otter, save that it is not certain that it subsists on fish. A related smaller potamogale (*Geogale aurita*) inhabits the valleys of Madagascar.

**Potash.** See POTASSIUM.

**Potassium** (from "pot-ashes," wood ashes being one of the best known sources of the carbonate of the metal), a metallic element, many of whose compounds have been known from antiquity, but which was first prepared in the metallic form by Davy, in 1807, by the electrolysis of fused potassium hydrate,—a substance which had previously been supposed to be itself elementary. In 1808 Gay-Lussac and Thénard showed that the hydrate can be reduced by heating it with finely divided iron, and in the same year Curaudan showed that the reduction can also be effected by carbon. Several methods of preparing metallic potassium are now in use. The best known of these, and the only one that was in practical service for many years, consists in the direct reduction of the carbonate of potassium by carbon, the reaction being carried out in an iron retort heated to redness. The chief products of the distillation are carbon monoxid gas and metallic potassium, the latter being volatile at a red heat. The production of potassium by this method is attended by more or less danger, not only because the vapor of potassium takes fire spontaneously upon contact with air or with water, but also because under certain conditions potassium and carbon monoxid combine to form a black, explosive compound, whose production has caused a number of fatal accidents. The potassium vapor should be permitted to condense before it issues from the neck of the retort, a cooling device being provided for effecting its liquefaction; and the molten metal should then be allowed to drip into a receiver containing petroleum oil, or some other similar fluid that is free from oxygen. In Castner's process, the carbonate (or hydrate) of potassium is mixed with carbon and finely divided iron, or with carbon and a metallic carbide, and the reduction is effected by the agency of heat, as before. A considerable part of the commercial supply of metallic potassium is now produced, however, by the electrolysis of the melted hydrate or chloride of potassium.

Potassium is a lustrous, silvery-white metal, brittle at 32° F., but soft and wax-like at ordinary temperatures, so that it can be easily cut with a knife. It melts at about 140° F., and boils at about 1,250° F. (when heated in an atmosphere of hydrogen), its vapor being green. It has a specific gravity of about 0.87, and, with the exception of lithium, is the lightest metal known. Its specific heat is 0.166, and its coefficient of linear expansion (Fahrenheit scale) is about 0.0000467. It conducts electricity much better than mercury does, and it is soluble in anhydrous liquid ammonia (NH<sub>3</sub>), forming a blue solution from which metallic potassium is again deposited upon the evaporation of the ammonia.

Chemically, potassium has the symbol K (from "kalium," the Latin word for potash), and the atomic weight 39.15. It oxidizes in the air with great readiness, a freshly cut surface becoming almost instantly covered with a film of oxid. It also decomposes water vigorously, uniting with it to form potassium hydrate, KOH, in accordance with the equation  $K + H_2O = KOH + H$ , hydrogen gas being liberated at the same time. When potassium is thrown upon the surface of water it floats, and the heat generated by the chemical action is sufficient to set fire to the liberated hydrogen and to part of the



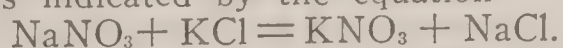
## POTASSIUM

potassium. This experiment is a favorite one in the lecture room, since it is beautiful as well as instructive, the flame having the purple color that is used in the laboratory as a test for the presence of volatile potassium salts. (See BLOW-PIPE ANALYSIS.) Potassium never occurs in nature in the free state, but it forms an essential constituent of many minerals, among the most important of which are feldspar, nitre, and carnallite. It also occurs in the animal body and in plants, and in remote country districts its carbonate is still prepared (chiefly for the manufacture of soap) by leaching wood ashes.

The potassium compounds are exceedingly numerous, and many of them are of great importance both in the laboratory and in the arts. Two oxids of the metal are certainly known, and others probably exist also. Potassium monoxid,  $K_2O$ , which is the oxid that is understood when "potassium oxid" is mentioned without qualification, is formed when thin slices of the metal are allowed to oxidize in cool, dry air. It may be prepared more readily on the large scale by heating potassium just to its melting point, and then leading over it a stream of air that has been dried and freed from carbon dioxid. The monoxid is a gray, brittle substance, which has a specific gravity of 2.66, and melts at a strong red heat. It has a powerful affinity for water, with which it combines with the evolution of much heat, to form potassium hydrate,  $KOH$ . Potassium tetroxid (or peroxid) is formed when potassium is burned in a stream of pure, dry oxygen. It has the formula  $K_2O_4$ , and is a yellowish substance at ordinary temperatures, melting, at a red heat, to a black liquid, which crystallizes upon cooling. The tetroxid combines with water to form potassium hydrate and peroxid of hydrogen, oxygen being also set free at the same time. When heated to a white heat, the peroxid gives off oxygen and becomes reduced to the monoxid.

Potassium chloride,  $KCl$ , occurs native in large quantities at Stassfurt, Germany, chiefly in combination with magnesium chloride, with which it forms the mineral "carnallite,"  $KCl \cdot MgCl_2 + 6H_2O$ . Most of the commercial supply of potassium chloride is now prepared from this mineral by crystallizing its solution. In order to obtain a satisfactory product, however, many practical details must be carefully attended to, for which reference must be made to advanced works on inorganic chemistry, and to treatises on alkali manufacture. Potassium chloride is very similar in its general properties to sodium chloride (common salt). It has a saline taste, is white in color, and crystallizes in cubes. Its specific gravity is 1.94, and it melts at about  $1,350^\circ F$ . Potassium chloride is now extensively used as a source of potassium in the preparation of other salts of that metal.

Potassium nitrate, or "nitre" (q.v.),  $KNO_3$ , occurs native, but the greater part of the commercial supply is now manufactured by acting upon the cheaper nitrate of sodium ( $NaNO_3$ ) by means of potassium chloride; the reaction being as indicated by the equation



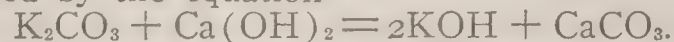
Potassium forms two carbonates, known respectively as the "normal" carbonate and the "acid" carbonate. Normal potassium carbonate,  $K_2CO_3$ , may be obtained in an impure state by leaching wood ashes and evaporating the result-

ing solution to dryness. The residue is then strongly heated to destroy any organic matter that it may contain, and is subsequently re-dissolved and re-deposited by evaporation. The crude product as obtained from wood ashes is known as "pearl-ash," or often simply as "potash." Pure normal potassium carbonate is best prepared by heating ordinary mono-tartrate of potassium (see below), which is thereby resolved into a mixture of free carbon and potassium carbonate, from which the latter salt may be obtained by solution, filtration, and subsequent evaporation. Acid potassium carbonate has the formula  $HKCO_3$ , and may be prepared by passing carbon dioxid over the normal carbonate, or through its concentrated solution in water; the reaction being as indicated by the equation



The greater part of the commercial supply of normal potassium carbonate is now prepared by a method similar to the Leblanc process for the preparation of carbonate of sodium. (See SODIUM.) Normal carbonate of potassium is quite strongly alkaline, and is deliquescent, and very readily soluble in water. It is used in the manufacture of soap, and as a raw material in the manufacture of various compounds of potassium. The acid carbonate is much less soluble than the normal salt, and its solution is nearly neutral to litmus paper.

Potassium hydrate, potassium hydroxid, or "caustic potash,"  $KOH$ , is formed when metallic potassium is dissolved in water; but the commercial supply is obtained either by the electrolysis of a solution of a potassium salt, or by acting upon a solution of normal potassium carbonate by means of slaked lime,  $Ca(OH)_2$ ; the reaction, in the latter case, being as represented by the equation



The calcium carbonate ( $CaCO_3$ ) that is formed at the same time is practically insoluble, and may be removed by filtration. The solution is then evaporated to dryness, and the resulting hydrate of potassium is finally melted and cast into sticks in metallic molds. Potassium hydrate is a white substance, absorbing moisture from the air with great readiness, and also taking up carbon dioxid gas from the air, being thereby converted into the acid carbonate. The hydrate dissolves in half its own weight of water, the solution being intensely alkaline. The solid hydrate has powerful cauterizing properties (whence the name "caustic potash"), and destroys the skin when brought in contact with it. It is used in the arts and in the laboratory for a great variety of purposes.

The bromide of potassium ( $KBr$ ) and the iodide ( $KI$ ) are soluble, crystallizable salts, which are largely used in medicine and in photography. The bromide may be prepared by adding bromide to a solution of potassium hydrate, the reaction being



To remove the potassium bromate ( $KBrO_3$ ) that is formed, the solution is evaporated to dryness after the addition of a small quantity of powdered charcoal, and the dry residue is well pulverized, and finally raised to a dull red heat. The carbon that is present then reduces the bromate to potassium bromide and free carbon dioxid gas. When this process is complete, the

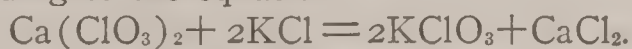


## POTASSIUM PERCHLORATE—POTATO

mass is cooled and re-dissolved in water, after which the pure bromide of potassium is prepared by evaporation and crystallization. Iodide of potassium may be obtained in a similar manner. Potassium chlorate,  $\text{KClO}_3$ , which is used in the laboratory for effecting oxidations and also as a source of free oxygen, and which is likewise employed in medicine, may be prepared by passing chlorine gas through a warm, concentrated solution of potassium hydrate; chloride of potassium being formed at the same time, as is indicated by the equation



the reaction being entirely analogous to that given above for the formation of potassium bromide. As will be seen from the last equation, only one sixth of the potassium of the original hydrate is converted, by this method, into the form of chlorate; the remaining five sixths being converted into the chloride. The process as given is therefore wasteful; for although the potassium chloride may be easily recovered, it is not available for the manufacture of further quantities of the chlorate until it has been re-converted into the hydrate. In practice it is therefore customary to prepare calcium chlorate,  $\text{Ca}(\text{ClO}_3)_2$ , as the first step in the process; potassium chlorate being then obtained by treating the calcium chlorate with potassium chloride, according to the equation



Several sulphates of potassium are known, the most important of these being the normal sulphate,  $\text{K}_2\text{SO}_4$ , and the acid sulphate,  $\text{HKSO}_4$ . These may be prepared by the action of sulphuric acid upon potassium chloride; but the commercial supply is obtained in large measure from the mineral "kainite," which occurs in great quantities at Stassfurt, and which consists of normal potassium sulphate in combination with the sulphate and chloride of magnesium. It is also obtained as a by-product in the working up of beet root, vinasse and kelp, and in other chemical industries. Normal potassium sulphate forms, with aluminum sulphate, a compound familiarly known as "alum" (q.v.) or "potash alum," which crystallizes in octahedra having the composition



Three important salts of potassium, known respectively as the cyanide, ferrocyanide, and ferricyanide, are described under HYDROCYANIC ACID, and the permanganate of potassium is described under MANGANESE. Several sulphides of potassium may be prepared, the best known being those having the formulæ  $\text{K}_2\text{S}$ ,  $\text{K}_2\text{S}_2$ ,  $\text{K}_2\text{S}_3$ , and  $\text{K}_2\text{S}_5$ . These are all soluble, and evolve sulphuretted hydrogen when heated with an acid. Common "liver of sulphur" is a brown, ill-smelling substance, prepared by heating normal potassium carbonate with sulphur. It contains various sulphides of potassium, together with more or less of the normal sulphate and carbonate of potassium. When potash and pulverized quartz are melted together, a compound of potassium, oxygen and silicon is obtained, which is usually described as a silicate of potassium. This compound is soluble in water, and is known in the arts as "potash water glass," the corresponding compound of sodium being known as "soda water glass." The residue left when a

solution of water glass is evaporated has a glassy appearance, from which fact the popular name is derived.

With tartaric acid,  $\text{H}_6\text{C}_4\text{O}_6$ , potassium forms two compounds (the acid being dibasic). Mono-potassium tartrate, or acid potassium tartrate,  $\text{KH}_5\text{C}_4\text{O}_6$ , is formed in the course of the fermentation of wine, and, as deposited by the wine in a crude state, is known as "tartar," or "argol." When purified, it constitutes the substance familiarly known as "cream of tartar," which is used in the manufacture of various baking powders. The normal tartrate of potassium,  $\text{K}_2\text{H}_4\text{C}_4\text{O}_6$ , is not used in the arts to any great extent.

With the fatty acids (for example, stearic, palmitic, etc.), potassium combines to form salts that are familiarly known as "soaps;" the combination being usually effected by boiling potassium hydrate or carbonate with fat. The fats are composed of glycerine in combination with various fatty acids; and the potassium, being more basic than the glycerine, replaces it in the compound, the result being the formation of a soap, and the simultaneous liberation of free glycerine. (See SOAP.)

**Potas'sium Perchlorate.** See PERCHLORIC ACID.

**Potato**, a perennial herb (*Solanum tuberosum*) of the order *Solanaceæ*. It is a native of the Chilean and Peruvian Andes, but extends more or less irregularly as far north as Colorado where a wild form is occasional. Its tuberous roots send up weak stems which bear pinnate leaves and white or lilac flowers which in cultivation are rarely followed by fruits. When fruits are produced they are globular, yellow or purple, and about the size of a gooseberry. The plant is extensively cultivated in temperate climates for its tubers, which are used as a staple food for man, and to a less extent for animals. It was in cultivation before the discovery of America, and was taken to Europe (probably to Spain from Peru) in the early part of the 16th century. It seems that Sir Francis Drake introduced it into England in 1586, though Sir Walter Raleigh is said to have brought it with him the year previous. Gerarde mentions it in his *Herball* in 1597 under the name *Batatas Virginiana*, but it seems to have been regarded somewhat as a curiosity until the latter part of the 18th century, although the Royal Society of London had recommended it in 1663 as a possible safeguard against famine among the Irish peasantry. Owing to the failure of grain crops in 1772 the potato soon commenced to grow in popularity as a food-plant, but even as late as 1771 only two varieties, one white and one red, were listed. In 1900 it was no uncommon thing for agricultural experiment stations in the United States and Europe to test more than 150 varieties at one time. The crop is one of the most important in Germany, France, Ireland and the United States. In the last-named country the yield per acre averages less than 90 bushels (1899) but with proper attention to cultivation, etc., yields of 200 to 400 bushels are not unusual, and even 1,000 bushels have been obtained under the best conditions. By artificial methods 2,558 pounds of tubers have been grown from one pound of seed in one season; but this was in a competition for prizes.



## POTATO

The crop in the United States for 1899 was 228,783,232 bushels, which sold at an average of 39 cents a bushel. Besides being an important article of food the potato is largely used in the manufacture of starch, and in some countries for making alcohol, etc. For such purposes special varieties are generally grown; these are usually coarse and are little used for human food.

The culinary varieties have been found to contain about 78 per cent water, 18 per cent starch, 2.2 per cent protein, 1 per cent ash and 0.1 per cent fat. During storage these proportions change, since the tubers shrink nearly two per cent a month as an average for seven months. Since the potato is rich in starch and poor in protein it is valued chiefly as a carbohydrate food, the deficiency of protein being made up by eggs, meat, fish, beans, peas, etc., and that of fat being supplied by butter, fat, oat-meal, etc. During the process of cooking the cells are ruptured, the starch expanded and made "mealy," and great changes in flavor and palatability are produced, either by the dissipation of raw flavors, the development of new ones, or both. In the cooked state more than 90 per cent of the nutritive substances are considered assimilable. Large quantities of potatoes are annually evaporated to supply the demand for provisioning expeditions, camps, cruises, etc. "Saratoga chips" are thin slices of potato which have been fried in fats or oils and sprinkled with salt. The potato is cooked in perhaps a greater variety of ways than any other vegetable, but fundamentally the various processes are baking, boiling, and frying, the first being the most economical when properly performed.

*Methods of Propagation.*—The potato is propagated almost wholly by means of its tubers, which are cut in many ways intended to increase the amount of "seed." Some growers plant the whole tuber, others half-tubers, and others "single-eye pieces." Probably there is no one method which is best under all conditions of soil, cultivation, etc., but it seems as if the half-tuber of medium sized, well formed specimens is in most general favor. Extra large and little potatoes are not favored. In the propagation of new varieties seed-balls are used, and after the variety is proved to be worthy it may be increased rapidly by means of cuttings made from the sprouts. These are rooted under glass in the same way as geranium cuttings, etc., and the rooted plants set in good soil when the weather has become settled. Some growers expose their "seed potatoes" to the sun for about ten days before planting in order to hasten the growth. During this period of exposure small rosettes of sprouts appear at the eyes, and it is claimed that some of the starch is converted into sugar, with the result that when the tubers are planted they make a more rapid growth than under ordinary conditions. With certain varieties and upon certain soils the period of growth may be shortened to eight weeks or even less.

The plants will thrive in the cooler tropics and even in the colder temperate regions; in moist and dry climates; and on many kinds of soil. But the mild-temperate regions, fairly dry climates, and light loamy soils generally suit them best. Such produce earlier, mealier, more highly flavored potatoes than the other conditions. While Americans demand potatoes

of this order, Europeans seem generally to prefer the harder, less mealy tubers, produced in cloudy climates and upon rather rich, moist loamy soils. The soil should be well supplied with organic matter, but this should not be added fresh in the form of stable manure. Such applications should be made to a previous crop, such as corn, since practice has shown that the quality of the crop is thus improved. Generous applications of commercial fertilizers should be given. Dried blood, sulphate of potash, superphosphate, ammonium sulphate and wood ashes are favorite fertilizers for this crop. The amounts to apply will depend largely upon the character and quality of the soil. The plowing should be as deep as the surface soil will permit, six inches or more. It should be done as soon as the weather becomes settled. The "seed" is dropped at intervals of 12 to 18 inches in rows about 30 inches apart. Generally this is done by hand in a furrow about four inches deep, but upon a large scale potato planting machines are used. These machines make their own furrows, sow the fertilizer, drop the "seed" at regular intervals, cover the row and mark the position of the next row.

Before the young plants appear a weeder is run over the field once or perhaps twice to keep the surface loose and to destroy spouting weeds; after the plants are up the cultivator is used between the rows until the vines cover and shade the ground. Flat cultivation is in general vogue, but ridging or hilling has its advocates, who claim that the practice dries and warms the soil, thus hastening maturity, and that the young potatoes are less likely to be exposed to the sun and thus become green. When the tops begin to turn yellow the tubers may be dug; but late kinds, which are generally planted three or four weeks later than the earliest crops and about two inches deeper, are allowed to remain in the ground until the vines have died or until the weather becomes cold in the autumn. The number of cultivations varies from a minimum of three for the earliest crops, to a maximum of eight or sometimes more for the late. Hand digging is usually practised upon small farms; a specially made plow is also often employed; but upon large plantations machines which sift the tubers from the soil and leave them at the surface are in common use. In the South a second crop of potatoes often follows the first in the same season; in the North the land occupied by early potatoes is often planted to winter wheat; that occupied by a late crop is left bare until spring when cereals frequently are sown. Potatoes are favorite crops for preparing the land for such crops as strawberries, raspberries and other small fruits, truck crops, etc.

Among the insects which feed upon the potato are tortoise beetles, blister beetles, and flea beetles. The three-lined potato beetle (*Lema trilineata*) and the tomato worm (*Sphinx quinque-maculata*) are also frequently seriously troublesome. The most widely destructive enemy, however, is probably the potato-bug or properly the Colorado potato beetle (*Doryphora decemlineata*). Unlike most insect pests this beetle became troublesome first in the West and migrated eastward. When the potato was first cultivated in the West this insect left its original food plant the sand-bur (*Solanum rostratum*), and traveled from field to field, living upon



## POTEMKIN — POTENTIAL

potato vines. In 1860 it had become troublesome in Nebraska; in 1870 it was busy in Ohio and Ontario; and in 1875 it was well known in the Atlantic States as far south as Virginia. Its spread in the South has been less rapid probably because the potato is there less extensively grown than in the North. The hibernating adults appear in the spring and lay yellow eggs in clusters upon the foliage, sometimes even before it appears above the surface. In about a week the red larvæ appear, eat ravenously for about three weeks, pupate for about ten days and emerge for feeding and egg-laying. From two to five broods appear in a season. This insect has a number of enemies, but farmers prefer to depend upon Paris green or other arsenites which are sometimes applied as a dust while the dew is on the plants, but usually as a spray. This is also more or less effective for the other species mentioned above.

Two stalk-borers are often troublesome; one, the larva of an owlet moth (*Gortyna nitela*), the other of a beetle (*Trichobaris trinotatus*). Wilting of the vines is generally the first indication of their presence and the only remedy recommended is the burning of the vines as soon as observed to be wilting.

Two so-called plant diseases are reported troublesome in the North; early blight (*Alternaria solani*) and late blight or rot (*Phytophthora infestans*). In the South *Bacillus solanacearum* is believed to be the cause of the brown rot. These three maladies are characterized by the destruction of the plants and are thought to be spread by insects which feed upon the foliage. Hence the remedies most in vogue are the control of the insects and the use of Bordeaux mixture. Care in selecting "seed" potatoes from non-infected districts and rotation of crops, the potatoes being moved to fresh soil each year, are also recommended. The scabbiness of tubers is thought to be prevented by soaking the "seed" in a solution of formalin or of corrosive sublimate, and by rotation of crops.

Consult: Carman, 'New Potato Culture'; Terry, 'A B C of Potato Culture'; Smith, 'Economic Entomology'; and many bulletins of the State Agricultural Experiment Stations, and of the United States Department of Agriculture.

**Potemkin**, pŏ-tēm'kĭn (Russ. pŏt-yŏm'kĭn), **Gregory Alexandrovich**, prince of Taurida, Russian field-marshal: b. Smolensk, Russia, 1736; d. Bessarabia, Russia, 16 Oct. 1791. He came of a noble Polish family, entered the Russian army, was distinguished for bravery in the war against the Turks in 1771-2 and was promoted lieutenant-general. He soon supplanted the brothers Orloff in the favor of the empress Catharine and from 1776 until his death was her acknowledged favorite, a position in which he wielded great power. He enlarged the Russian army, built a fleet on the Baltic Sea, annexed the Crimea, founded the cities Kherson, Kertch, Nikolaiev, Sebastopol, etc., was honored by Frederick the Great, Maria Theresa, Joseph II., and other monarchs, and became recognized as an important factor in the politics of Europe. He was waging a successful war against Turkey at the time of his death. In his private life he was mean and avaricious though loaded with wealth by the empress, and his public life, though eminently successful, shows little indication of

high ability as a statesman. Consult Cérenville, 'Vie de Prince Potemkin' (1807).

**Potential.** In the third volume of the *Mécanique céleste*, Laplace, in 1784, determined the attraction exerted by a spheroid on a particle outside the mass, in the course of which he discovered the so-called potential function as the limit of the sum obtained by dividing every element of the mass of the attracting body by its distance from the point upon which the force is exerted. That is, in the case of gravitation, if  $\Delta m$  denotes the element of mass,  $r$  the distance from the particle at P and V the potential function, then

$$(1) \quad V = \lim_{\Delta m \rightarrow 0} \sum \frac{\Delta m}{r}$$

where the numeration includes all the elements that compose the mass M. Laplace then proceeded to show that if the potential function of a mass was known at any external point, the attraction exerted in any direction by the mass upon that point could be found at once by performing a differentiation of the function in the required direction and, finally, that such a potential function would always be a solution of the differential equation

$$(2) \quad \nabla^2 V \equiv \frac{\delta^2 v}{\delta x^2} + \frac{\delta^2 v}{\delta y^2} + \frac{\delta^2 v}{\delta z^2} = 0$$

when  $\nabla^2$  is a symbol generally employed to denote the operator

$$\Delta^2 \equiv \frac{\delta^2}{\delta x^2} + \frac{\delta^2}{\delta y^2} + \frac{\delta^2}{\delta z^2}.$$

This is called Laplace's equation and V is a potential function.

Poisson (1813), a student of Laplace, gave the form of the equation which V must satisfy for all points, situated either within or without the attracting mass, as

$$\nabla^2 V = -4\pi\rho.$$

This equation must be satisfied by the potential function for every conceivable distribution of attracting matter at any point P, where  $\rho$  is the density of the attracting matter at P. Since  $\rho = 0$  for points outside, Poisson's equation reduces to that of Laplace in such a case.

In 1827, George Green, a self-educated mathematician, and before he took his degree at Cambridge in 1837, noted the peculiar property of V; namely, that it is a function of the initial and the final position only, thereby recognizing its universal application in dynamics in the treatment of a conservative system of forces, that is, a system that is independent of all intermediate conditions. For example, the work done in moving a mass against the force of gravity from P to Q is the same whether it is lifted directly up from P to Q or moved along any other path, as an inclined plane, provided always there is no friction. That is the earth and every mass connected therewith constitute a conservative system with respect to gravity. The work done is independent of the path. But if, as in practice, friction is involved, some energy is dissipated in overcoming this force and the system is no longer conservative. Green recognized, therefore, that, so far as natural phenomena are concerned, forces that are functions of distances only constitute a conservative system to which the theory of the potential is applicable and, in particular, that in addition to gravitation, forces



## POTENTIAL

exerted by electrified and magnetized bodies upon each other are of this nature. Green was the first to call  $V$  the potential function. Its peculiar property may be said to be this: that it measures the work done in moving a unit of mass, electricity or magnetism from one position to another by virtue of the forces in action.

*Attraction.*—Newton's law states that every particle of a body attracts every particle of another body with a force that varies directly as the product of the masses of the attracting particles and inversely as the square of the distance between them. Let  $P$  be any particle, or point,  $M$  any mass,  $\rho$  the average density of an element of mass,  $\Delta v$ ,  $Q$  a point of the element whose coördinates are  $x', y', z'$ , and take  $x, y, z$  as the coördinates of  $P$ . By definition the attrac-

tion at  $P$  in the direction  $PQ$  will be  $\frac{\rho \Delta v}{PQ^2}$

and its components in the direction of the axes become  $\frac{\rho \Delta v}{PQ^2} \cos \alpha$ ,  $\frac{\rho \Delta v}{PQ^2} \cos \beta$ ,  $\frac{\rho \Delta v}{PQ^2} \cos \gamma$ , where

$\alpha, \beta, \gamma$  are the direction cosines of  $PQ$ . But  $QP^2 = r^2 = (x' - x)^2 + (y' - y)^2 + (z' - z)^2$ ,

whence  $\cos \alpha = \frac{x' - x}{r}$ ,  $\cos \beta = \frac{y' - y}{r}$ ,  $\cos \gamma = \frac{z' - z}{r}$ .

Denoting the components of the total attraction by  $X, Y, Z$ , we have, by Newton's law:

$$X = \iiint \frac{\rho(x' - x) dx' dy' dz'}{r^{\frac{3}{2}}},$$

$$Y = \iiint \frac{\rho(y' - y) dx' dy' dz'}{r^{\frac{3}{2}}},$$

$$Z = \iiint \frac{\rho(z' - z) dx' dy' dz'}{r^{\frac{3}{2}}},$$

when the integration is taken over the mass  $M$ . It follows that the resultant attraction at  $P$  due to  $M$  will be  $R = \sqrt{X^2 + Y^2 + Z^2}$ . But by definition, the potential function of  $P$  due to  $M$ , assuming as the element of mass  $dm = \rho dx' dy' dz'$  will be

$$V = \iiint \frac{\rho dx' dy' dz'}{r^{\frac{1}{2}}} = f(x, y, z), \text{ and } \frac{\delta v}{\delta x} = \iiint \frac{\delta}{\delta x} \left\{ \frac{\rho dx' dy' dz'}{[(x' - x)^2 + (y' - y)^2 + (z' - z)^2]^{\frac{1}{2}}} \right\} = \iiint \frac{\rho(x' - x) dx' dy' dz'}{r^{\frac{3}{2}}},$$

differentiation under the sign of integration being possible when  $P$  is outside the mass  $M$ , since  $r$ , the radical in the denominator, can in that case never become infinite. By comparison observe that the last expression is the attraction  $X$ . That is

$$\frac{\delta v}{\delta x} = X, \frac{\delta v}{\delta y} = Y, \frac{\delta v}{\delta z} = Z; \text{ whence}$$

$$R = \sqrt{X^2 + Y^2 + Z^2} = \sqrt{\left(\frac{\delta v}{\delta x}\right)^2 + \left(\frac{\delta v}{\delta y}\right)^2 + \left(\frac{\delta v}{\delta z}\right)^2}.$$

That is, to find the component of the attraction in any direction for a point  $P$ , find the potential

function at  $P$  and differentiate this function partially in the required direction.

*Potential Function as Measure of Work.*—By definition, the work done in moving a unit of mass along a path  $S$  against a force  $F$ , is equal to the product  $F \times S$ . Let the attraction at any point of the path and opposing the force

$F$  be  $-\frac{\delta v}{\delta s}$ , negative since in the opposite direc-

tion from the motion, and let  $\Delta s$  be an element of the path. Then, if the unit mass moves from  $P_1$  to  $P_2$ , the work done is given by

$$W = \lim_{\Delta s \rightarrow 0} \sum_{P_1}^{P_2} F \Delta s = - \int_{P_1}^{P_2} \frac{\delta v}{\delta s} ds = V_1 - V_2,$$

when  $V_1$  and  $V_2$  are the values of the potential function of  $P_1$  and  $P_2$  respectively. That is, the difference or loss in potential measures the work done.

Since the difference of potential is the measure, we observe that the farther  $P_2$  is from the attracting mass the less  $V_2$  becomes. For, in general,

$$V = \lim_{\Delta m \rightarrow 0} \sum \frac{\Delta m}{r},$$

and if  $r_0$  denotes the distance of the nearest point in the attracting mass from  $P$ , then

$$V < \frac{1}{r_0} \sum \Delta m, \text{ or } V < \frac{M}{r_0}.$$

That is when  $P$  is at infinity  $r_0 = \infty$ , and the potential is zero.

It follows that when  $P_2$  is at infinity,  $W = V_1 - V_2 = V_1$ .

That is, the potential function or the potential at any point  $P$ , due to an attracting system is equal to the work done in moving a unit mass considered as concentrated at  $P$ , from  $P$ , to infinity along any path. In most modern works on mathematical physics the word "potential" does not denote the value of the potential function at a point but measures the work done in moving a mass from a given position to infinity in the presence of the system considered.  $W$  is used by some authors as "the potential of the mass  $M'$  with reference to the mass  $M$ ." Others use the negative of  $W$  as the equivalent of "the mutual potential energy of  $M$  and  $M'$ ."

*Laplace's Equation.*—It is not difficult to show that  $\frac{\delta^2 V}{\delta x^2}$ ,  $\frac{\delta^2 V}{\delta y^2}$ ,  $\frac{\delta^2 V}{\delta z^2}$  are everywhere finite and

that, as a consequence, the potential function is always finite and continuous. Moreover, when  $P$  is outside  $\psi$  the masses, the expression under the radical in  $\frac{\delta V}{\delta x}$  is every-

where finite within the limits of integration and it becomes possible to differentiate under the signs of integration. That is,

$$\frac{\delta^2 V}{\delta x^2} = \iiint \frac{3(x' - x)^2 - r^2}{r^5} dx' dy' dz',$$

$$\frac{\delta^2 V}{\delta y^2} = \iiint \frac{3(y' - y)^2 - r^2}{r^5} dx' dy' dz',$$

$$\frac{\delta^2 V}{\delta z^2} = \iiint \frac{3(z' - z)^2 - r^2}{r^5} dx' dy' dz',$$

whence we derive by addition Laplace's equation as one to be satisfied by the potential func-



tion at all points outside the attracting mass

$$\nabla^2 V = \frac{\delta^2 V}{\delta x^2} + \frac{\delta^2 V}{\delta y^2} + \frac{\delta^2 V}{\delta z^2} = 0.$$

The generalized form due to Poisson requires an application of a form of Green's theorem due to Gauss and is applicable to all points. As stated, Poisson's equation is  $\nabla^2 V = -4\pi\rho$ .

For a clear treatment of the elements of the theory of the potential function, consult: 'Newtonian Potential Function,' B. O. Peirce, 1886, from which the present article is in the main derived. Consult also the mathematical papers of George Green, reprinted by Ferrers; Thomson and Tait, 'A Treatise on Natural Philosophy'; Maxwell, 'An Elementary Treatise on Electricity'; Watson and Burbury, 'The Mathematical Theory of Electricity and Magnetism'; Clausius, 'Die Potentialfunktion und das Potential.'

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**Potentilla, Cinquefoil, or Five-Finger**, a genus of herbs and shrubs of the order *Rosaceæ*. The numerous species are mostly perennials and widely distributed in the north temperate and arctic zones. They have compound leaves and variously colored flowers like the strawberry, from which the species are readily distinguished by the dry receptacle; that of the strawberry is juicy. They blossom throughout the whole season with a climax in midsummer. They may be readily propagated by division and by seed, and thrive well upon heavy soil. However, they may become persistent weeds in favorable situations. *P. fruticosa* is especially troublesome upon moist soils when it has once become established. *P. tridentata* is an evergreen species which forms a dense carpet of verdure.

**Potenza**, pō-těnzä, Italy, a river, province and city. (1) The Potenza River lies in the province of Macerata, rising in Monte Pennino, about 4,800 feet above sea-level, crosses the province in a northeasterly direction, and empties into the Adriatic at Porto Recanati, near Potenza Picena, the ancient Roman colony of Potentia, founded 184 B.C. the site of the abbey of Santa Maria. (2) The province, formerly called Basilicata, is described under that name. (3) The city, capital of the province, lies on the left bank of the Basento and on the railroad between Naples and Metaponto, is the seat of a bishop and of several important courts, has a cathedral church, a liceo, a technical school, and a great prison. Pop. (1901) 16,186. It is near an older city of the same name, the old Roman colony of Potentia in Lucania, which was captured by the Emperor Frederick II., and by Charles of Anjou. An earthquake 16 Dec. 1857 nearly destroyed the modern city.

**Potidæa**, pōt-ī-dē'a, in ancient history, a city of the peninsula of Pallene in Chalcidice, founded as a Corinthian colony in the beginning of the 6th century B.C. It was successfully defended against the Persians under Artabazus in 479; in 432 revolted from the Athenian League, thus precipitating the Peloponesian war, in which it was captured by the Athenians in 429 and occupied by Athenian colonists; was destroyed in 356 by Philip II. of Macedon; and was replaced in 316 by Cassandreia, which prospered until its destruction by the Huns.

**Potiphar** (pōtīfār) **Papers, The**, a series of sharply satirical papers on New York society by George William Curtis, first published in Putnam's Magazine in 1853. The papers are somewhat in the manner of Addison's satires on the pretensions and insincerities of society; but at times the bitterness becomes more scathing, and reminds one of Thackeray in its merciless analysis of folly and ignorance. One of the enduring characters is the Rev. Cream Cheese, who sympathetically advises with Mrs. Potiphar as to the color of the cover of her prayer-book.

**Pot'latch**, among American Indians, a feast often lasting several days, given to a tribe by one of its members who aspires to the position of chief. The word is from the Nootka, meaning a gift, and at the potlatch feast, numerous and valuable gifts are distributed among the members of the tribe.

**Potocki**, pō-tōts'kē, **Ignanzy**, COUNT, Polish patriot, cousin of S. F. Potocki (q.v.): b. 1751; d. Vienna 20 Aug. 1809. He was grand marshal of Lithuania, and united with Malachowski, Kolontady, and other patriots in support of the constitution of 3 May 1791. He procured the declaration of the king in its favor, and in 1792 went to Berlin to induce the Prussian court to protect the Poles from Russia. When the Russian troops took possession of the country Potocki fled to Dresden, and was deprived of his estates. In 1794 he returned to Warsaw to engage in the attempt of Kosciusko, and was appointed general and member of the supreme national council. After the capture of Warsaw he remained in the city, but was arrested and confined as a state prisoner until 1796. In 1806 he again engaged in public affairs, and exerted himself to effect the abolition of serfdom, and to promote the progress of education among the people.

**Potocki, Jan**, Polish historian: b. 1761; d. Oladovka 1815. At an early age he formed the resolution of clearing up the obscurity that rested on Slavonic history, and prepared himself for carrying out his resolution by a course of linguistic studies, and by traveling over the lands occupied by Slavonic nations. His chief works are: 'Essai sur l'Histoire Universelle et Recherches sur la Sarmatie' (1788); 'Histoire Primitive des Peuples de la Russie' (1802); 'Fragments Historiques et Géographiques sur la Scythie, la Sarmatie, et les Slaves' (1794).

**Potocki, Stanislas Felix**, COUNT, Polish patriot and statesman: b. 1745; d. 1805. He adhered pertinaciously to the old constitution of Poland, and exerted his influence against the constitution of 3 May 1791. (See POLAND.) Potocki so far forgot his duty to his country as to form connections with Russia, and on 14 May 1792, joined with Rzevuski and Branicki in the declaration at Targovice against the constitution. He then united himself with the Russian army, and was one of the leaders of the diet of Grodno, which abolished the constitution, and subscribed the act for the partition of the country. He was thought to aspire to the crown, and received important appointments from Catharine II.

**Potocki, Stanislas Kostka**, Polish patriot and statesman, brother of I. Potocki (q.v.): b. 1752; d. 14 Sept. 1821. He distinguished himself



## POTOMAC—POTOSI

greatly by his eloquence in the various diets which were held between 1788 and 1792. When the king acceded to the Confederation of Targowice, and by that false step consummated the ruin of Poland, Potocki retired to Austria; but was arrested there and imprisoned in a fortress. On his release he continued to live in retirement till the creation of the grand-duchy of Warsaw in 1807, when he returned to his native country, and as president of the council of education applied himself to the promotion of intellectual culture among his fellow-countrymen. When Napoleon gave out that he meditated the restoration of the ancient kingdom of Poland, Potocki's talent and influence were called into action. In 1815 he was appointed minister for ecclesiastical affairs and public instruction. He wrote a work on eloquence (1815) and an uncompleted Polish translation (1815) of Winckelmann's work on ancient art.

**Potomac**, pō-tō'māk, a river in the eastern part of the United States, formed by the junction of two rivers on the boundary between Maryland and West Virginia. The river called North Branch rises in the western Alleghanies and the South Branch in the central Alleghanies, and flowing northeast they unite about 15 miles southeast of Cumberland. The North Branch flows southeast from Cumberland. From the junction of the two head-streams, the river flows generally east-southeast, forming the irregular boundary between Maryland and West Virginia and between Maryland and Virginia, and after a course of over 400 miles enters Chesapeake Bay about 73 miles from the Atlantic Ocean. The chief branches are the Shenandoah from Virginia, and the Monocacy from Maryland. At Harper's Ferry the river breaks through the Blue Ridge, forming a picturesque gorge. There are a number of falls, especially in that part of the course through the mountains. About 15 miles above Washington begins a rapid descent which in two miles is 80 feet and which ends with the Great Falls, a cataract 35 feet high. At Washington the river meets the tide, 125 miles from its mouth; and about 25 miles below it becomes an estuary from two to eight miles wide. It is navigable for large vessels to Washington. The Chesapeake and Ohio Canal is parallel to and near the river the whole length from Georgetown to Cumberland. The Potomac is the most important river in this section of the United States. It was the route whereby explorers journeyed to the interior in the early days, and it has been closely associated with many of the important events in the history of the country. The Nation's capitol is on its bank, the home of the first President, and his grave, is a few miles below, and Arlington (q.v.), with its white tombs, may be seen from the Capitol.

**Potomac, Army of the**, a great Federal army in the Civil War, which operated in the East, mainly in the Virginias. It was organized in 1861 by Gen. George B. McClellan. Under him, in 1862, it served in the Peninsula campaign (q.v.) and later in that of Antietam. Under Gen. A. E. Burnside, who took command in November 1862, it was defeated at Fredericksburg in the following month. In January 1863 command of the army passed to Gen. Joseph Hooker, and at Chancellorsville,

in May, it met another defeat; but in July of the same year, under Gen. G. G. Meade, it won the decisive battle of Gettysburg. General Meade continued in command, under Gen. U. S. Grant, throughout the operations of the latter in 1864-5.

**Potomac Company, The**, in American colonial history, a land company chartered in 1784, with General Washington as president. It was organized for the purpose of connecting the Potomac Valley with the West by means of a canal, and for general land improvement. The Chesapeake and Ohio Canal Company succeeded it in 1828.

**Potomac Formation**, a name designating certain of the lowest deposits of the Cretaceous period in America, so-called from the location of some of its typical beds. It is represented by a narrow belt in Maryland, running southward, east of Washington to North Carolina, by strips in New Jersey and in Alabama, Arkansas and Texas. The series has been found to be from 5 to 500 feet thick. It is made up of various sandstones, gravel, sand and clays. Portions of the formation have supplied glass sand, clay (at Amboy, N. J.) and iron-ore for manufacturing purposes.

**Potomac, Society of the Army of the**, a military organization which grew out of the Civil War. It was founded in New York city 5 July 1869, since when it has held annual reunions. All officers and soldiers who served in the Army of the Potomac and in the Tenth and Eighteenth army corps, Army of the James, are eligible to membership.

**Potosi**, pō-tō-sē', Bolivia, (1) city, capital of the department of Potosi; on the side of the Cerro do Potosi, at an elevation of over 13,000 feet; about 50 miles southwest of Chuquisaca. It is one of the highest inhabited places in the world. The city owes its origin to the silver discovered in the mountains and at the site of the present city about 1540. The first mine was opened in 1545; the city was founded in 1547; a royal mint was established in 1562 at a cost of over \$1,000,000. From the time of the first discovery to 1864 these mines supplied, it is estimated, an amount of silver equivalent to some \$3,000,000,000. If the smuggled silver could have been taken into account no doubt the amount would be much greater. The number of mines worked was formerly 300. A certain number are still worked, although their yield is very much less than in former years. The city is still one of the most important in Bolivia. It has a mint, a cathedral, numerous churches, convents, and various public buildings, but the general appearance is dilapidated and unattractive. In the 17th and 18th centuries the population was over 160,000. Pop. (1903) estimated 17,000. (2) A department of Bolivia, in the southwest, bordering on Chile and Argentina. Area, 52,300 square miles. It is crossed by long mountain ranges; but in the northwest is a low, saline marsh, called "Grande Salinas." Mining silver is the chief industry. Other minerals found here, but not in large quantities, are gold, copper, and tin. The silver mines of this department are the richest yet discovered in Bolivia. Many of the inhabitants are Indians. Pop. (1903) estimated 375,000.



## POTOTAN—POTSDAM

**Pototan**, pō-tō'tän, Philippines, pueblo, province of Iloilo, island of Panay; on the Jalaur River, 17 miles north of Iloilo. It is well built and contains a large church and a convent. Pop. 14,500.

**Potsdam**, pöts'däm, Germany, a district and a city of the province of Brandenburg in Prussia. (1) The administrative district of Potsdam lies between Mecklenburg-Schwerin and Anhalt in the western part of the province of Brandenburg, and is well watered by canals, lakes, and the rivers Oder, Havel, Spree, and Ücker, is marked by fine strips of forest and stretches of moorland, and has a flourishing commerce, good fisheries, agriculture and grazing. There are 18 administrative divisions in the district, and 10 electoral districts for the choice of deputies to the Reichstag. Area, about 8,100 square miles; population (1900) 1,929,304, of whom 1,784,151 were Evangelical Protestants, 113,793 Roman Catholics, 9,250 members of other Christian bodies and 20,780 Jews. (2) The capital city of the province is situated in its most pleasant and beautiful part, on an island where the Nuthe and several canals and lakes join the Havel, 17 miles southwest of Berlin and about lon. 13° 5' E., and lat. 52° 25' N. Most of the city is well built, with broad straight streets, fine houses, and trees planted in the squares and streets; and the five different parts, the old city or Potsdam proper, and the Berlin, Nauen, Brandenburg and Teltow quarters are connected by bridges, steamers, and tramways. Among the city's beautiful squares are the Wilhelmsplatz, with a bronze statue of Frederick William III. by Kiss; the Bassinplatz with Dutch architectural treatment; the Lustgarten with its parade-ground and park and a bronze statue of Frederick William I. by Hilgers, busts of the heroes of the War of Liberation and statues of the generals of the armies of Brandenburg and Prussia and cannons captured between 1680 and 1858; the Old Market with a red and white marble obelisk 75 feet high; and in the narrowest part of the river on the Freundschaftsinsel a place with a bronze equestrian statue of the Emperor William I. by Herter, erected in 1900. The churches of the city, five Protestant and one Catholic, include the Garrison Church planned by Gerlach in 1730 (and rebuilt in 1898), with a tower 295 feet high and the graves of Frederick William I. and Frederick II.; the Nicholas Church, begun in 1830 and finished in 1850, with a beautiful dome 240 feet high and four bell-towers; the French church, after the Pantheon; the Church of the Holy Spirit, with a steeple as tall as the Garrison Church; and the fine Friedenskirche. Among the profane edifices the chief are the Brandenburg Arch, on the lines of the Roman triumphal arch, built in 1750, and leading to Frederick the Great's palace and French gardens of Sans Souci; the Palace of Sans Souci is a low building on fine terraces, its historical associations quite out of all proportion to its poor appearance; the New Palace built at the close of the Seven Years' war; the Marble Palace, now the summer residence of the Kaiser, situated in a northeastern suburb; northwest of this palace the Pfingstberg, an ornate building with two towers and a fine view. In the extreme northeastern part of the city in one of the broadest

expanses of the river lies the large Pfaueninsel (or Peacocks' Island) with a park and a hunting lodge. Woods, hills, and the stretches of water everywhere make the city an ideal one.

The city is situated on the Berlin-Magdeburg branch of the Prussian governmental railroad system, and has other rail connections with Berlin. The commerce is comparatively unimportant; there are sugar factories, several breweries, etc. It is an important garrison post, and among the educational institutions of the city are a military school, a war-school for the training of officers, and a military orphanage, in which there are 800 pupils. There are also excellent schools for girls, a normal school for women, training schools for gardeners, etc. Pop. (1900) 59,796, of whom 5,012 were Catholics and 442 Jews.

Potsdam was a Wendish fishing village founded about 1300, and attained no importance until 1660 when it was selected as a site for a palace by the Great Elector. In 1685 (8 November) by the terms of the Edict of Potsdam he opened the city to the French refugees and made the city his residence. He not only built the palaces mentioned above as his, but erected many private houses to keep up the tone of architecture. Frederick William IV. did hardly less for the city's scenic features with the help of Lenné and Meyer. The Peace of Potsdam was signed here 3 Nov. 1805, ratifying an alliance between Russia and Prussia against France.

Consult the works cited under the article BERLIN; also 'Geschichte der Königlichen Residenzstadt Potsdam' (1883) and 'Potsdam ein deutscher Fürstensitz' (illustrated, 1893).

**Potsdam**, pöts'däm, N. Y., village, in Saint Lawrence County; on the Raquette River, and on the New York Central and Hudson River railroad; about 20 miles from the Saint Lawrence River and 90 miles north of Watertown.

In 1786 the State of New York created a Land Commission to further the settlement of the unexplored northern part of the State. Ten towns were established, one of which was Potsdam. The sale of these towns took place 10 July 1787 "at XI. o'clock in the forenoon at the Coffee house in the city of New York." One lot in each town was to be set apart as a "school and gospel lot," and one for the "promotion of literature." Later Garrett Van Horn and David M. Clarkson purchased the town of Potsdam. In June 1803 their agent, Benjamin Raymond, arrived at the place to sell the property. A number of persons from Vermont soon purchased land and settled here. The village of Potsdam was incorporated in 1831. It is in a productive agricultural region, which has had extensive lumbering interests from its foundation. The first industrial establishment built by Benjamin Raymond was a saw mill, and saw mills have been there for over 100 years. In the winter of 1903, one Potsdam company alone had 1,000 men employed in lumber camps in the Adirondacks, and in spring floated down the Raquette River, to the Potsdam mills 30,000,000 feet of log stock. The village has flour and lumber mills, paper mills, creameries, and machine shops. It has an extensive trade in lumber, paper, farm and dairy products, and men's clothing. The celebrated Potsdam sandstone (q.v.) is quarried in the vicinity. It has the Potsdam State Nor-



## POTSDAM SANDSTONE — POTTER

mal and Training School, which has a library of 7,000 volumes, the Clarkson School of Technology, founded in 1895, the Crane Institute of Music, a high school, and public elementary schools. There are seven churches. The Potsdam sandstone is used in nearly all the large buildings. The two banks have a combined capital of \$100,000. The government is administered by a village president and a board of five trustees elected annually. The village owns and operates the waterworks. Pop. (1890) 3,396; (1900) 3,843. *Editor 'Recorder.'*

**Potsdam Sandstone**, an American geological formation of the Cambrian Period of which a yellowish brown sandstone found at Potsdam, N. Y., is typical. The formation was long supposed to be the oldest of Palæozoic time in America, but is now placed at the top of the Cambrian group. It is found to the north of the Adirondacks in New York and in Canada, and in Michigan, Wisconsin, and Virginia.

**Pott, pöt, August Friedrich**, German philologist: b. Nettelröde, Hanover, 14 Nov. 1802; d. Halle 5 July 1887. He studied at Göttingen, became a lecturer at Berlin in 1830, and in 1833 professor of the science of language at Halle. His reputation as a comparative philologist was established by his 'Etymologische Forschungen auf dem Gebiet der Indogermanischen Sprachen' (1833-6; 2d ed. 1859-76), and he soon took place with Grimm, Bopp, and W. von Humboldt among the students of that newly-developed science. His researches were peculiarly thorough; and this fact makes them yet of value despite the advances made in his subject in more recent times. His books, which have been compared, for their want of order, to the plain of Shinar upon the confusion of tongues, include further: 'Die Zigeuner in Europa und Asien' (1845); 'Die quinäre and vigesimale Zähl-methode' (1847); 'Die Personennamen und ihre Entstehungsarten' (1853); 'Anti-Kaulen' (1863); 'Die Sprachverschiedenheit in Europa, an den Zahlwörtern nachgewiesen' (1868); and 'Wilhelm von Humboldt und die Sprachwissenschaft' (1876).

**Pott, Percival**, English surgeon: b. London 1713; d. 22 Dec. 1788. He was assistant surgeon in Saint Bartholomew's Hospital, 1745-9, and a chief surgeon there from 1749 to 1787. In spinal diseases he was a specialist, and won distinction by his investigation of angular curvature of the spine, the cause of which he found in a disease of the bones of the spinal column, called after him Pott's disease (q.v.). He wrote a number of works, including 'A Treatise on Ruptures' (1756); 'Fistula Lacrymalis' (1758); 'Practical Remarks on Hydrocele' (1762); 'Some Few General Remarks on Fractures and Dislocations' (1769); and 'Remarks on That Kind of Palsy of the Lower Limbs Found to Accompany a Curvature of the Spine' (1779).

**Pott's Disease**, an affection of the spinal vertebræ characterized by tuberculous inflammation of their bodies; spinal caries. The nature and cause of the disease were first correctly described by the English surgeon Percival Pott (q.v.), after whom it was named. The inflammation is sometimes followed by total paralysis of the lower limbs. On the diseased parts tuber-

cles form, resulting in disintegration of the vertebræ. A curvature or hump is formed by the visible projection of spinal processes beyond their normal situation. The treatment of the disease must always be hygienic and constitutional, and for surgical treatment special methods are now in general use whereby excellent results are often obtained.

**Pottawattomi** (pöt-a-wöt'ö-mī) **Indians**, an American tribe of the Algonquian family, early occupied what is now lower Michigan and upper Illinois and Indiana. Joining Pontiac, they surprised Fort Saint Joseph in 1763. During the Revolution they were hostile to the Americans, but joined in the treaty of 1795. The tribe was then composed of settled bands and the wandering prairie tribes. In 1812 they aided England. A few descendants are now living in Kansas and Iowa.

**Pot'ter, Alonzo**, American Protestant Episcopal bishop: b. Beekman, Dutchess County, N. Y., 6 July 1800; d. San Francisco, Cal., 4 July 1865. He was graduated from Union College in 1818 and became a tutor there in the following year. In 1821 he was made professor of mathematics and natural philosophy. Of Quaker parentage, he nevertheless studied for the Episcopal ministry and was ordained to the priesthood in 1824. He was rector of St. Paul's Church, Boston, 1826-31, and then returned to Union College as professor of moral philosophy and political economy, which position he retained until his elevation to the episcopate. He was consecrated bishop of Pennsylvania 23 Sept. 1845, and became known as one of the most sagacious and practical prelates of his day, as well as a man of marked intellectual force and spiritual fervor. His plans of church extension and benevolence were large and costly, but he found means to carry them into effect, and not a few flourishing institutions, including the Episcopal Hospital and the Philadelphia Divinity School, owe their origin chiefly to him. Among his published works are several educational treatises and 'Religious Philosophy' (1870), besides sermons and addresses, and the Lowell Institute lectures on natural theology and Christian evidences, delivered in Boston 1845-9. Consult memoir by Bishop Howe (1870).

**Potter, Edward Tuckerman**, architect; son of Alonzo Potter (q.v.): b. Schenectady, N. Y., 25 Sept. 1831; d. New York city 21 Dec. 1904. He was graduated from Union College in 1853 and studied and practised architecture in New York city, giving his attention principally to collegiate and ecclesiastical architecture. He designed and superintended the building of the Church of the Heavenly Rest, in Fifth Avenue, New York city, the Colt Memorial Church at Hartford, Conn., the Church of the Good Shepherd and the Memorial Hall at Schenectady.

**Potter, Eliphalet Nott**, American educator and Episcopal clergyman, son of Alonzo Potter (q.v.): b. Schenectady, N. Y., 20 Sept. 1836; d. City of Mexico 6 Feb. 1901. He was graduated from Union College in 1861 and from Berkeley Divinity School in 1862, in which year he entered the Episcopal ministry. He was rector of a parish at South Bethlehem, Pa., 1862-9, and professor of ethics at Lehigh University in 1866-71. He then accepted the pres-



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idency of Union College and when the college was made a university in 1873 he was elected chancellor. In 1884-97 he was president of Hobart College and in the latter year became president of the Cosmopolitan University, a correspondence school. He wrote: 'Parochial Sermons'; 'Washington a Model in His Library and Life' (1895); etc.

**Potter, Henry Codman**, American Protestant Episcopal bishop: b. Schenectady, N. Y., 25 May 1835. He is the son of Bishop Alonzo Potter (q.v.), and was educated at the Episcopal Academy, Philadelphia, and at the Theological Seminary of Virginia. In 1857 he was ordained deacon and in 1858, priest. He was rector at Christ Church, Greensburg, Pa. (1857-8); and at St. John's Church of Troy, N. Y. (1859-66); then became assistant at Trinity Church, Boston, and in 1868 rector of Grace Church, New York city. In 1883 he was consecrated assistant bishop of New York, and on the death of his uncle Horatio Potter in 1887 became bishop. Under his energetic and successful administration the site for the cathedral on Morningside Heights has been purchased and funds raised for building, and in his decisions on theological questions and controversies he has proved himself sagacious and tolerant. He has taken a deep interest in political life of the city and nation, and has written and spoken forcefully and freely on a wide variety of educational and political subjects. He has lent his influence to promoting friendly relations between labor and capital, and to assisting the reform movement in New York city. He has published 'Our Threefold Victory'; 'Young Men's Christian Associations and Their Work'; 'The Church and Her Children'; 'Sisterhoods and Deaconesses' (1873); 'The Religion for To-day' (1877); 'The Gates of the East' (1877); 'The Scholar and the State' (1897); 'The East of To-day and To-morrow' (1902); 'The Industrial Situation' (1902); 'Law and Loyalty' (1903); 'The Drink Problem' (1905).

**Potter, Horatio**, American Protestant Episcopal bishop, brother of Alonzo Potter (q.v.): b. Beekman, Dutchess County, N. Y., 9 Feb. 1802; d. New York 2 Jan. 1887. He was graduated at Union College in 1826, like his brother studied for the ministry, and was ordained deacon in 1827 and priest in 1828. In the latter year after having held one pastoral charge in Maine, he was elected professor of mathematics and natural philosophy in Washington (now Trinity) College, Hartford, Conn. He was rector of St. Peter's Church, Albany, N. Y., 1833-54, and was then (1854) elected provisional bishop of New York. His predecessor, Bishop Benjamin T. Onderdonk, after trial before a court of bishops, had been suspended from his office on a charge of immorality, the truth of which, however, he never acknowledged. Thus the diocese remained for some time in an anomalous position, until finally a canon was passed authorizing the election of a provisional bishop. On the death of Bishop Onderdonk, in 1861, Bishop Potter assumed entire charge of the diocese, and ruled it prudently until his own death. The care of such a large and important diocese, especially in the trying times of the Civil War and the ritual controversy, required an unusual amount of courage, wisdom and impartiality. These qualities Bishop

Potter exhibited in such a degree as to bring a large measure of unity and peace to New York diocese. His published writings are principally sermons, addresses, and pastoral letters dealing with religious and occasionally with civic questions.

**Potter, John**, English Anglican archbishop: b. Wakefield, Yorkshire, 1674; d. London 10 Oct. 1747. He was educated at Oxford, and in 1694 became fellow of Lincoln College, Oxford. In 1697 he printed an edition of 'Lycophron.' In 1697-9 appeared his 'Archæologia Græca,' or the 'Antiquities of Greece,' which has gone through many editions, and was long indispensable to the classical student. In 1708 he was appointed regius professor of divinity at Oxford, and in 1737 was appointed Archbishop of Canterbury. His 'Theological Works' in 3 vols. appeared in 1753.

**Potter, Mary Knight**, American art writer: b. Boston, Mass. She has published 'Love in Art' (1898); 'Peggy's Trial' (1901); 'Councils of Croesus' (1902); 'The Art of the Vatican' (1902).

**Potter, Paul**, Dutch artist: b. Enkhuizen, November 1635; d. Amsterdam January 1654. He came with his father to Amsterdam in 1631, and in 1646 joined the Painters' Guild of Delft and three years later that of The Hague. In 1653 he settled in Amsterdam. Of exceedingly precocious genius he early won a reputation as a painter and etcher, and although he died early takes the first place in the Dutch school of painting as an animal painter. His life size pictures such as 'The Young Bull' in the Museum of The Hague, and the 'Bear Hunt' in the Museum at Amsterdam, have contributed less to his reputation than the smaller canvases, in which are represented cattle, sheep, horses and swine out at pasture. His clear and true color, and the fidelity of his drawing and modeling are remarkable. His chief works are 'The Cow'; 'The Sentence of the Beasts upon the Hunters' (at the Hermitage, Saint Petersburg); 'Horse Standing before a Cottage'; 'The Meadow' (Louvre); 'The Shepherd's Cottage'; 'Orpheus and the Beasts'; 'Shepherds with their Flocks' (Amsterdam Museum). The Dresden Gallery possesses two landscapes with cattle, of his, in which the flat fields, peculiar sky and pollard trees of the local scenery are depicted with singular felicity. Most of his pictures are in English galleries. He is also to be considered one of the best etchers of his day. Consult Westrheene, 'Paulus Potter, sa Vie et ses Œuvres' (1867).

**Potter, Paul M.**, American dramatist: b. Brighton, England, 3 June 1852. He entered journalism, was foreign editor of the New York *Herald* 1876-83, and its London correspondent 1883-4. He was on the editorial staff of the Chicago *Tribune* in 1888 and in 1889 composed his first play, 'The City Directory.' Among his many later plays may be cited 'Our Country Cousin' (1893), a dramatization of 'Trilby' (1895); 'Under Two Flags' (1901); 'Notre Dame' (1903).

**Potter, Robert B.**, American lawyer and soldier, son of Alonzo Potter (q.v.): b. Schenectady, N. Y., 16 July 1829; d. Newport, R. I., 19 Feb. 1887. He studied at Union College; began the practice of law in New York; became colonel





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BISHOP OF NEW YORK.







## POTTERIES

of the 51st regiment New York volunteers upon the organization of that regiment; and served with distinction at Newbern, where he stormed the intrenchments on the Confederate left, and at Antietam, where he carried the stone bridge and saved the day. He fought also at Fredericksburg, was made a brigadier 13 March 1863, commanded the 2d division of the Ninth corps at Vicksburg, and the corps at the siege of Knoxville. Under Grant he commanded his division from the Wilderness to the final attack on Petersburg. He was brevetted major-general in 1863.

**Potteries, American.** It is to the archæologist, not to the historian, to whom we must turn for the first chapter in the history of American potteries. During the prehistoric ages, of which we have practically no record, the Mound Builders made earthenware as receptacles for food and drink. Later, when the prehistoric man had gone, the Indians made and used such utensils, but whether they were the originators of their art, or learned it from some prior race of people, one may only surmise.

In the early days of the American colonies all the porcelain that was used in this country came from China. The manufacture of white ware in America, however, began in 1685, when Dr. Daniel Coxe, a wealthy resident of London who was financially interested in several colonial projects, established a pottery at Burlington, N. J.

Although Dr. Coxe continued to make his imitation "china ware" in both white and cream colors for many years, it was not until considerably later than the middle of the next century that he had any American competitors. It is known that a pottery was established at New Quincy, Mass., about 1760; that another was operated for a short time in South Carolina, about 1765, and that a third was started in Philadelphia, in 1769. Beyond the fact that they were of short life, we know little about them, except that all the efforts to establish this industry in America were causes of great concern to Josiah Wedgwood, the English potter. For years he had known of the value of the clays in this country, for he had imported them both from Florida and Carolina, and he feared that, with such superior material so conveniently located, to say nothing of cheap wages, the American colonists would become dangerous competitors, not only in their own field, but in the markets of the world.

By the close of the Revolutionary War there were several potteries in operation, and, during the next quarter of a century, the number increased steadily. The establishment of Abraham Miller, of Philadelphia, continued to manufacture pottery with considerable success for many years. There was a "china" factory also in Philadelphia, near Fourth and Chestnut streets, in which plain white ware was made, while, in 1808, the Columbian Pottery announced its ability to produce ware that was equal in quality to any of that which was made at Staffordshire, England. In every instance, however, the output of these potteries was small, for everything was made by the hands and feet, with the use of the ancient potter's wheel, the power for which, in those days, was obtained from the thrower's foot alone. In fact, practi-

cally the only improvement made in the thrower's wheel — or "kick wheel," as it was called — is that the wheel now receives its impetus from steam power instead of being dependent upon foot-power for its rotary motion.

The first important attempt to establish a pottery in the United States was that of the Jersey Porcelain and Earthenware Company of Jersey City, N. J., which was incorporated by George Dummer, Timothy Dewey, and others, in 1825. Possessing some secrets of the trade unknown to their predecessors in the field, they were able to manufacture goods of a quality so superior to any that had ever been produced in this country, that, in 1826, the Franklin Institute presented the corporation with a silver medal as a recognition of its achievement in making "the best china from American material." The successors of this company, the American Pottery Manufacturing Company, also produced goods of excellent quality, but, for business reasons, they confined themselves to the manufacture of special articles and never attempted to make a general line of crockery ware. During the same year in which the New Jersey company was incorporated, however, William Ellis Tucker, who had already established a pottery at Schuylkill Front, now Twenty-third, and Chestnut streets, Philadelphia, announced his intentions to manufacture a full line of goods. Although he was at no time handicapped for lack of capital, and while he pursued none but the simplest methods of manufacture, it was some time before he was able to carry out his plans, owing to the fact that a secret agent of the English potters, who was in his employ, spoiled his product, even resorting to criminal interference to carry out the nefarious scheme upon which he was engaged. With the discovery, and discharge of this workman, however, success rewarded Tucker's efforts, and, in 1827, he, too, received a silver medal from the Franklin Institute as a recognition of the excellence of his workmanship.

From the very beginning of the pottery industry American potters had been compelled to meet the most strenuous and often the most unfair kind of competition at the hands of the English manufacturers. Prior to 1833, therefore, several attempts were made to interest Congress in the new industry. Bills were prepared providing for a special tariff on china-ware and crockery, but, although it received the support of some influential men, Congress responded, not only by killing the measure, but by actually reducing the rates on these products. As the result, Tucker was compelled to retire from business, in spite of the fact that the prices asked, even for the plainest white china, were still very high. For example, teapots then sold from \$1 to \$1.25 each; coffee pots brought \$2; sugar bowls, 75 cents; cream pitchers, 37½ cents; cups, \$1.50 per dozen; saucers, about the same price, and plates, from \$2.50 to \$4 per dozen.

Although Congress had shown no interest in fostering the new industry, manufacturers whose product did not come into such direct competition with the foreign producers were able to continue to develop their trade. Manufactories of stoneware, yellow and Rockingham, and other colored wares, were established in various parts of the country. In 1827, the Perrine stoneware works was started at Baltimore; in 1828, John



POTTERIES

Hancock opened a yellow-ware factory at South Amboy; in 1829, the Lewis Pottery, which was afterward moved to Pittsburg, where it continued operations until 1836, was established at Louisville, Ky.; in 1831, Homer & Shirley began to make flintware at New Brunswick, N. J., and, in 1837, Charles Cartlidge established a factory to make porcelain hardware trimmings at Greenpoint, Long Island. Sometime about 1836, a Mr. Clews, who was not only experienced in the making of pottery, but who had long been supplying the American market with goods manufactured at his works in England, came to the conclusion that it would be economical for him to manufacture a portion of his product in this country. He accordingly opened a pottery at Troy, Ind., on the Ohio River, where he began to make his decorative ware, consisting of such American scenes in dark blue as views along the Hudson River, the "Landing of Lafayette at Castle Garden," etc. He was at first so successful that the concern was incorporated under the name of the Indiana Pottery, but, after a series of reverses, it was finally shut down in 1846. In the same year, at Bennington, Vt., a concern was established to make Rockingham, yellow and white ware in the old stoneware pottery of Norton & Fenton. In 1849, this firm was incorporated under the name of the "United States Pottery," and it continued to rank as one of the most progressive and successful manufactories for many years. In 1853, the demand of its fine Parian and the new ware of its own invention, called "flint enamel," was so great that the company found it necessary to enlarge its factory to the extent of constructing six of the most improved kilns, but unforeseen changes in business conditions occurring, the corporation went out of business in 1858.

Of course, these were by no means the only potteries of that day. Among the other concerns that were interested in this industry were the potteries of Ralph B. Beach, in Philadelphia; William Wolfe, in Tennessee; Moro Phillips, on the James River; James Carr, at South Amboy; George Walker, at West Troy, N. Y.; T. D. Wheeler, at South Norwalk; Houghwout & Daily, on Broadway, New York; Sanford S. Perry, at West Troy, N. Y., and the American Porcelain Manufacturing Company at Gloucester, N. J. In Aiken, S. C., the Southern Porcelain Company had established a kaolin factory, which was the only pottery in the South that continued to turn out its product of white and porcelain ware during the war, while East Liverpool, Ohio, and other towns located in the Ohio Valley, had been the scene of several prosperous pottery enterprises during the period which had elapsed since the discovery of clay in its neighborhood by James Bennett, an English potter, in 1839.

Although the history of the early days in the pottery industry is largely a record of failures, this lack of success was chiefly due to unfavorable conditions for which the quality of the product manufactured was in no way responsible. In fact, these beginnings were not without their examples of artistic excellence, and the success attained by potters during the latter half of the 19th century was largely the result of the meritorious performances of these pioneers in the pottery trade.

It was in 1852 that the firm of Talyor, Speeler

& Bloor opened its first factory at Trenton, N. J. In 1853, William Young & Sons also established a factory at Trenton, this particular point in New Jersey having been selected because, in addition to its own native clay deposits, this location was so central, and so well provided with railway facilities, that both Maryland and Pennsylvania could be drawn upon for their flint and china-clay, while feldspar need be brought no further than from Connecticut, or, at most, from North Carolina. These factories began by manufacturing both common ware and Rockingham.

The advent of the War tariff gave the greatest possible impetus to the pottery industry, and, during the next 20 years, many new establishments sprang up, both at Trenton and elsewhere. By 1880 the 752 potteries in this country were turning out an annual product that was valued at almost \$9,000,000, and, by 1890, while there were but 707 potteries in the United States, these establishments were so much larger and more progressive that the annual product had increased to \$22,057,000. Of this amount Trenton's share was more than \$5,000,000, and this New Jersey city is still so thoroughly the great home of the trade that it turns out almost every kind of pottery product, from the daintiest of decorated porcelain to the most heavy earthenware productions that are used by sanitary factories. The following table shows the detailed development of the entire industry since 1880, according to the reports of the United States census:

POTTERY IN THE UNITED STATES, 1880-1900.

	1880	1890	1900
Number of establishments .....	752	707	1,000
Capital .....	\$7,366,323	\$26,127,104	\$65,951,885
Wage-earners .....	10,221	18,980	43,714
Wages .....	\$3,600,727	\$8,864,032	\$17,691,737
Value of product..	\$8,977,333	\$22,057,090	\$44,263,386

Although certain political agitators and many campaign orators have had a great deal to say about the protection of home industry, the relations that have existed between the pottery trade and the national commerce have almost always been a very one-sided arrangement. If it is true that many infant industries have been protected by suitable tariff legislation, the industry of the potter has received no such aid from the nation's lawmakers. In the early days potteries were driven out of business simply because Congress would not give them the protection which they required, and it was not until such protection was actually demanded by the Government as a war measure, that the American potter was able to compete with the English producer, even in the American market. Such a condition, of course, was due to several factors. In the first place, American potters were compelled to pay a rate of wage that was fully double the amount paid by the English manufacturers to their employees. Moreover, the labor-saving devices which had been invented to reduce the cost of production in other trades did not apply to the making of pottery. In other words, the only possible relief was through legislation, and to such relief the National Congress was unwilling to give its assent.



## POTTER'S CLAY—POTTER'S WHEEL

For many years prior to 1861 the tariff rate on white granite, etc., was 24 per cent. In 1861, by the passage of the war tariff, the rate was increased to 40 per cent. on white, and, as the premium on gold likewise doubled, the potters saw their opportunity and they were not slow to take advantage of it. By 1863, several new potteries had been started, and those which had previously been established had begun to increase their facilities to meet the growing demand for their output. In 1866, there were 11 factories making W.G. and C.C. wares, and while, in 1863, all the big factories were engaged in producing Rockingham, yellow-ware, etc., three years later there was but one prominent factory in which such goods were made. Even in the Ohio Valley—at East Liverpool and other towns in that neighborhood—the products of the pottery establishments were changed before 1863. Built for the purpose of making Rockingham and yellow-ware, they were among the first manufactories to show their appreciation of the new tariff rates by producing a better quality of crockery. New potteries were built, old factories increased their facilities and added decorating departments, until, at last, there were more than 20 pottery establishments in full and successful operation in the vicinity of East Liverpool alone.

As this tariff protection remained unchanged for several years, and did not entirely disappear until 1879, the pottery industry was, by that time, pretty thoroughly established in this country. It is true that the American manufacturers have not yet succeeded in entering the foreign market to any great extent, but, to speak the truth, they have not as yet tried to do it. The task of winning their home market was sufficiently difficult to require all their attention. Ever since the days when the making of pottery was pursued largely as a local industry by every village that possessed a neighboring clay pit, the home-made "china" ware, like the domestic home-spun, had never been a dominant factor in the market. The impetus given to the industry enabled the local manufacturer to overcome the prejudices of the local consumer. It was not until the people were confronted by the problem of being compelled to choose between very high-priced foreign importations and very moderate-priced goods of local manufacture that the American potters were able to persuade them that their goods were equal in quality to the foreign wares.

By 1884, however, European wares had commenced to pour into the United States again, and, in 1885, the importations of foreign pottery had attained such volume that they amounted to \$4,837,782. Since that time the imports have continued to increase. There was a slight decline in the amount imported in 1893, owing to the depression in business conditions, but, with this single exception, the demand for foreign wares has shown no abatement. Although our exports, on the other hand, are still an unimportant item, averaging less than \$200,000 per annum, this fact is no indication of the growth of the trade in America, where the value of the product in 1900, \$44,263,386, when compared with that of 1890, shows an increase of more than 100 per cent.

Although the art of pottery making does not properly include the manufacture of brick

and tile, such artistic results have recently been obtained by workers in this branch of the craft that it has come to be regarded as a branch of the pottery trade. Abraham Miller, one of Philadelphia's pioneer potters, was the first person to give his attention to the making of tiles other than the old terra-cotta product that was commonly used in roofing. This was in 1838. The first tiles to be used for flooring were made in 1853, by the United States Pottery at Bennington, Vt., but, as the attempt to introduce it commercially was an utter failure, the enterprise was soon abandoned. In fact, it was not until after 1870, when the damp-dust process was discovered, that the making of flooring tiles succeeded in passing beyond the experimental stage. To-day, however, the various clays, glazes, and colorings are handled with such artistic success and mechanical precision that fine examples of modern terra-cotta work are now to be seen in every pretentious building.

**Potter's Clay.** See CLAY.

**Potter's Field,** the name commonly given a piece of ground usually adjoining a cemetery, and reserved as a burial place for strangers and the friendless poor. The name is derived from its use in the following passage from the Bible: "And they took counsel and bought with them (30 pieces of silver) the potter's field, to bury strangers in." Matthew xxvii. 7.

**Potter's Wheel.** The wheel as used by the potter ranks among the earliest mechanical contrivances. The Egyptians classed it among the inventions of the gods and claimed that Num, the creator, fashioned man upon it. As a broad principle the wheel consists of a disk revolving in a horizontal plane. The primitive form was simply a turn-table. The edge of the disk was made of heavy substance to secure momentum and steady motion. It was rotated by the hand. The Chinese improved upon this by sinking holes in the perimeter of the wheel; a short stick pushed into one of the holes enabled the disk to be rotated with ease. A cord running in a groove on the wheel was also used. In Europe the favorite device was a lengthening of the axle of the wheel, enabling a heavy disk some three feet in diameter to be placed at the bottom. The potter seated himself at the wheel and propelled it with his foot, working on the disk. This was the first form of the "kick" wheel. A modification of this principle is used in America, in which the axle is fitted with a crank. A treadle in connection with the crank is kept in constant motion by one foot, while the potter stands upon the other. The introduction of power gave rise to two forms of wheel. The special requirement is that the speed of the wheel shall be variable at the will of the workman. This is accomplished either by cones in contact or by a traveling disk. In the former case a cone with a slightly curved face is fitted to the axle, so that it forms the base of the machine. In contact with this is an inverted cone faced with paper or leather and so arranged that the potter can, by pressure of his foot, bring the large end of one cone into contact with the small end of the other or *vice versa*. Thus the speed of rotation is completely under control. In the disk wheel the power is applied to a large steel disk revolving in a vertical



## POTTERY MANUFACTURE

plane. Upon the shaft of the wheel is a small disk faced with leather and free to move up and down the shaft, but revolving with it. A treadle enables the workman to place this either at the centre or the edge of the large steel disk, thus securing any desired speed. The potter's wheel is fast disappearing from our manufactories. Tools more strictly mechanical are taking its place. It is now used mainly for shaping blanks, which are afterward pressed into molds or is employed by the makers of artistic pottery for the sake of the individuality of the work. Stoneware makers also use it for the production of large jars. See POTTERY MANUFACTURE.

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**Pottery Manufacture.** Pottery may be divided into two broad classes, that made from a single natural clay and that made from a mixture of clays. To the former class belong brick (q.v.), terra-cotta (q.v.), stoneware (q.v.), and the commoner grades of household pottery known as jet, Rockingham and yellow wares. To the second class belong every grade of white dishes and utensils. The chief difference in the production of, say, yellow ware and white ware, lies in the preparation of the clay. The actual manufacture and the burning differ only in the amount of care bestowed upon the work. "Rockingham" is the name given to the brown ware familiar in teapots. The body is similar to that used for "yellow," but the glaze is colored brown by manganese. The name comes from a town in England where such wares were manufactured. Yellow ware can be made of any clay which is cheap, provided that it does not burn red, like a brick clay. Clays of the coal measures are sometimes used, those which are too fusible for refractory work being best adapted for yellow ware manufacture. The glaze is a simple lead silicate.

Jet ware is made of red clay and covered with a glaze made blue by cobalt. The blue over red gives the necessary black. The clay for these types of pottery is usually slummed or blunged with water to the consistence of cream. It is then passed through a screen of 80 to 100 meshes to the linear inch and flows into a settling tank. A lean clay can be thickened in a filter-press, but most of these unmixed clays are too plastic to permit of this. By one means or another the clay is brought to a plastic condition for use by the potter.

The production of white ware is a more complicated matter. The materials used are kaolin, ball clay (see CLAY), quartz or flint and feldspar. The kaolin is washed by the miners, the ball clay is usually shipped crude. The flint and feldspar reach the factory in a state of fine powder. In an earthenware body the clay ranges from 45 to 60 per cent, the quartz from 20 to 40 per cent, and the feldspar from 15 to 30 per cent. The mix is made with relation to the heat of the kiln and the purpose of the pottery. Two thirds of the clay usually comes from the ball clay. The materials being weighed out are fed to the blunger with sufficient water to bring the whole to suspension. The blunger consists of a large tank, in which is a revolving shaft bearing paddles. These stir and break up the mass until a perfect mixture results. Following upon this comes the screening or "lawning,"

for silk lawn of 140 to 160 mesh is used for the finer grades, and the "slip" or liquid clay is pumped to the filter press. This consists of a series of chambers, each of which contains a lining of cotton cloth. The pressure of the pump forces the superfluous water through the cloth and the clay remains within. A thorough kneading by a pug-mill or other machine renders the clay fit for use by the potter. The process of formation may be either "throwing," "pressing" or "casting." The first process is that carried out at the potter's wheel (q.v.), the second may be either by hand, when it is called pressing, or at a wheel, when it is called jiggering. All circular wares are jiggered, that is, made on a jigger, and this work is subdivided according to the shape produced. In a factory the man who goes by the name of jiggerman is he who makes bowls, kitchen and bedroom wares, etc. Other workmen, though operating a similar machine, are spoken of as plate-maker, saucer-maker, and cup-maker, respectively. The essential part of jiggering is, in these later times, the use of a pivoted arm or bascule, named a "pull-down," to which the tool is attached. The mold is set in place on the jigger-head and rapidly revolves. A disk of soft clay is pressed to the shape and the pull-down, operated by the workman, smooths the upper side and gauges the thickness. Plates and saucers are made upside down, hollow pieces usually the other way. Hand pressing is resorted to when the shape will not permit of wheel work. Jugs, vegetable dishes, teapots, etc., are mostly pressed by hand. The clay is beaten into a disk, the upper side polished with a knife blade and the disk lifted, inverted and the polished side set against the face of the mold. Strong pressure is used to secure perfect contact and a complete filling of all interstices. Casting is performed with the fluid clay or slip, and is most readily adapted for the production of intricate shapes. Statuettes and figurines are made this way, as are most vases and many fancy-shaped cups. The mold is made in sections in such a manner that the piece will leave it readily. Any undercutting must be strictly avoided. An opening is, of course, left in the mold by which the mouth of the vase or jug may be filled and emptied. The mold being well bound together is poured full of slip. These molds, like all others used in pottery, are made of plaster of Paris, and are very absorbent. Hence the water contained in the slip is drawn into the wall of the mold, and the clay thus rejected is deposited in an even coating all over the interior. Time allows this coating to accumulate and as soon as it is judged thick enough the balance of the slip is poured out. Every piece is thus left hollow. The work as it leaves the mold, whether pressed or cast, is set to dry and the surface is afterward finished ready for the kiln. Two burnings are generally used, the biscuit and the glaze or glost. The types of white pottery made in the United States are C. C. or cream color, granite, hotel china, semi-porcelain and Belleek (see CERAMICS). They are all made from kaolin, ball clay, flint and feldspar, the difference being in the proportions used and in the temperature of the kilns.

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# POTTERY

(Various specimens of glazed earthenware of antique origin)



Dutch tile, styled the Hirschvogel tile (German, 16th Century)



Vase from Delft (Fayence, 18th Century)



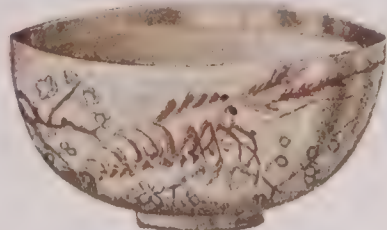
Glazed earthenware in relief, by Lucca della Robbia, Florence (about 1500)



Chinese vase



German escutcheon tile (16th Cent.)



Japanese Satsuma bowl



Pot of Boettger porcelain (18th Century)



Palissy platter (French, 16th Century)



Spanish-Moorish Maiolica jug (14th Century)



Plate, by Urbino (Italian Majolica, 16th Century)



Wedgwood Pitcher (English, 18th Century)



Saucer, by Caffagiolo (Italian Majolica, 16th Century)



Persian platter (16th Century)



Henry II. vessel (French 16th Century)



Paste porcelain (Minton, English, 19th Century)



Misian coffee-pot (Old Saxon, 18th Century)



Saucer, by Gubbio (Italian Majolica, 1519)







## POTTO — POULTNEY

**Pot'to**, or **Kinkajou**, a small South American carnivore (*Cercoptes caudivolvus*) related to the coatis and racoons, so named by the negroes after the native name of one of the lemurs of eastern Africa. It has the general shape of a weasel, but is much larger, and has a thick, soft yellowish fur. It is arboreal in its habits, climbing easily by aid of its prehensile tail, and feeding mainly on insects. It makes a docile and gentle pet.

**Potts'town**, Pa., borough, Montgomery County; on the Schuylkill River, and on the Pennsylvania and Philadelphia & R. R.R.'s; 35 miles northwest of Philadelphia. It was laid out as a town in 1752, and was at first named Pottsgrove; in 1815 it was incorporated as a borough and named Pottstown; the size of the borough was increased in 1888. It is the trade centre of a fertile agricultural region; and there is also a considerable amount of mineral wealth in the vicinity. The borough is noted for its manufactures of iron and steel; it contains rolling mills, blast furnaces, steel mills, bridge works, boiler works, nail factories and manufactories of agricultural implements, also cigar factories, carriage works, planing mills, and creameries. It has a public high school and school library, and is also the seat of the Pottstown Business College, and of the Hill School, a private non-sectarian secondary school for boys. Pop. (1890) 13,285.

**Potts'ville**, Pa., borough, county-seat of Schuylkill County; on the Schuylkill River near its source, and on the Pennsylvania, the Lehigh V., and the Philadelphia & R., and the Central of N. J. R.R.'s; 75 miles northwest of Philadelphia. It was first settled in 1800, was incorporated in 1828, and made the county-seat in 1851. It is situated among the Schuylkill anthracite coal fields, and is one of the most important mining centres and shipping points of the region. Its manufacturing interests are also of importance; they include steel mills, blast-furnaces, rolling mills, and foundries; also planing mills, cotton-velvet, and silk mills. It was in Pottsville that anthracite coal was first successfully used in smelting iron ore. Among its more important buildings are the county court-house and jail, a public hospital and the Pottsville Athenæum. The Athenæum contains a library, and the borough also has a public school library and the county law library. There are a public high school, two Roman Catholic parish schools, and the Commercial Union School. The chief executive officer of the borough is a burgess, who holds office for three years; the legislative body is a borough council, which also has power to appoint many of the city officers; the city auditor, city treasurer and the school directors are elected by the people. Pop. (1890) 14,117; (1900) 15,710.

**Pottsville Conglomerate**, the name by which the millstone-grit at the base of the coal measures is generally known in Pennsylvania, because it has its greatest development at Pottsville, near the eastern edge of the anthracite fields. It is there more than a thousand feet thick, but toward the west and north grows thinner. The rock is composed of sand and pebbles, chiefly of quartz, giving it considerable hardness.

**Potvin**, pō-văn, **Charles**, Belgian author: b. Mons, Belgium, 2 Dec. 1818; d. Ixelles 1 March 1902. He was educated in the Catholic University at Louvain, became professor of national literature at Brussels, in 1883 conservator of the Wiertz Museum there, and in 1881 a member of the Belgian Academy. He was editor of 'La Nation' in 1850-3, and in 1862 became editor of the 'Revue de Belgique.' His writings comprise volumes of verse and criticism, including: 'Marbres Antiques et Crayons Modernes' (1862); 'Jacques d'Artevelde' (1861); 'L'Histoire des Lettres en Belgique' (1882), and 'L'Art Grec' (1895).

**Pouched Dog**. See DASYURE.

**Poughkeepsie**, pō-kīp'sī, N. Y., city, county-seat of Dutchess County; on the east bank of the Hudson River, and on the New York C. & H. R. and the Central N. E. R.R.'s; about 70 miles north of New York city. It has regular steamer connections with all the Hudson River ports, and a bridge spanning the Hudson at this point connects the city with the West Shore Railroad on the west side of the river. Electric lines connect the city with cities and towns on both sides of the Hudson. Part of the city is on a plateau extending back from the river, and part of it is on the slope to the river.

It was settled about 1698 by the Dutch. On the same site there had been an Indian village called Apokeepsing, meaning "safe harbor." It was the capital of the State during the Revolutionary War. The State convention which ratified the National Constitution met here in 1788. Alexander Hamilton was one of the leading members of the convention. In 1799 the village was incorporated and in 1854 it was chartered as a city. The cantilever bridge, which was opened in 1889, cost about \$5,000,000. Its length is 7,100 feet, it has three cantilevers, and rests on six massive piers. The chief industrial establishments are foundries, machine shops, lumber mills, cooperages, mowing machine works, shoe factory, cigar factories, patent medicine works, breweries, and flour mills. Two miles north of the city is the Hudson River State Hospital for the Insane, and in the city is Saint Barnabas Hospital, a Home for Old Ladies, Home for Old Men, and a Home for the Friendless. East of the city is Vassar College (q.v.). The educational institutions of the city are the Eastman Business College, Berkely School for boys, Lyndon Hall School for girls, Riverview Military Academy, a high school, public and parish graded schools, the Adriance Memorial Library, containing 25,000 volumes, and the libraries connected with several of the schools. The Vassar Brothers Institute is one of the fine buildings of the city. College Hill Park has an area of 100 acres. There are several fine church buildings. The revised charter of 1900 provides for a mayor, who holds office two years, and a council. The city owns and operates the waterworks. Pop. (1890) 22,206; (1900) 24,029.

**Poultney**, pōlt'nī, Vt., town, Rutland County; on the Poultney River, and Lake St. Catherine, and on the Delaware & Hudson railroad, 18 miles southwest of Rutland. It is in an agricultural region; slate is quarried in the town and vicinity, and there are slate manufactures, a foundry and machine shops. It is situated in a picturesque country in the Green



## POULTON—POULTRY

Mountains, the lake affords facilities for boating and fishing; consequently the town has become popular as a summer resort, and contains several hotels. It has a public high school established in 1887, and is also the seat of the Troy Conference Academy, a coeducational secondary school. Pop. (1890) 3,031; (1900) 3,108.

**Poulton**, powl'ton, **Edward Bagnall**, English scientist: b. Reading, Berkshire, 27 Jan. 1856. He was educated at Oxford and was demonstrator in the anatomical department of the University Museum 1877-9, and lecturer in natural science at Keble College 1880-9, as well as at Jesus College 1880-8. In 1889 he became a fellow of the Royal Society and since 1893 has been university professor of zoology at Oxford. He delivered a course of lectures before the Lowell Institute, Boston, Mass., in 1894 on 'The Meaning and Use of Colors in Animals.' He is the author of 'The Colors of Animals' (1890); 'Charles Darwin on the Theory of Natural Selection' (1896).

**Poultry**, a term designating collectively all birds which have been domesticated for their flesh or eggs, including fowls, ducks, geese, turkeys, guinea fowls, peacocks and pigeons. The word "fowl" once included game-birds, but now applies only to the domestic kinds and includes fowls, turkeys, guineas and all of the great family *Phasianidæ*. Pheasants, however, belong to a smaller genus, *Phasianus*, which though kept in captivity are not readily domesticated.

*Origin*.—The common fowl which makes up the largest class of domestic poultry is supposed to have originated in western Asia. Darwin believed all domestic fowl to have sprung from a single species, the jungle-cock (*Gallus bankiva*), which still is found in the jungles of India in the wild state. His belief was founded upon the facts that *G. bankiva* closely resembled the black-breasted red game of to-day, one of the oldest varieties of domestic fowl known; that it crosses readily with the common hen, producing fertile offspring; that it resembles domestic fowl in voice and action; that it is readily domesticated, and that according to his observation it produced fertile offspring when crossed with other species of wildfowl, and that sterile offspring resulted when other wild species were crossed with domestic fowl. On this latter point it is believed that Darwin was in error, and that many varieties of common fowl have descended from several wild species and their crosses. In support of this belief it is known that several domestic varieties bear a much closer resemblance to other wild species than they do to *G. bankiva*. The Oriental games, for example, resemble *G. giganteus* much more closely than they do *G. bankiva*; indeed the *G. giganteus* kept in domestication by the natives of the Malay Peninsula at the present time are so like the Malay breed of our domestic fowl that they might be considered the same. Among the wild fowl now in existence which may have contributed largely or in slight degree to the foundation of the common fowl are *G. bankiva* (or *G. ferrugineus*) from southern India only; *G. sonneratii*, found in Hindustan; *G. furcatus* from Java; *G. stanleyi* from Ceylon; *G. giganteus*, the Kulm fowl of the Malay Peninsula; and others not so well known.

The characteristics of the domestic fowl are as follows: Beak heavy; gullet enlarged to form a crop; small stomach; gizzard strong to crush hard seed; two long feet (*sæca*) adapted to scratching, running and perching; wings not suited to long flight; gregarious, polygamous, domestic in the extreme; prolific; period of incubation 21 days; young covered with down and able to run about as soon as hatched; brave in defense; flesh and eggs prized as human food.

*History*.—Fowls are the oldest of our domesticated animals, so far as history records. The earliest record is to be found in a Chinese encyclopædia compiled from ancient documents, where it says "fowls are creatures of the west." Fowls were introduced into China in a dynasty 1400 years B.C., and the Chinese considered the Indian region as their source. They were also mentioned by Aristophanes between 400 and 500 B.C., and, it is said, are figured on Babylonian cylinders between the 6th and 7th centuries B.C. Mention of fowls is also made in the writings of the Greek and Roman authors Theognis, Aristotle, Diodorus, Æschylus, Plutarch, Plato, and Pliny, and are supposed to have been taken into the British Isles by the Romans, who regarded them as sacred to Mars. The cock has in all ages occupied an exalted position as an emblem symbolizing courage among the ancient Gauls and afterward among the French, who used it on their ensign after the Revolution. It figures also in the Bible and has been used in Christian art to symbolize the Resurrection. At the present day it is regarded as a herald of victory.

*Extent and Importance of the Poultry Industry*.—Poultry husbandry is an old art and a new science, for it is only within the present century that special attention has been given to raising poultry as a commercial enterprise; and only since about 1880 has any real effort been made to classify the information on the subject into anything like a science. The explanation of this advance may be found first in the fact that this class of domestic animals supply human food, second in importance and value only to the dairy products. The egg offers the most digestible form of meat known, and one which can be cooked in the greatest number of attractive ways, and the flesh forms an article of diet universally prized. The second reason is found in the fact that poultry, particularly fowls and pigeons, are variable and plastic in the hands of the breeder, and can be rapidly and skilfully made to acquire new forms and colors. In no branch of animal husbandry have so striking results been accomplished as in poultry-breeding. Observe the large number of varieties at the present time, and note the contrast between the mammoth Brahma weighing 12 pounds, and the diminutive Bantam of the same name weighing 20 ounces; the brilliantly spangled Hamburg and the sombre Orpington; the long tail of the Yokohama and the cushion-tail of the Cochin; the clean close feathering of the Indian game, and the abundant fluffy feathering of the Asiatics; the smooth shanks of the Plymouth Rock and the feathered shanks of the Langshan; the great prolificacy of the sprightly Leghorn, and the large solid muscle of the unproductive, clumsy Indian game. Also note the great variety in plumage both in color and in form, the spangled, laced, penciled, striped, barred, or solid-colored feathers, ragged in the



## POULTRY

frizzles and downy in the silky; varieties of fowls with eyes varying in color from black, to pearl, bay or gray; fowls with rose combs, leaf comb, single or pea comb, and fowls with or without beards and crests, and showing in their plumage every color of the spectrum. Then realize that all these have been produced within the history of man from a single or at most a few wild species of jungle-fowl. Moreover, all these (more than 100 varieties) breed true with a potency that is remarkable.

The following figures show the recent growth of the poultry industry in the United States: In 1879 the number of "barnyard fowl" was 102,272,135; in 1889, 258,871,125. In 1879, the product was 456,910,916 dozens of eggs; in 1889, 819,722,916 dozens; in 1899, 1,293,818,144 dozens. In 1895—2,282,414 cases of 30 dozen eggs each were received in New York city; in 1896—2,594,894 cases; in 1897, 2,751,833; and in 1898—2,709,880 cases. In 1900 the value of poultry in the United States was \$136,891,877. The value of eggs in one year was \$144,286,370. There are 5,739,000 farms in the United States containing 250,681,593 chickens, ducks, turkeys and geese more than three months old, or 42 head of fowls to each farm, worth \$70,000,000. There are now about 350,000,000 old and young chickens, ducks, geese, turkeys, and other domestic fowls on American farms producing yearly for market \$150,000,000 worth of poultry and \$225,000,000 worth of eggs. About a third as much more is consumed at home, making a total valuation of \$500,000,000.

### VALUE OF EGGS PRODUCED IN THE 10 BEST STATES.

1. Iowa	.....99,621,920 dozen	at 10 c....	\$10,016,707
2. Ohio	.....91,766,630	" " 11.1c....	10,280,769
3. Illinois	....86,402,670	" " 10.3c....	8,942,401
4. Missouri	...85,203,290	" " 9.8c....	8,315,371
5. Kansas	....73,190,590	" " 9.9c....	7,237,111
6. Indiana	....70,782,200	" " 10.5c....	7,441,944
7. Penna	....67,038,180	" " 13.5c....	9,080,725
8. New York	..62,096,690	" " 13.8c....	8,630,062

Poultry and eggs form 16.3 per cent of all animal products produced in the United States, being greater in value than any except dairy products, including milk, butter and cheese, and all animals sold or slaughtered. The poultry and eggs sold in the United States in one year is worth \$189,731,370 more than the wool product. The poultry and egg product of 1899 exceeded in value the wheat crop of 28 states and territories. The eggs marketed in one year in the United States are of more money value than all the gold and silver mined in a year, and the same is true of the value of the poultry output. The number of eggs produced per capita are 203 valued at \$1.89. The average price per dozen for eggs throughout the United States is 11.15 cents. It is estimated that in New York city the average egg consumption is nearly one egg per day for each inhabitant.

More than 50 poultry papers are published in the United States, several of which report circulations of 30,000 to 50,000 copies to each issue. In addition to this nearly all agricultural and live-stock papers conduct poultry departments. In order to hatch the billions of chickens produced each year more than 50 kinds of incubators are manufactured in the United States, which leads all nations in this field of inventive skill. In 1890 a 500-hen poultry farm was an object of wonder, but now there are thousands of poultry plants having 1,000 hens and

many which have 2,000 to 3,000 or more, besides broiler and squab-duck establishments which turn out more than 50,000 per year. Nevertheless, out of 62 State agricultural colleges in the United States only 10 offered in 1904 poultry instruction in any form. To Cornell University is due the credit of giving the first regular course of poultry instruction in the United States, which occurred in the winter of 1891. At Kingston, R. I., was opened in 1898 the first poultry school, where students could devote several weeks (six) to the study of poultry. Of the agricultural experiment stations in the United States only six have made any adequate provision for investigation.

*Poultry Keeping.*—Successful poultry keeping depends upon five factors:

First, a location in proximity to good markets, with access to cheap grain and having a rich, well drained soil, temperate climate, and sheltered situation.

Second, suitable buildings. These should be warm in winter, cool in summer, light and dry at all times. There should be about six square feet of floor-space per hen, six to eight cubic feet of air-space to each pound live weight, one square foot of glass surface to twelve square feet of floor surface; and each hen should have from 150 to 200 square feet of grass-covered yard. Allow six to eight inches perch room for small breeds, eight to ten inches for medium sized breeds, ten to twelve inches for large breeds. Every house should have a dust-box containing sifted coal-ashes and land plaster; and darkened nests, one foot square, and six inches deep.

Third, the right kind of food skilfully fed. Fowls are natural grain eaters, great insect hunters, and to a large extent grazers, therefore they should be fed a good variety of grains, an abundance of meat and plenty of green food. The fowl not having teeth must be supplied with grit for grinding. This should include both cracked oyster shell, and hard, cracked, flinty rock. The ration best suited to egg-production should contain digestible nutrients in a ratio of one pound protein to about five pounds carbo-hydrates, and should be so fed that the appetite will be kept good. Fowls should become neither very fat nor very poor. The best laying hen is the one that is in the best physical vigor. In this condition she will have a little surplus fat in her body. A good ration for egg-production is to feed night and morning a mixture of whole grain, consisting of about equal parts by weight of corn, wheat and oats, feeding more of the two latter in proportion at the morning meal which should be light, only enough to keep the fowls busy. At night they should have all they can eat. At noon feed what they will eat up clean within a few minutes of a meal mixture containing equal parts by weight of wheat bran, wheat middlings, corn meal, ground oats and meat scraps, mixed with cooked turnips and little potatoes and about five per cent of cut clover hay. Skimmed milk should be used to scald this feed if possible. Plenty of water and fresh vegetables should always be kept accessible.

Fourth, good fowls carefully bred. There are great differences between varieties of fowls and also between individuals of the same strain. It has been found by trap-nest records that a hen has laid 251 eggs per year, while the average of a good many flocks laid only about 140



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eggs per year, and several fowls were wholly unproductive. There is also great difference in the rapidity of growth, shape of body and quality of flesh of individuals. Therefore a rigid selection of the very best to breed from

COMPOSITION OF EGGS AND POULTRY.

	Water	Ash	Protein	Fat
Hen .....	55.8	3.8	21.6	17
Pullet .....	55.4	3.4	21.2	18
Capon .....	21.6	3.7	19.4	33.9
Fresh egg .....	65.7	12.2	11.4	8.9

should be practised. It will pay to keep pure-bred chickens because they are more uniform in size, shape and color, which makes them more attractive to sell, more alike in habits and characteristics, and this will result in greater production and better health. Their eggs hatch more satisfactorily because similar in size, shape and texture, and will bring higher prices. A good working rule in making breeding hens is to allow one male for 25 hens of the Mediterranean breeds; one male to 15 or 20 hens of the American breeds; one male to 8 to 10 of the Asiatic breeds. The proportion will vary, however, according to the power of individuals.

Fifth, ability to hatch and rear chickens. To grow chickens successfully six things should be observed,—keep them warm, dry, clean, busy and hungry, and keep them growing. Feed a ration of bread and milk and boiled egg for the first few days, then add a mixture of several small or cracked grains, including hulled oats, wheat, corn, millet, sorghum seed, Kafir corn and about one fifth by weight of the best meat scraps with plenty of skimmed milk to drink.

*Varieties of Fowls.*—There are more than 110 varieties of domestic fowl that breed true and are well known in the United States at the present time. Of these, 96 varieties, including bantams, are recognized by the American Poultry Association as standard-bred. In addition to these many well established varieties exist in other countries. All the standard-bred fowls are grouped into eleven great classes by the official poultry publication, 'The American Standard of Perfection.' This classification of breeds is based on similarity of characteristics, on blood relationship, and on place of origin:

*American Class.*—This is the largest class in the 'Standard.' It has five breeds divided into fourteen varieties: (1) Barred, white and buff Plymouth Rocks; (2) silver, golden, white, buff, partridge, black and silver-penciled Wyandottes; (3) black and mottled Javas; (4) American Dominiques; (5) Buff Orpington. With the exception of the Orpington the whole American class of fowls has been originated in the United States, and all are of composite blood, and combine to a high degree egg-producing, flesh-making and maternal qualities. They are medium to large in size, compact and meaty, extremely hardy; good layers of medium-sized, dark to light-brown eggs; careful mothers; fairly active. Their shanks are smooth and the skin is yellow, except in the case of black Wyandottes, Javas which have dark shanks, and Orpingtons which have white shanks. All have red earlobes. The Plymouth Rocks all have medium sized single combs and rich bay eyes. The Wyandottes have rose combs with a spike following the shape of the head, and bright bay

eyes. The Javas have small single combs, and the Dominiques a rose comb. The buff Orpingtons are the largest, the cock weighing 10½ pounds, the hen 8½. The Plymouth Rock and Java come next, the cock weighing 9½, the hen 7½, while the Wyandotte and Dominique weigh, —cock 8½, hen 6½.

The barred Plymouth Rocks are perhaps the most popular fowls in America. Their origin, like that of most of the domestic breeds, is disputed and obscure. They were first brought to public notice in Massachusetts in 1850 or Connecticut in 1860, and are thought to have been derived from a cross between the American Dominique and the black Java; others assert that they were the result of a cross between a common hawk-colored male and a black Cochin hen. It is most likely that the barred Plymouth Rock contains the blood of several varieties, and is due to man's good sense in seizing upon a happy accidental combination of size, form, color, hardiness, maternal qualities and general excellence rarely equaled, followed up by a systematic effort to produce the particular type found in the barred Plymouth Rock and which up to that time was possessed by no other breed. White Plymouth Rocks originated in Maine in 1873, and were admitted to the 'Standard' in 1888. They are said to be a sport from the barred Rocks. That a white Leghorn cross was used in their development is also certain. Buff Plymouth Rocks were admitted to the 'Standard' in 1893. They are supposed to be the result of a cross between buff Cochin and barred Rocks, yet good authorities claim that they have no Plymouth Rock blood in their makeup. They are prolific, grow well, have a popular color and are gaining rapidly in public favor.

Wyandottes are a valuable breed, the first variety of which was the silver Wyandotte, which originated in 1868 in New York State and was admitted to the 'Standard' in 1883; it was the result of a cross between silver Sebrights and buff Shanghais, or silver-spangled Hamburgs and dark Brahmas or Cochins. They are small-boned, full-breasted, plump, meaty, and quick to mature, about a pound lighter, and laying smaller eggs than Plymouth Rocks. Golden Wyandottes originated in Wisconsin, in 1881, and admitted to the 'Standard' in 1888, were formed by crossing pea-comb partridge Cochins and single-comb brown Leghorns, or else by crossing buff Cochins and golden Sebrights. The white Wyandotte is the most popular variety of all the Wyandotte family. It is supposed to have begun in a sport from the silver Wyandottes, or by a cross between silver Wyandotte and rose-comb white Leghorn. This variety is a close rival to the barred Plymouth Rock for first place as the most useful fowl in America, and has the advantage of white plumage, which is important for market poultry. Black Wyandottes are a sport from the silvers; and buff Wyandottes are becoming popular.

*Asiatic Class.*—This class consists of three breeds, embracing eight varieties, as follows: (1) light and dark Brahmas; (2) buff, partridge, white and black Cochins; (3) black and white Langshans. As a class these are meat fowls, and are the heaviest fowls known, the light Brahma being the largest cock, 12 pounds, hen, 10 pounds; Cochin cock, 11 pounds, hen 8½;



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Langshan, cock, 10; hen, 7. They are rather poor layers, producing small to medium brown eggs. They are hardy, excellent mothers, although inclined to be too broody, and of kind disposition; shanks and toes heavily feathered, skin yellow, heavily feathered, ear-lobes red, combs medium, single in Cochins and Langshans and pea-comb in Brahmas. The light Brahma is most popular as a meat fowl, and the Cochin for exhibition purposes. Cochins were introduced into England from China in 1843, as Shanghais or Cochin Chinas. They were of many types and colors, very large and awkward. Brahmas are said to come from native Malayan sources, but it is more likely that they were improved from the old Shanghai fowl. The Langshans represent a valuable but not very popular breed from North China, introduced into England in 1872 and admitted to the 'Standard' in 1883. They lay very dark-shelled eggs, have black shanks and pink skin, and are the most active and least broody of the Asiatic class.

*Mediterranean Class.*—This large and popular class consists of five breeds divided into twelve varieties, and are more widely distributed throughout the world than any other family of poultry. The breeds are: (1) Single-comb brown, rose-comb brown, single-comb white, rose-comb white, black, buff, and silver duck-wing Leghorns; (2) mottled Anconas; (3) white and black Minorcas; (4) blue Andalusians; (5) black Spanish. As a class they are noted for their activity, egg-producing and non-sitting qualities and for their early maturity; they are medium to large in size, the Minorcas and black Spanish weighing,—cock, 8 pounds, hen, 6½; blue Andalusians,—cock, 6½, hen, 5½; the Leghorns and Anconas should weigh about 6 pounds for cock and 4½ for hen. Hens of this class lay medium to large pure white eggs and are poor sitters and unreliable mothers. All have smooth shanks and single combs except the two rose-combed varieties; and all have white ear-lobes. Though originally from a warm country about the Mediterranean, and although they have large combs and close feathering, they prove remarkably hardy and prolific in northern climates.

Among Leghorns the brown variety is perhaps more uniform in type than any other, but not so uniform in color. White Leghorns are supposed to be a sport from one of the other Leghorns. They are larger than the brown, lay larger eggs that are a little whiter, and are the most popular laying fowl in the world. Black Leghorns are a variety imported from Italy in 1872 and admitted to the 'Standard' in 1876. They are a pure variety of long standing, popular in England and Switzerland, where they are called Italians, but their color makes them unpopular in America. Buff Leghorns are gaining rapidly in favor, but as yet the variety is not thoroughly fixed as to type or color, although it is recognized by the 'Standard' and has made great progress. Silver duck-wing Leghorns are little bred, and are kept mostly for their beauty and for exhibition.

Black Spanish is one of the oldest breeds known, and derived from Spain. Columella wrote about them nearly 2,000 years ago, and they were bred pure in England before either Cochins or Brahmas. Their value is principally ornamental, and they are rather delicate.

Minorcas probably came from the Island of Minorca in the Mediterranean, and are supposed to have descended from the black Spanish, which they much resemble, although larger and without the white face. They were imported to the United States in 1880. They are larger than Leghorns, slower to mature, and are conspicuous because of their brilliant, green-black plumage, large red single combs, long straight backs and deep bodies. Their eggs are snow-white and larger than those of any other kind of chicken.

*Polish Class.*—This family consists of one breed, having eight varieties, namely: White-crested black, golden, silver, white, bearded golden, bearded silver, bearded white, and buff laced. They are medium in size, good layers of white eggs, and non-sitters. All have large, showy crests, owing to which they fall easy victims to hawks and enemies. They have in some cases beards; small V-shaped combs, and slate or willow shanks. As they are chiefly ornamental, they are not popular in the United States.

*Hamburg Class.*—This is a Dutch family, small, active and prolific, with rose-combs with a spike turned slightly upward. They are unreliable sitters and mothers, and lay small white eggs. Two breeds are recognized, in eight varieties,—gold-spangled, silver-spangled, golden, silver and white penciled, and black Hamburgs, and Red-caps.

Red-caps are noted for their beauty, conspicuous red combs, red ear lobes and spangled plumage. They are delicate and in most respects resemble Hamburgs.

*French Class.*—Three breeds: (1) Houdan; (2) La Fleche; (3) Creve-cœur. This class may be described as composed of ornamental table fowls, and the Houdan is the only variety at all common in the United States, for as a rule they do not prove hardy in this climate. All are fairly good layers of medium-sized, white eggs, and are non-sitters. All have large crests, light skin and shanks, and five toes on each foot.

*English Class.*—The Dorkings, white, silver and gray, are, first of all, meat fowls, although also fair layers of large white eggs. They are robust in form and compact in flesh. In the United States they are delicate, the fact that they have five toes is a disadvantage; and the pale skin and shanks so much prized on all English and French breeds are decidedly objectionable in the United States.

*Game Class.*—The games are supposed to be the oldest of all domestic fowl. They were originally kept for fighting. Now they are largely bred for exhibition purposes, and are divided into two families: pit games and exhibition games. All are brave and cruel. Their flesh is extremely solid and fine grain, and their plumage close and scanty. For the most part they are only fair layers of dull-white, small to medium, globular eggs. They are excellent mothers. Every variety of exhibition game is represented in the bantams. The following varieties are recognized as standard-bred: black-breasted red, brown red, golden duck-wing, silver duck-wing, red pile, white, black, and birchen.

Five varieties are grouped as Oriental games, containing four breeds as follows: Cornish and white, Indian game, black-breasted red



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Malay, black Sumatra, black-breasted red Malay bantam. The characteristics of this class are large size, coarse flesh, cruel disposition (although they are poor fighters) and unsatisfactory laying qualities, although they make good mothers; all have yellow skin and shanks.

*Bantams other than Games.*—This class comprises 16 varieties grouped under 7 breeds, namely: golden and silver Sebright; white and black rose-combed bantam; white-booted bantam; light and dark Brahma; buff, partridge, white, and black Cochins; black-tailed, white and black Japanese; white-crested white, and buff-laced Polish, and many other varieties not admitted to the 'Standard.'

*Miscellaneous.*—Among the miscellaneous breeds not otherwise classified there are:

(1) Silkies, an old and very beautiful breed that have been bred wholly without natural feathers, but with a beautiful downy, hair-like coat in two colors, black and white. (2) Frizzles, a breed that has its entire plumage ruffled and crumpled, turning in unnatural directions, and is kept only as an oddity. (3) Sultans, a very beautiful breed, valuable as a lawn fowl. They resemble Polish in most respects, except that they have feathered legs. Russians, Sumatras, and rumpless fowls are also in this class of oddities and ornamentals.

The breeds of fowl can be arbitrarily classified as to their utility characteristics, as follows:

<i>Best Layers</i>	<i>Best for Meat</i>	<i>Best General Purpose</i>
Leghorns	Indian Games	Plymouth Rocks
Hamburgs	Dorkings	Wyandottes
Minorcas	Brahmas	Rhode Island Reds
Houdans	La Fleche	Orpingtons
<i>Best Mothers</i>	<i>Poorest Mothers</i>	<i>Most Hardy</i>
Wyandottes	Leghorns	Plymouth Rocks
Plymouth Rocks	Minorcas	Leghorns
Games	Hamburgs	Games
Brahmas	Spanish	Wyandottes
<i>Least Hardy</i>	<i>Most Ornamental</i>	
Dorkings	Polish	Black Spanish Silkies
Spanish	Hamburgs	Sultans Yokohamas

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**Poultry as an Industry.** The information of the present article will be given under the following divisions: (1) The demand; (2) conditions of success; (3) details to be observed; (4) the necessary equipment; (5) the profit of the industry.

### THE DEMAND.

There is a steady and constantly increasing demand for first-class poultry products, both in the form of eggs and poultry for the table, and when the production of either of these commodities is combined with pure-bred poultry the producer has a doubly assured and considerably increased income.

There is certainly no danger of over-stocking the market, provided the quality be first class. Statistics prove that the city of Greater New York consumes more eggs each year than the entire Empire State produces. The two States of New York and Pennsylvania consume five times as many eggs as they produce. The importation of poultry into these two States is even proportionately larger than that of eggs. The people who produce the choicest poultry for the tables of the more fastidious residents of our great Eastern cities realize prices more than double the average price of the average poultry products marketed in those same cities. The retail price of strictly first-class eggs during the fall and winter months is more than three times the average summer price of average eggs in those same markets. There is a constant demand at these high prices for a product that can be guaranteed strictly first class, while it is only the second-class or third-class products that are at any time a drag on the market. The people are being educated to the fact that there is a vast difference between fowls of the same age for table purposes, and that even fowls of the same variety and age vary largely in quality according to the methods by which they have been fattened and dressed.

### CONDITIONS OF SUCCESS.

There are a few general principles, therefore, that he who hopes to succeed in the poultry business should become familiar with before embarking largely in this enterprise. 1. He must ever bear in mind that to acquire the greatest profit he must produce the finest quality. The market is generally glutted with the lower grades of poultry and eggs. These are supplied at an actual loss. 2. He must decide upon some one branch of the business which he will make his specialty, and, having made his decision, he must push that line to the limit, cultivating only as accessory the other minor branches of the industry. In making this decision he must give careful attention to his own adaptability to his chosen branch of the work, considering well his location and surroundings, his proximity to market, and the demands of that market. 3. He must be prepared to apply the business principles of the business man to the poultry industry. He must apply the principles of industry, thrift, and economy in poultry production with the same energy and persistence as they are practised in our great manufactories. In fact, he becomes a manufacturer, converting the raw materials of the farm crops into those finely finished products, eggs and poultry.

### DETAILS TO BE OBSERVED.

Having decided, for example, that egg production for the city markets shall be his chief aim, he must proceed in building up his business with that particular object constantly in



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view. In this work the following hints will be useful:

1. *Selection of his Variety.*—He must keep but one variety, so that his eggs may be as nearly uniform in color and size as possible. Boston calls for a brown egg; New York prefers a white egg. Each city will pay a few cents per dozen more for eggs of its favorite color. The Asiatics—Brahmas and Cochins—and the Americans—Plymouth Rocks and Wyandottes—produce the brown eggs. The Mediterranean varieties—Leghorns, Minorcas, and Anconas—are the largest producers of the white eggs.

He must, however, in selecting his variety, remember that the Brahmas and Cochins will produce but few eggs until eight months old, while the Plymouth Rocks will lay at six months, and the Wyandottes and Leghorns at five months.

If he intends to grow his own young stock he must provide incubators and brooders for the non-sitting Mediterranean varieties, while the Asiatic and American varieties will hatch and rear their own young.

He must also calculate on building warmer and more comfortable houses for the Mediterraneans than will be necessary for the close-fitting rose-combs of the Wyandottes or the small pea-combs of most of the Asiatics. All the Mediterranean varieties have large combs and pendulous wattles, very susceptible to frost. The Plymouth Rocks, with their medium sized combs, come between the extremes described, in this particular.

The time of year when he stocks his plant will decide whether he shall start by purchasing eggs for hatching or shall purchase fowls for his foundation. If he begins in the spring, and is equipped with incubators for hatching—and few now depend exclusively on the hens for hatching and rearing—then he will start more cheaply by purchasing eggs from some reliable breeder of his chosen variety. In the fall of the year it is best to start by buying pullets then four to six months old and ready to begin producing eggs.

2. *Care of the Stock.*—No hen can be a profitable egg producer unless she is kept comfortable and happy. More poultry plants have been wrecked and abandoned because of neglect in caring for the fowls than by any other cause. The questions of food and shelter will be considered under those headings, so we shall content ourselves here with merely mentioning two items:

(a) *Cleanliness.*—The hen is not an exacting tenant but she is naturally rather fastidious about some things, and she has a right to be. She must have her bath, and that bath is not a water bath, but a dust bath in which she can wallow occasionally and sift her feathers full of fine dust. This looks to be dirty, but it is not; simply dusty. Her quarters, furthermore, must be frequently cleansed. All droppings should be removed from the dropping-board at least once each week, and a little sweetening of the surroundings by a liquid disinfectant and insecticide is most advisable. Fresh straw as a litter for the floor of the house should be provided occasionally, and the nests—the receptacles for those fresh eggs so susceptible to any taint—should be renewed with fresh material frequently.

(b) *Water.*—Since an egg is two thirds water, it seems useless to argue for a constant supply of pure, fresh water. If this is provided, a hen will drink 20 times a day. If it is not supplied, her natural thirst will compel her to drink from filthy pools wherever she can find them, even from the cow tracks in the mud of the barnyard. Is it strange that fastidious people are becoming so particular as to specify how the hens that produce their eggs shall be supplied with food and water?

3. *The Separation of the Sexes.*—This subject is attracting much attention of late, and properly. So soon as the cockerels can be determined from the pullets they should be separated. Both sexes develop much more satisfactorily when kept by themselves. The cocks should be removed from the yards at the close of the breeding season, say in June, not to return until January or February. This much for the best interests of the fowls themselves.

But it is for a better and more certain quality of the eggs that we urge a separation of the sexes. When a hen that has been mated produces an egg, that egg has been fertilized at a certain point in its passage down the oviduct. From the moment of said fertilization until it is deposited in the nest—under normal conditions about 12 hours—the heat of the hen's body has caused the process of incubation to progress. If some great excitement prevents the hen from depositing the egg until the next day, the egg shows bloody streaks. We have known eggs to be thus retained by the hen for 60 hours, so that at the time the egg was laid the heart beats of the embryo chick could be seen with the naked eye.

While the process of incubation practically ceases as soon as the freshly-laid egg reaches a temperature as low as 80°, yet succeeding hens coming on the nest, perhaps several of them the same day, each warm that fertile egg up above 90° and the process of incubation is resumed. Where eggs are gathered at irregular periods—too often only “every few days”—it can readily be seen that only absolutely infertile eggs, those laid by unmated hens, are safely fresh, and many institutions, and even private families, are now making their contracts for “virgin eggs.”

On the other hand, eggs that are absolutely infertile may be kept in almost any temperature without spoiling. We have placed such eggs in an incubator and kept them there for three weeks at a temperature above 100° all the time, and at the end of that period amateurs could not distinguish them from fresh eggs. Only the infertile egg will bear transportation in warm weather, and only those who will take care to have such can hope to realize the highest prices.

4. *Poultry Diseases.*—This subject is now very properly attracting much attention in our agricultural colleges. All desire to be excused from eating the eggs of a diseased hen. One's comfort comes, however, in the fact that diseased hens do not lay many eggs. There is a further satisfaction in the knowledge that the much-talked-of fowl cholera is a rare disease. Only a very few well-authenticated outbreaks of this disease have occurred in this country. There are a few other diseases with somewhat similar symptoms that are frequently mistaken for cholera.

(a) *Diarrhœa and Dysentery.*—These dis-



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eases are both usually brought on by neglect in the matter of food and drink. Pure water is one of the first essentials, and the fowls usually having an unnatural thirst, the pure water is an easy medium for administering some of the simple remedies, such as the Douglass mixture or a little carbolic acid in the water. With brooder chicks many of these irregularities of the bowels are caused solely by extremes of heat and cold. Chicks under three weeks old will scarcely endure day and night extremes of more than 15 or 20 degrees without manifesting bowel trouble, however carefully they may be fed. With mature fowls in confinement, a failure on the part of the attendant to provide them with grit, gravel, oyster-shell, and broken bone is a fruitful cause of these two diseases. Sour and rancid food will also cause diarrhœa, while fowls nearby fed on sound grains will be free from it.

(b) *Roup*.—This is by far the most common disease to which our domestic fowls are subject. It is generally considered contagious, but the most careful experimenters have failed to identify the germ or to inoculate a well fowl from a diseased one. Still we advise caution, and recommend that affected birds be isolated. Roup being simply an aggravated cold which rapidly takes on the catarrhal form, prevention is most advisable. Under buildings we shall urge freedom from draughts and dampness, which are the most prolific causes. The bird taken in the early stages, kept warm and dry, fed liberally, and the throat and nasal passages sprayed with a weak solution of carbolic acid or an emulsion of unrefined petroleum, will generally recover. If he gets seriously ill, kill and bury him.

5. *The Kinds of Food*.—This is a subject on which volumes could be written. In brief, since analyses show that the egg and the body of the young bird are almost identical, we may conclude that the food that is best for egg production is almost the best also for the growing fowl. When the fowl is grown and is about ready to be fattened for market, then a different ration is best, as will be shown.

For either the growing chick or the egg-producing hen, in addition to the grits, bone, and shell already referred to, the best results are obtained by a liberal supply, in large variety of form, of the three following classifications of food:

(a) *The Grains*.—These are the natural food of our domestic fowls. They grow in such a variety in this country that there is no excuse for limiting our fowls to a scanty variety. Many erroneously suppose that what a hen picks up first is best for her. Throw down a few handfuls of corn, wheat, oats, and millet to a bunch of fowls and the corn will be taken first, the others in the order named. Notice that this is in the order of the size, instinct teaching them to take first that of which they can get the most in the shortest time. Now the corn is the grain that ordinarily should be fed the most sparingly. It is so rich in the carbonaceous, or fat-making, elements that it is neither a good egg-maker or a good flesh-producer. To feed to fowls thin in flesh or to feed on a very cold evening, to enable the fowls to keep up their temperature through a long night, corn is best.

Of all our grains we esteem oats the best. Fowls do not take so kindly to oats as to wheat which we rank as second. Use these two grains alternately. Do not mix your grains. Give them something different each time if possible. Kaffir corn is one of our very best poultry foods. Sorghum seed and broom-corn seed are very similar. Buckwheat and sunflower seed in moderate quantities are excellent. Never feed more grain than they will clean up in a few minutes, unless you bury it among the litter so that they must scratch and work for it. Better that your fowls be kept slightly hungry and in working condition than too fat.

There is not so much necessity for soft foods as most people imagine. With plenty of grit to do the grinding, fowls will do well a longer time on the grains fed whole than on any other rations. There are, however, two forms of the grains that we urge to be used freely, namely, common coarse bran constantly in boxes, dry, where the fowls, young and old, can get all they will eat of it, and ground oats. This last we like to feed mixed with bran for the middle-of-the-day feed—the only time we think it advisable to feed soft, wet food.

(b) *The Greens*.—The hen at liberty, or in a state of nature, in summer consumes a large quantity of green, succulent food—clover, white clover, alfalfa, lawn-grass, plantain, and a score of other forms of greenness will be found in her full crop as she comes up to the perch at night. On such a ration, together with the grains she picks up, she does her best at the egg-basket, or puts on good flesh the most rapidly. This should teach us, therefore, what to supply her in the cold weather if we wish her to do then the work of summer. We must supply these green things to her. Cabbages and mangel wurtzels, one each hung in her pen, are good. Clover and alfalfa, harvested before the stalks have become woody, cut into short lengths, steamed or wet with hot water, and then dried out in part with the bran or chopped oats—this is the most dependable of all green foods in winter.

(c) *The Meats*.—"As full as an egg is of meat" is an old-time proverb. The white of an egg is largely albumen, and this is best supplied to the laying hen in some form of meat. The hen at liberty gets many a bug and worm. The hen in confinement must have these supplied if she is to produce eggs. The growing and fattening fowl also needs the meat in some form.

Avoid as far as possible the meat-meals of the trade, of uncertain origin and quite likely to be adulterated. Use the coarse granulated beef-scraps whose contents can generally be discovered. These, having been prepared by steam cooking, keep well in any climate. Add to these an abundant supply of clean-cut bone and the combination is cheaper, richer, and better than even the ground bone obtained by grinding fresh bones secured from the butcher.

(d) *Fattening Fowls*.—Where it is desired to quickly finish either young or old birds for the market, the crate-fattening process has no equal. Two birds are confined to a slatted coop two feet each way, and, for convenience in handling the droppings, the bottoms are slatted also. The most successful food is some skim milk or buttermilk, thickened to the consistency of batter with finely ground and sifted oats.



## POULTRY AS AN INDUSTRY

Feed in a small trough in front of the coop all the birds will consume in 20 minutes, then remove the trough, returning it clean for the next feeding. Some give an occasional feed of grit and cut bone with advantage. Three weeks is as long as birds can be fed by this method; in that time many will gain 40 per cent some 50 per cent. The improvement in the quality of the flesh is as noticeable as is the increase in quantity. To advance a cockerel weighing  $3\frac{1}{2}$  pounds and worth 10 cents per pound, to one weighing 5 pounds, worth 15 cents per pound, in three weeks, at a food cost of 8 cents, is to almost double one's investment, and many are doing this very thing. The yellow-skinned bird takes on a quality of flesh well distributed and having the white skin and white flesh so much desired by epicures.

(e) *The Secret of Successful Feeding.*—To put it in a word, it is variety. Whether feeding for eggs or for growth, your aim must be to have the fowl consume and assimilate the largest possible quantity of food and then convert and manufacture this into eggs or flesh. With the hen as with the dairy cow, the individual with the best digestive apparatus is the one you can feed most profitably, and you must constantly cater to her appetite; when she gets tired of one thing, have something else more appetizing to tempt her to eat more of it.

### THE NECESSARY EQUIPMENT.

(a) *Houses.*—We have already intimated that the houses must be clean and comfortable. In order to be comfortable they need not be made warm with artificial heat. Fowls will endure intense cold if it is dry cold. Their bodies generate enough heat, if properly conserved, to keep them comfortable through the danger period—the night time. In the day they should have an opportunity to exercise and make their blood circulate in scratching in the litter on the floor for their grain ration.

The simplest and best houses we have ever seen are 12 feet wide and of any length desired so as to be divided into compartments each 12 feet square. The rear posts are  $4\frac{1}{2}$  feet high, the front posts  $5\frac{1}{2}$  feet high, the rear rafter 9 feet long, and the front rafters 5 feet long. This makes a house low at the back and only 7 feet high at the apex of the rafters, which is about two thirds of the distance from the rear to the front.

When the rafters are set, sheeting boards are put on the back and roof lengthwise. Over these the best quality of three-ply tarred paper is placed, running from the ground at the rear to the front eaves. This, if treated to a coat of hot gas tar, twice the first year and once each year thereafter, will last for a dozen years or more, and it will be a house "air-tight at the back." The front and ends may be covered with finished weather-boarding and painted, but if so the ends should be lined with the tarred paper.

Be sure that the house is only  $4\frac{1}{2}$  feet high at the back. Build the dropping-boards  $3\frac{1}{2}$  feet wide, exactly half way between the floor and the roof. Use 2 x 4-inch scantling, flat side up, and running lengthwise of the house, for perches. These, if placed 6 inches above the dropping-boards, will place your fowls at night 10 feet distant from the front or cold portion of the

house and will give them a very limited space overhead, so the warmth of their bodies will not be scattered but will be retained where it will keep most combs from freezing in the coldest weather.

Put one window in the front of each compartment. Do not be too lavish of glass. It radiates the heat and makes the house cold at night. A window  $2\frac{1}{2}$  by  $4\frac{1}{2}$  feet is large enough. If hung on hinges, it serves as a door through which one can step out from each compartment into its corresponding yard in front. A small exit hole, 8 x 14 inches, in the front for the use of the fowls makes sufficient ventilation in winter. In April the glass hinged windows may be removed and replaced until November or later with wire-screening doors.

All nest boxes, feed boxes, etc., should be attached to the front and sides of each compartment,  $1\frac{1}{2}$  feet above the floor, so as to leave the entire floor area for scratching room for the fowls.

Each compartment being 12 x 12 feet, and each hen requiring a floor area of 6 square feet in order that she may have sufficient room for healthful exercise, it will be readily seen that 24 hens is the proper number of occupants for each compartment. A house of this kind, 120 feet long, divided into 10 compartments, holding 240 hens, should not cost more than \$240, or \$1 per hen. Do not be deluded into the idea of making the walls double and stuffing the space between with straw or sawdust. The thin walls, if made air-tight as directed, are better in every respect and the house will be dryer and more wholesome.

(b) *Incubators and Brooders.*—Better buy these from those who have learned how to make them. There are a dozen good incubators on the market. Purchase the one that seems to you simplest and best. After some experience you may learn to make large box brooders out of discarded piano boxes that will save you some money, and give greater area for the chicks than the brooders you buy. Those of the writer are  $5\frac{1}{2}$  x  $5\frac{1}{2}$  feet, 2 feet high at the back,  $3\frac{1}{2}$  feet high at the front, with a 2 x 3 feet window in the front. They are built on 12-inch plank set edgewise for a foundation, thus allowing room for the lamp-box underneath the back. When chicks no longer need artificial heat, the heating apparatus may be removed and this brooder used as a colony house for the youngsters until cold weather.

### THE PROFIT OF THE INDUSTRY.

This must depend largely upon the intelligence, skill, energy, and location of the operator. On farms the cost of food does not exceed 75 cents per hen per year. Where everything is bought, in most localities it need not exceed \$1 per hen. It is a poor class of hens that cannot be made to average 120 eggs each, and it is a poor manager, anywhere east of the Missouri River, who cannot realize 2 cents each for those eggs. Deducting food cost of \$1, the returns for labor and investment are \$1.40 per hen. Many are averaging 180 eggs per hen and receiving  $2\frac{1}{2}$  cents each for the eggs, which brings the income on the egg business up to \$4.40 per hen.

The best poulterers are combining the branches of the industry by raising pure-bred



## POUNCE — POUND-NET FISHING

birds of some variety popular and saleable. They sell most of their surplus eggs for hatching during February, March, April, and May, the price they realize varying with their reputations, from 5 cents to 50 cents per egg.

Their next sales are from the cull male birds of their early hatchings. These go for broilers, at from 35 to 75 cents each, from April to July. The early hatched chicks, at one pound each, bring more than those three times as large but later, in the Eastern cities.

The early hatched pullets become egg-producers by August and September, just in time to replace the hens that have quit laying on account of the moulting. The choicest of both sexes are reserved for breeding, show, or sale purposes, and bring fancy prices. It is no unusual return for such a fancier to have an income of from \$5 to \$10 for every hen that he starts the year with, before that year closes.

T. E. ORR,

*Secretary of the American Poultry Association  
and Superintendent of Poultry at the Saint  
Louis Exposition.*

**Pounce** (a corruption of *pumice*), gum sandarach or some other substance pounded and sifted very fine, to rub on paper in order to prevent ink from spreading on it. The best pounce for this purpose is ground cuttlefish bone. Pounce is also the term applied to charcoal dust enclosed in a piece of muslin, or some other open stuff, to be passed over holes pricked in a work, in order to mark the lines or designs on paper, silk, etc., placed underneath, which are to be afterward finished with a pen and ink, a needle, or the like; or to any other coloring matter prepared and used in a similar manner.

**Pound**, (1) an English weight of two different denominations, *avoirdupois* and *troy*. Since 1856 the legal original standard weight in Great Britain and her colonies has been the imperial pound *avoirdupois*, a cylindrical mass of platinum, grooved near the top and bearing the mark "P. S. 1844 1 lb.," the two letters P. S. signifying "Parliamentary Standard." The pound troy in Great Britain is defined as 5,760 grains and is divided into 12 ounces, being used almost entirely for measuring bullion; the pound *avoirdupois* contains 7,000 grains, divided into 16 ounces, and is used for all ordinary commodities. The imperial standard troy pound constructed in 1758 was the only legal original standard weight between the years 1824 and 1856, but previous to these years certain weights, both troy and *avoirdupois*, constructed in 1858 under Queen Elizabeth had been the standards. These standards were not very accurately constructed, and through constant use became worn, but the pound *avoirdupois* probably contained as much as 7,002 of our present grains, while the pound troy weighed 5,759 grains. In the United States the British imperial pound *avoirdupois* has been copied to a great extent, but in theory the pound *avoirdupois* of Elizabeth is legal in this country. Edward III., from evidence in the official records, made the pound *avoirdupois* the standard, and Elizabeth probably copied her standard from his 56-pound weight, although standards had existed since 1497. The troy pound derives its name from the city of Troyes, where it was used as the standard of weight in the fairs held in that city. In 1497 it was made the legal weight for gold and silver, and some

authorities claim it was also used for bread, being known as the "old commercial weight of England," and containing 7,600 grains. This troy pound displaced the monetary pound which had been in use from the times of the Saxons, and which contained 5,400 or 5,420 grains and was divided into 12 ounces or 20 shillings. At about the same time the merchant's pound containing 6,775 grains, divided into 15 ounces, came into considerable use. (2) Pound is also the highest monetary denomination used in British accounts, being equivalent to 20 shillings or 240 pence, and originally to a pound weight of silver (or of the alloy used). In the use of pound as designating money, the epithet *sterling* is generally affixed to discriminate from the pound weight. (See WEIGHTS AND MEASURES.) (3) In law, an enclosed space for keeping cattle which have strayed on another man's ground, until they are replevined or redeemed. When cattle are put into pound it falls to the person impounding them to feed them, but he is entitled to charge the owner of the cattle the cost of keeping them in settling with him for the amount of damages to be paid. In England, an attempt to release from a pound cattle lawfully impounded is punishable by a fine. In Scotland the seizing of stray cattle and keeping them till damages are paid is called poinding of cattle.

**Pound-net Fishing**, any fishing which is conducted by means of fixed enclosures of considerable size into which the fish are led by suitable guides, and within which they are confined by appropriate devices. Under this head will be included the pound-nets proper and trap-nets, as well as the simpler forms of weirs, which together constitute a class of automatic fishing gear quite distinct from the various forms of seines, gill-nets, etc., on the one hand, and the small fish-traps, baskets and eel-pots on the other. Devices of this sort are employed in the prosecution of the fisheries in many parts of the world, but the method, although not originating in the United States, has here been more highly elaborated and is more characteristic of our fisheries than elsewhere. The precise form and construction of pound-nets varies greatly in different localities, owing to the necessity of adapting it to local conditions of bottom, tides, currents, the kind and number of the fish sought, the available capital, resourcefulness of the fishermen, etc.

**Weirs.**—The terms weir and pound in connection with the fisheries are to a great extent used interchangeably, according to local custom. The chief distinction between a weir and a pound-net seems to lie in the character of the enclosure within which the fish are confined. In the former this is more fixed and has no bottom which can be lifted; in the latter the pound is a netting bag which can be raised to the surface.

The most primitive apparatus of this sort in use in the United States is represented by the brush weirs employed in the herring fisheries of Maine and Canada. These consist of brush walls constructed in the following manner: Stout stakes from 6 to 8 inches in diameter at the butt, and 20 to 35 feet long, according to the depth of the water, are driven into the bottom to a distance of about 6 feet and 3 feet apart. Between these brush, preferably of cedar or spruce for the bottom courses, is woven in and



## POUND-NET FISHING

out and held firmly in place by smaller stakes placed on the outside and bound to the large body-stakes. Toward the top a looser construction is adopted and the brush is placed vertically, as being less liable to be carried away by the current. Sometimes the brush is constructed in sections ashore and subsequently attached to stakes driven in the proper positions. This has the advantage that the brush sections can be removed and saved at the close of the fishing season, whereas the ordinary weirs, with the exception of such brush as can be removed from the tops, are likely to be totally destroyed by the winter's storms. When weirs are located on a bottom of solid rock into which no stakes can be driven, recourse is had to the construction of a platform of solid plank, which serves as a bottom to which the poles are fastened. The whole is heavily weighted and held in place by loading it with stones. In form and size scarcely two weirs are alike, but each is adapted to the topography of the bottom and the character of the currents to which it is related; and so varied are they that each is known to the local fishermen by a specific name. New weirs are constructed each spring, and the fishermen study with great care the arrangements of the channels, the conformation of the bottom, the set and force of the currents and especially the roadways along which the schools of herring move, locating their weirs with the idea of intercepting the greatest possible number of fish. The simplest form is perhaps the tidal weir, so arranged that fish can enter at openings through which the water flows during the last half of the flood tide, but find their retreat cut off during the last half of the ebb. The captured fishes are left stranded at low water and can be gathered by hand. This form of weir has, however, been practically abandoned, and more elaborate structures with wings and leaders adopted. These have the advantage of acting all through either the flood or the ebb tide or both. In a typical weir of this type the inner enclosure is more or less circular and perhaps 100 to 150 feet in diameter, with a mouth about 15 feet wide. The wings are of similar construction and about 100 to 150 feet long, diverging from the entrance of the weir into which they enter as the sides of a wedge-shaped passageway leading to an interior entrance about 10 feet wide. The outer ends of the wings are curved or hooked in various ways in order to direct toward the weir any fishes swimming in their direction. Leaders or centre fences are also walls of brush passing from the shore or bar to a point between the outer hooks of the wings. They may be several hundred feet long and are arranged at various angles to the weir proper. Among the fishermen a complete weir, with all the parts just described and of more or less symmetrical plan, is known as a patent weir; but very often the conformation of the shore or the presence of a bar or small island is taken advantage of and used as a substitute for the leader, for one or both of the wings, or for a part of the wall of the enclosure, in order to lessen the labor of construction. As a result we have bar weirs, shore weirs, channel weirs, etc. Sometimes a trap-door of netting is so placed across the mouth of the weir that it can be readily raised by pressure from without, but resists a push from within, thus furnishing an additional safe-

guard against the escape of captives. Owing to their construction the most effective method of fishing these weirs is by drawing a seine through them and thus removing the catch whenever desirable and expedient. Usually this is done at low water.

The use of true brush weirs is almost entirely limited to the waters of Passamaquoddy Bay. Where weirs are employed elsewhere in the United States their walls are usually constructed in whole or in part of cotton-twine netting. In the salmon fisheries of the Penobscot River and Bay a form of weir is employed in which the leader or run and the wings are constructed of spruce poles and alder brush, the second and third pounds of netting and provided with wooden floors so placed that the fish are left stranded at low water on the floor of the third or fish pound. The several pounds are arranged either across the channel or parallel to the shore. In the Kennebec River the shad weirs are, with the exception of the leader, which may be of brush, constructed entirely of netting, and they have no floor save the bottom of the river. They are fished by means of small seines. In a few places laths have been substituted for brush in the construction of small weirs. On the north shore of Cape Cod, where the bottom is sandy and very gently shelving, the leaders are often half a mile long and even then the bottom of the weirs is nearly dry at low water. These shallow-water weirs are fished in a unique manner. At low water light two-wheeled carts are driven to them across the sands and the fish are simply shoveled or bailed into them and carried to the shore.

*Pounds.*—A pound-net in the more restricted sense of the term is constructed entirely of cordage netting, supported and held in place by stakes, and consists of three essential parts: the pound or bowl, the wings and the leader. The pound is located off-shore, usually in from two to four fathoms of water and consists of a bag of very stout netting of about one inch mesh, the margin of which is supported above the level of the water by stout upright stakes driven into the bottom at suitable intervals which vary with the character of the ground and the force of the waves and currents. Where the bottom is rocky further security is found by the attachment of anchored guy ropes to some of the stakes. The only opening in the pound is the slit-like entrance, usually about six feet across, on the in-shore side. At this point the walls of the net are carried inward, in order to render the opening less conspicuous from the inside, and are so arranged that by means of suitable ropes they may be used to close the opening when the net is drawn. The bottom of the pound is spread and secured by means of ropes which pass through loops or pulleys near the bottom of the stakes. The pound varies in diameter from 45 to 90 feet or more, and in shape may be circular, heart-shaped, rectangular or irregular, according to local custom and circumstances. Sometimes the pound is divided into inner and outer compartments, in which case the former is the real pound in which the fish are collected and retained; or the division may be so arranged as to classify the contents, as in the case of the pound-nets of Delaware Bay, many of which segregate the king crabs in staked enclosures. To many pound-nets is also appended at the side



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a pocket or netting bag of convenient size and shape for the purpose of keeping fish alive after they have been removed from the pound, when it is desirable not to market them immediately.

The wings are vertical fences of netting, diverging from the entrance to the pound and having a length of 100 feet or more. The ends directed toward the shore are carried toward one another in the form of a semicircle, but leaving a wide opening between the two wings. The netting of which the wings are constructed is lighter than that forming the pound, and of about  $1\frac{1}{2}$  inches mesh. It is supported by stakes and reaches from the bottom to the surface, the lower border being weighted with a heavy chain. The exact arrangement of the wings varies endlessly; sometimes there is but one; sometimes they have the form of an arrow-head; frequently there are two sets, one forming the inner or smaller "heart" which opens directly into the pound, and receives the open apical end of the outer or large "heart." But whatever their form they are designed to direct the fish toward the mouth of the pound, and to present as many obstacles as possible to its passage in the opposite direction. The leader is simply a straight fence of netting running from a point at or near the shore to just within the opening between the wings. It is made of lighter cordage and much larger mesh than either the pound or wings and lengths of heavy chain or other sinkers attached to the lower margin serve to keep it close to the bottom, the upper edge being supported at the level of high water by stakes.

The cordage pound-net is capable of almost unlimited modification, and the fishermen have shown the greatest ingenuity in adapting the principle to local and special requirements. Perhaps the most perfect and efficient form has been developed on the Great Lakes, where the pounds are often set in water of considerable depth, and the bag or pound proper may be as much as fifty feet or even more deep, with the entrance in the form of a funnel projecting into its interior. Size and shape of pound and wings vary with the conformation of the ground, kind and abundance of fish and direction of currents, but are very largely governed by local prejudices and regulations, or by the amount of capital available. The size of mesh and twine in pound, wings and leader also varies greatly, being controlled by the strength of the currents, the amount of eel grass, marine algæ and flotsam which accumulates, the kinds of fishes sought, and sometimes by local regulations and customs which have little apparent relation to the natural factors. A leader constructed of netting having a large open mesh collects less floating material and is consequently less likely to be carried away by strong currents than one of small and close mesh, and is almost as effective in directing fishes into the wings as the latter. In the wings and pound, however, and especially in the latter, the mesh must be sufficiently close to retain the valuable kinds of fishes in the blind and the vigorous dashes for freedom which follow the discovery of their imprisonment. Generally in the sea-fisheries everything, from herring, or even bait-fish and squids, to bonitos and sturgeon, is desired; and the nets must be stout enough to withstand the fierce rushes of sharks or other sea-monsters. Consequently a small mesh of very stout

twine, often reinforced by slings of stout rope, is employed. If the fisheries are specialized and only a particular kind of fish, as whitefish, shad or salmon, is desired, the net can be endowed with a certain selective property by using a mesh just small enough to retain that kind, while permitting the escape of all of smaller size. As the object of leaders is to intercept the moving schools of fishes and to direct them toward the enclosure, they are naturally placed in such positions as the fishermen's knowledge of local movements and conditions dictates. They may begin at or near a shore or at the edge of a bar and their length varies greatly with the gentleness or abruptness of the slope of the bottom, and is further controlled by navigation laws prohibiting the obstruction of channels. Sometimes owing to local topography or to the set of the current continuously in one direction the leader is arranged with an opening on one side only so that fishes swimming in but one direction are taken. When located in tidal waters, however, they usually have double wings and openings so that they operate with both ebb and flow of the tide and are effective against fishes moving both up and down the shore. Frequently when the bottom slopes very gently, and the fish are known to move diffusely or in scattered schools, several pound-nets are arranged in lines or series, the leader of one beginning at the outer end of the pound of another. On the Atlantic coast pound-nets are generally placed singly and very rarely are more than two placed on a line, but in Lake Erie four or even more may be arranged in a series, the last member of which may reach far out into the lake and into deep water. Such lines must be extremely effective and almost completely obstruct the passage of larger fish. But perhaps the greatest ingenuity is shown in the methods of fastening the nets to the bottom. Usually stout stakes of oak or other wood are employed, varying in number, length and thickness according to requirements. Where the bottom is of mud, clay or sand, these are driven in by use of a pile-driver, maul, or other means, for about six feet, more or less, according to the holding quality of the ground, force of current, etc. When the bottom is soft and the stakes small a man is often suspended in a sling from the top and the stake worked into the ground by swinging it back and forth. On sandy bottoms suction-pump and force-pump pile-drivers are sometimes employed for driving the stakes. Where the bottom is very stony and the stakes difficult to drive and insecure in their hold, they are often supplemented by guy ropes attached to anchors, large stones, or large outlying piles. Anchored nets may be buoyed up by floats attached along the upper edge, and sometimes become practically floating pound-nets. Such nets, which are in use on the coast of Maine, are operated by a complex system of ropes. At places on the coast of Maine where the bottom is of solid rock it becomes necessary to attach the stakes to solid plank platforms weighted with heavy stones.

*Trap-nets.*—Any form of enclosure employed in the capture of fish may be called a trap, and trap-net is frequently used as an equivalent of pound-net. The best usage of the term, however, is to indicate those forms of pound-



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nets which are especially adapted to deep waters or a considerable tidal rise and fall by the attachment to the upper margin of the nets of floats which keep it always level with the surface. When surface-swimming fish only are sought, the parts which correspond to the leaders and wings of pound-nets frequently hang suspended above the bottom. The whole is of course held in position by a suitable system of ropes, anchors and moorings. This type of apparatus is an approach to the floating gill-net, the sets of which are often arranged in the form of leaders and enclosures.

*Methods of Operation.*—The method of fishing and caring for pound-nets of course differs in details according to the locality and size of the net, tides, currents, disposition of catch and numerous other factors, but is essentially the same everywhere. Usually three or four men constitute a fishing-crew, who proceed to the net in a large scow-like boat. The first operation is to loosen the bottom-lines which keep the pound distended. This is done successively at each stake around the entire circumference of the pound. At a point especially designed as an entrance and usually situated at one side of the mouth of the pound, the edge of the net is then lowered just sufficiently to admit the boat, and immediately after its entrance is again raised. The mouth of the pound is then closed, and the men begin to lift the net and pile it in the boat, proceeding slowly forward, so that the fish are crowded into a continuously diminishing space. The area into which they are finally "bunted" is frequently constructed of stouter twine in order to withstand the strain imposed upon it by a large catch. The fish are then bailed out with dip-nets, either into the fishing boat or into another boat which has been stationed on the outside of the net or into the pocket at the side of the pound. Except under special circumstances, as when the fares are very small, or during the progress of severe storms, it is customary to fish pound-nets on every week-day, preferably at low water, or occasionally, when the run of valuable fish is unusually heavy, even twice a day.

*Places and Seasons.*—Notwithstanding the great ingenuity exercised, pound-net fishing has certain limitations. These devices can be effective only in the comparatively shallow waters in the proximity of shores or bars, and on relatively smooth bottoms, though the former difficulty has been somewhat overcome for certain classes of fishes by the invention of the floating trap and the latter by the construction of artificial floors. A more serious obstacle is their inability to withstand the beating of severe storms or heavy surf. The ideal location is in a sheltered bay or estuary, where the bottom slopes gently to a channel washed by strong tidal currents and serving as a roadway for migrating schools of valuable fishes. The absence of pound-nets from great stretches of our coast and their concentration at certain favored points is due more to these factors than to the distribution of valuable kinds of fishes. A very brief review of the geographical distribution of pounds and weirs may be given. Brush weirs are nearly peculiar to the fisheries of Maine and in the typical form are nearly restricted to the capture of herring on both the Canadian and American sides of Passamaquoddy Bay. Net-

ting weirs are largely employed in the bays and rivers of Maine, on the north shore of Cape Cod, in Narragansett Bay, parts of Delaware and Chesapeake Bays, Albemarle Sound and the Great Lakes. Of true pound-nets a few are found on the coast of Maine, a great many in Vineyard Sound and other waters south of Cape Cod, where perhaps the most important pound fisheries of the country exist, some large ones in Long Island Sound and the neighborhood of New York harbor, others in the bays and even on the ocean front of New Jersey, in Delaware Bay and a very large number in Chesapeake Bay and the lower parts of its tributary rivers. The southernmost point on the Atlantic coast at which pound-nets are employed to any considerable extent is in Albemarle Sound. In the fisheries of the Great Lakes and especially at the western end of Lake Erie pound-nets are very extensively employed. On the Pacific coast they have been adopted only in the lower waters of the Columbia River, where they have now almost completely superseded the old form of wooden trap in the salmon fisheries. It will be observed that from the entire Gulf coast and the greater part of the southern Atlantic and Pacific coasts of the United States pound-nets are practically absent. Several years ago an attempt was made to use pound-nets on the coast of Texas, but the frequent tearing of the nets by sharks, large gars, etc., permitting the escape of the contents, led to their abandonment. It is quite probable, however, that this difficulty could be overcome by the construction of weirs of galvanized-iron wire-netting and that their employment in southern waters in the vicinity of large cities would prove extremely profitable. The prevalence of severe storms during the winter has rendered the operation of pound-nets feasible only in the warmer months and this also has prevented their use widely in the South, in many parts of which facilities for preservation and rapid transportation of fish are lacking. In most places the extreme limits of the fishing season are the months of April and November, and even within this period the nets are sometimes completely wrecked by storms; and on many days the more exposed nets are quite inaccessible even to the hardy and experienced fishermen who operate them.

*Importance, Extent and Products.*—If a classification of the fisheries of the United States according to the kind of apparatus employed were made, it is altogether probable that those conducted by means of pound-nets and weirs would rank first in the value of their product. While the complete data for an estimate of this sort are not available the great importance of this class of apparatus may be appreciated by a review of a few statistical facts relating to some of the fisheries in which it is employed. For the shad fishery, one of the most important of the Atlantic coast rivers and bays, the latest complete statistics published cover the year 1896. During that season 13,714,755 shad, having a value to the fishermen of \$1,655,000, were taken by all kinds of apparatus. Of this number 3,139,830, valued at \$361,632, were captured in the 3,810 pound-nets set especially for this purpose, and about 750,000 more from others from which returns were received. These nets were valued at \$464,062 and 3,076 persons were employed in their operation. By far the most important cen-



## POUND-NET FISHING

tre for this fishery is located in Chesapeake Bay and its tributaries, which yielded from pound-nets alone about one fourth, and from all kinds of apparatus about one half of the entire product of the United States. The next most important pound-net shad fishery is in Pamlico and Albemarle Sounds. Very few shad are taken in the ocean-front pounds of New Jersey and elsewhere, but considerable numbers in the river weirs of Maine. The herring used in the sardine factories of Maine are practically all yielded by the brush weir fisheries of Passamaquoddy Bay, covering an area of about 100 square miles. In 1895, 384 weirs were located in these waters and supplied the canneries in the vicinity of Eastport with 47,979 hogsheads of herring of 1,000 pounds each, with a value to the fishermen of \$99,845. Of these weirs 331 were on the Canadian and 53 on the American side, the latter valued at \$28,483, operated by 139 fishermen, and yielding 9,683 hogsheads of herring having a value of \$15,134. In 1892, 378 pound-nets, valued at \$276,800, were employed in the salmon fisheries of the lower Columbia River in Oregon and Washington. They captured that year 8,788,685 pounds of salmon, valued at \$275,059. The alewife fisheries of the Atlantic coast yielded in 1896 more than 60,000,000 alewives, valued at \$460,000, as the product of pound-nets and weirs.

A few figures showing the value of the apparatus at some of the chief centres of the pound-net fisheries will be further instructive. In each case the figures are given for the nets and weirs alone and are exclusive of valuations of boats and all kinds of shore property and accessory apparatus. In 1898 the number of weirs and pounds-nets in use in the New England States was 1,096, with an aggregate value of \$405,424. The Middle States, Maryland and Virginia employed in 1897 no less than 2,491 pound-nets, trap-nets and weirs valued at \$499,115. The number of the same class of apparatus in use in Lake Erie in 1899 was 1,724, valued at \$245,561. In the lower Columbia River region, the only locality where pound-nets are in use on the Pacific coast, the figures for 1895 are 423 pounds and traps, worth \$309,675. Leaving out of consideration vessels and boats, which are employed in connection with all kinds of apparatus, the value of pound-nets and weirs exceeded that of any other single class of fishing property in the first three regions, and in the fourth fell below that of seines only. In the Saginaw Bay region of Lake Huron as much as three fourths of the product of the fisheries comes from the pound-nets and trap-nets. In Massachusetts in 1880, when the pound-nets were valued at \$76,875, they produced fish having an original value of \$210,000. The variety of fishes taken in pound-nets is no less remarkable than the quantity. Among the most important are salmon, shad, bluefish, herring, alewives, Spanish mackerel, mackerel, bonito, scup, weakfish or squeteague, sea bass, tautog, smelt, cod, flounder, striped bass, butterfish, kingfish, pompano, sturgeon, whitefish, perch, pike-perch, and sheepshead, besides many smaller food-fishes and the various kinds used for bait and ground up for fertilizer.

*Financial Organization and Profits.*—While the smaller and simpler forms of weirs may be built at very slight expense the construction and

operation of the larger and more elaborate kinds of pound-nets requires considerable capital. Consequently the organization of the owners and their financial arrangements differ almost as widely as the modifications of the apparatus. Naturally the fishermen themselves are primarily concerned and the simplest arrangement is that in which several combine, as in the brush-weir fisheries of Maine, and together supply all necessary labor and capital and share the product. Sometimes small stock companies are so formed. As a result of these various agreements, many curious local customs and practices have grown up, often having all the force of written laws and, indeed, some of them have come to be embodied in the actual law. Very often a number of pound-nets located at widely different points are owned by a wealthy man or group of men, who employ on regular wages local foremen and fishing crews, arrange for the disposal of the product and derive handsome incomes from their investment. Of late years the tendency toward completer organization and the economy of operation on a large scale has led to the formation of large stock companies with abundant capital. Wherever the field is sufficiently tempting, as in the Great Lakes, Chesapeake Bay, on the New Jersey coast, and elsewhere, such corporations are now engaged in pound-net fishing. They own many pounds, with fleets of boats, including steam tugs, and employ many men. Such companies are generally financially prosperous, pay large dividends, and have become powerful influences in our fisheries. The profits of pound and weir fishing are often very great, but, like all kinds of fishing, are subject to periodical wax and wane, the result of unforeseen and uncontrollable factors. It is known that some of the largest and best located pound-nets will often yield from \$5,000 to \$7,000 net profit in a single good season, and some of the companies have paid annual dividends of 20 per cent.

*Legislation.*—Various laws have been passed to regulate weir and pound-fishing. Many of these have reference to the obstruction of navigable waters, prohibiting the extension of nets into channels beyond a certain distance, or, where long lines of pound-nets are employed on shelving bottoms, requiring that suitably marked gateways for the passage of small boats be left at proper places. Others determine the length of the fishing season, relations, and responsibilities of the owners, etc. Frequently the fishing rights along a shore are controlled by the local township government, and privileges are rented upon the payment of a license fee. In such cases the rights cover a certain specified extent of shore, and the length of the leaders, distance between pounds, and other conditions affecting neighboring fishermen are regulated. Shore privileges are of course secured from the owner of the land. Owing to an apparent correlation between the introduction of pound-nets and a local diminution in the numbers of certain shore fishes, pound-nets have found bitter opponents in the ranks of the more conservative hand-line fishermen, anglers, and others who view the pound-net as a destructive agency, the employment of which transgresses their rights. Consequently many bills have been introduced into State legislatures and even into the Federal Congress either totally prohibiting or greatly



## POUNDAL—POURBUS

restricting the use of pound-nets in waters over which these bodies have jurisdiction. While some of the less drastic of these measures have occasionally become laws, prohibiting the use of pound-nets in certain bays, channels, and other waters of limited area, they have for the most part been defeated, partly through the activity of the powerful interests opposed to them, but chiefly because of the widespread opinion that the employment of the most effective methods in the fisheries is in the interests of the people at large. It is impossible in a brief article to discuss adequately this question and the charge of wasteful destructiveness which has been made against the pound-net fisheries. While it is apparent that many improvements in the utilization of the products of these and, indeed, of nearly all branches of our fisheries, are possible it has never been proved that the use of pound-nets is really detrimental to the other fisheries, nor that they are really responsible for the lessened abundance of certain sea fishes. While a diminution in the numbers of some species has been largely coincident with the introduction and growth of pound-net fishing in certain regions it is equally evident that other species, such as the herring and scup, have become more plentiful during the same period. The whole subject of fluctuations in abundance of sea-fishes is an exceedingly complex and little understood one; but, although some hold a contrary opinion, the general belief of close students of the sea-fisheries and of marine zoologists is that man is a factor of very slight importance in relation to the magnificent scheme of oceanic life.

*History and Development of Pound-Fishing.*—The essential principal of the weir and pound-net,—that of automatic utilization of the long-observed habit of most fishes of swimming for a time straight away in any direction toward which they have been turned by a sufficient obstruction,—is capable of almost indefinite development and has been employed by many peoples for long periods. All that is necessary is to utilize the materials at hand and, taking into consideration the habits of particular fishes and the local conditions, to construct an enclosure of such a form that the fish on the outside are insensibly led to the entrance and once within are induced by a labyrinth of walls to circle about in a vain attempt to discover an exit, which few succeed in finding. In many tropical coral islands large numbers of fishes are imprisoned by the receding tide in natural pools. It is only a step from the utilization of these by the natives to their improvement by opening or closing passages and finally to the artificial construction of stone enclosures of more or less complex form and often with leading walls and wings closely following the essential plan of our own pound-nets. All stages in the development of these stone weirs may be found in use by the natives of the various South Sea islands. Bamboo is excellently adapted to the construction of weirs and is much employed for this purpose in Oriental waters, some bamboo weirs of exceedingly ingenious design being used on the island of Guam. In Europe the use of weirs and fixed nets is practically unknown and indeed is in most countries prohibited. "Stake-nets" are still used to some extent in the British salmon fisheries. In North America weirs more or

less rudely constructed of interwoven brush were employed by the Indians, chiefly in the capture of herring, before the advent of the white man. They were early adopted by the Canadian fishermen and were introduced into our waters from Nova Scotia in 1820. These early ones were of small size and of the half-tide type, but were gradually improved in plan and construction and increased in size as the demand for smoked herring increased. After the Civil War this demand declined and with it the Maine weir fisheries, but the latter have regained their importance with the growth of the sardine industry since 1875. Pound-nets were first used in our waters in Connecticut in 1850 and about the same time netting began to be employed in the weirs of Penobscot Bay and the double form was first substituted for the less efficient single hook type. On the New Jersey coast the first pound-net was set on the inner shore of Sandy Hook in 1855, and 20 years later, after the discovery of their importance in the Spanish mackerel fishery, their use became general in these waters, wherein some of the largest and most lucrative pound-nets in the country are now located. Against the construction of a pound-net on the Virginia shore of Chesapeake Bay in 1858 the prejudices of the local fishermen were so strong that it was removed at night and carried ashore and the owner was forced to remove to a more friendly neighborhood. However, the seed was sown and in a few years the rapid introduction of pound-nets into that region so completely revolutionized the fisheries that they have grown from almost nothing to be among the most important in the country. Once established at these important points pound-nets have grown rapidly in favor. As their use extended, new forms and modifications have appeared and they have been adapted to an ever widening variety of conditions and kinds of fishes.

*Bibliography.*—Much information relating to all phases of the use of pound-nets in the American fisheries will be found scattered through the 'Annual Reports' of the United States Bureau of Fisheries and of the commissions of the various States in which these fisheries are located, and especially in the 'Fisheries Industries of the United States' (Washington 1884-7).

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**Poundal.** See FORCE AND MECHANICS.

**Pourbus, poor-büs, Frans, THE ELDER,** Flemish painter: b. Bruges 1545; d. Antwerp 19 Sept. 1581. He was a pupil of his father Pieter, the younger, and of Frans Florus, and became a free master of the Guild of St. Luke at Antwerp in 1564. He died of a malignant fever caught in the guard house of the civic guard of which he was standard bearer. His wife, the daughter of Frans Florus, married Jordaens, the painter, after the death of Pourbus. He painted historical subjects, landscapes, animals and portraits; in the last named department his work is best known. Several religious subjects are to be found in the cathedrals of Ghent and Tournai.

**Pourbus, Frans, THE YOUNGER,** Flemish painter: b. Antwerp 1570; d. Paris Feb. 1622. He was a pupil of his father and doubtless studied with others, for his father died when he was ten. He was a free master of the Guild of St.



## POURBUS—POUSSIN

Luke in 1591. After 1600 he resided at Brussels, then in Italy at the court of the Duke of Mantua, and after 1610 was court painter to Henry IV. of France. Of the latter monarch he painted several portraits, also he painted Maria de' Medicis, the Louvre portrait of the queen being accounted his greatest work. A portrait of Catherine de' Medicis from his hands is in Madrid. His portraits are inferior to those of his father in warmth of color.

**Pourbus, Pieter, THE ELDER**, Flemish painter: b. probably Gouda 1463. He is supposed to be the father of Pieter the younger and grandfather of Frans the elder. A portrait of a goldsmith, now at Vienna, is assigned to him.

**Pourbus, Pieter, THE YOUNGER**, Flemish painter: b. probably Bruges 1510 or 1513; d. there 1584. He was a pupil of his father and probably of Lancelot Blondeel whose daughter he married. In 1540 he entered the Serment des Arbalétriers de S. George and in 1543 became a free master of the Guild of St. Luke, of which he was "doyen" in 1569 and 1580. As he did not buy his citizenship at Bruges it is argued that his father must have moved thither from Gouda before his birth. He worked as decorator and surveyor, having remarkable gifts as a geometrician; but he is known chiefly as a portrait painter. His portrait of Dr. Ambrose Paré is owned by the Historical Society of New York.

**Pourtalès, poor'ta-lā, Louis François de**, Swiss-American naturalist: b. Neuchâtel, Switzerland, 4 March 1824; d. Beverly Farms, Mass., 19 July 1880. He studied engineering but turned to natural science; was a pupil of Louis Agassiz (q.v.), whom he assisted in 1840 in an exploration of Alpine glaciers; and in 1847 came with him to America, where the next year he entered the United States coast-survey. He was the first in this country to attempt deep-sea dredging. Among his important researches in this field being those conducted during the Hassler expedition from Massachusetts Bay to California by way of the Straits of Magellan. From 1854 until his resignation from the survey in 1873, he was in charge of the office and field work of the tidal division. His chief work was accomplished in marine zoology, and the large collections accumulated by him in connection with that subject were deposited in the Cambridge museum of comparative zoology in which he became an assistant in 1873, and as keeper of which he succeeded Agassiz. The genus *Pourtalesia* of sea-urchins was named after him. His writings include besides articles in scientific journals and contributions to the survey reports, the following works among several published by the Cambridge museum: 'List of the Crinoids Obtained on the Coasts of Florida and Cuba in 1867-9' (1869); 'Deep-Sea Corals' (1871); 'The Zoölogical Results of the Hassler Expedition' (with A. Agassiz, 1874); 'Corals and Crinoids' (1878); a report on 'Corals and Antipatheria' (1880).

**Poushkin.** See PUSHKIN.

**Poussin, poo-săn, Gaspar**, Italian painter: b. Rome 1613; d. there 15 May 1675. He was the son of a Frenchman named Dughet, who had settled at Rome but in signing his etchings he Italianized the paternal name into Duche. When his sister married Nicolas Poussin he took the

name of his brother-in-law, whose studio he entered as pupil. The standard landscape of his day was that of Claude Lorraine, but Poussin was not so conventionally classical but more true to the animalism of nature than his great rival, the transparent lucidity of whose aerial perspective he never attained to. As he painted on a red background his pictures have so darkened by age that it is hard to imagine their effect when first produced. It can, however, be seen that he discerned the true lines of a landscape, that he composed with natural grace his groups of forest trees and antique ruins; and that his land storms, in which the trees seem to quiver and bend, are genuine transcripts from tempest-harried plain and mountain. He was imitated by many painters of his day. Most of his pictures are at Rome. They are painted in tempera or oil, and examples of both styles may be seen in the Palazzi Doria, Colonna and Corsini and in the gallery of the Accademia di San Luca. At Rome he executed the frescoes 'History of Elijah and Elisha' in the church of San Martino a' Monti. There are pictures of his to be found in the galleries of Paris, Saint Petersburg, Madrid, and Dresden, and a great number are scattered through the private galleries of England. The most famous of his works in the latter country is 'The Calling of Abraham' which was bought by the nation in 1882 for \$9,975. It was originally in the Colonna collection; afterward belonged to Beckford at Font-hill; and passed through the hands of a third owner to its present ownership.

**Poussin, Nicolas**, French painter: b. Les Andelys, Normandy, 15 June 1593; d. Rome 19 Nov. 1665. He studied first in his native place, and then at Paris. He had already acquired considerable reputation when, in 1624, he went to Italy, where at Rome, Marini, the poet, inspired him with a taste for the Italian poets, in whose works Poussin found many subjects for his art. After the death of Marini (1625), though left without patronage, he continued the study of geometry, perspective, architecture, anatomy, as well as the practice of his art. His conversation, his walks, his readings were also almost always connected with it. He copied antiques, modeled statues and reliefs, diligently painted from nature; and all his works show the results of this study. At last he was attacked by an illness brought on by his labors. He was, however, taken care of by a Frenchman, Jacques Dughet, the father of Gaspar Poussin (q.v.). In 1630 Poussin married the daughter of his benefactor. About this time his affairs began to improve. He found patrons in Cardinal Barberini and the Cavaliere Cassiano del Pozzo, for whom he painted the celebrated 'Seven Sacraments.' These works likewise gained him celebrity in France; and Cardinal Richelieu invited him to Paris to paint the great gallery of the Louvre. Louis XIII. appointed him his first painter, with a pension of 3,000 livres. Poussin arrived in Paris in 1640, and executed numerous works, particularly historical pieces from the Old Testament, and a repetition of his 'Seven Sacraments,' but was much harassed by his enemies. The painter Jacques Fouquières had been employed to decorate the gallery and the architect Mercier had overloaded it with ornament. Poussin found himself under the necessity of removing their labors. He also had to



## POUT — POWELL

contend with the whole school of Simon Vouet. Harassed on every side he determined to leave Paris. In September 1642 while employed on cartoons of the 'Labors of Hercules' for the gallery of the Louvre, he returned to Rome (ostensibly for the purpose of bringing his wife to France) and never again quitted that city. As a painter his drawing is remarkably correct; his composition dignified, and noble, his invention rich; his style grand and heroic. His expression approaches that of Raphael, and he has been called the Raphael of France. He has been censured for a too studied arrangement, and a too great propensity to episodes; too much uniformity in the attitudes, air, and expression of his figures; an excessive fulness in the drapery, and too small proportions in his figures — faults which may have been owing to his close imitation of the ancients. But notwithstanding these faults Poussin may be compared with the greatest Italian masters. Among his most celebrated works are: 'Seven Sacraments'; 'Deluge'; 'Death of Germanicus'; 'Capture of Jerusalem'; 'Plague of the Philistines'; 'Rebecca'; 'The Adulteress'; 'The Infant Moses'; 'Moses bringing Water from the Rock'; 'The Worship of the Golden Calf'; 'John Baptizing in the Wilderness'; etc., and many fine landscapes. Consult: Bouchitté, 'Le Poussin' (1858); Poillon, 'Nicolas Poussin, Etude Biographique' (1875).

**Pout, or Horned Pout.** See BULLHEADS.

**Pou'ter**, a variety of fancy pigeon, the chief character of which is its projecting highly inflatable breast. See PIGEON.

**Poutrincourt**, poo-trăñ-koor, **Jean de Bien-court**, SIEUR DE, French soldier: b. France 1557; d. Mery-sur-Seine 1615. In 1603 he came to Canada, where De Monts made him a lieutenant, and in 1604 received a grant of Port Royal and established there a colony of which he took little care. The grant was confirmed in 1607, and at the same time the king urged Poutrincourt to labor for the conversion of the savages. Desirous of keeping the Jesuits from Port Royal, he delayed their departure from France, sent back glowing accounts of his own missionary success, and welcomed the Jesuits very ungraciously. He went to France in 1612, and after the English left Acadia sailed thither in 1614, but did nothing to rebuild Port Royal.

**Pow-wow**, an American Indian term meaning (1) a ceremony, with conjurations, held for the curing of diseases; (2) a consultation of chiefs or leaders; a deliberation over important tribal matters. In colloquial use pow-wow is used in American politics as applied to any noisy meeting or gathering.

**Pow'der**, a general name applied to explosives as gun powder, giant powder, etc. See EXPLOSIVES.

**Powder-down Feathers.** See PLUMAGE.

**Pow'derly**, **Terence Vincent**, American labor leader and lawyer: b. Carbondale, Pa., 22 Jan. 1849. His early education was obtained in the public schools and he then (1862) became a railroad switch tender. At 17 he became a machinist's apprentice, settled in Scranton, Pa., in 1866, and there worked as a machinist until 1877. He was elected mayor of that city on the Labor ticket in 1878 and re-elected in 1880 and 1882. He was General Mas-

ter-Workman of the Knights of Labor in 1879-93, but resigning in the last named year took up the study of law, and was admitted to the bar of Lackawanna County, and in 1901 to that of the Supreme Court of the United States. He was United States commissioner-general of immigration 1897-1902. He has lectured frequently, made many Republican campaign speeches in 1896 and 1900, and published 'Thirty Years of Labor 1858-89' (1899-1900); 'History of Labor Day'; etc.

**Pow'ell**, **Baden**, English Anglican clergyman and mathematician: b. Stamford Hill, London, 22 Aug. 1796; d. London 11 June 1860. He was graduated from Oxford in 1814, took orders in the English Church and became vicar of Plumstead, Kent, in 1821. He was elected a fellow of the Royal Society in 1824, and in 1827 was appointed Savilian professor of geometry at Oxford, on which occasion he resigned his living of Plumstead. He contributed many papers on optics, radiant heat, and other physical subjects to the 'Philosophical Transactions,' but it better known by his essay in the celebrated 'Essays and Reviews' (1860), on 'The Study of the Evidences of Christianity.' Earlier theological works of a similarly liberal character are: 'The Connexion of Natural and Divine Truth' (1838); 'Tradition Unveiled' (1839); 'The Unity of Worlds' (1855); 'The Study of Natural Theology' (1856); 'Christianity without Judaism' (1857); and 'The Order of Nature' (1859). See BADEN POWELL.

**Powell**, **Edward Payson**, American Unitarian clergyman and author: b. Clinton, N. Y., 1833. He was graduated from Hamilton College in his native town and from Union Theological Seminary, New York, in 1858. Entering the Congregational ministry he was pastor at Adrian, Mich., 1860-71, and of the Second Congregational Church, St. Louis, 1871-4. From 1874 to 1877 he held a Unitarian pastorate in Chicago and has since been editorially connected with secular and religious journals. He has published: 'Our Heredity from God' (1886); 'Liberty and Life' (1890); 'Nullification and Secession in the United States' (1896); 'Wind-breaks, Hedges, and Shelters' (1900); 'The Orchard and Fruit Garden' (1904).

**Powell**, **Frederick York**, English historical writer: b. 1850. He was educated at Rugby and Oxford and has been regius professor of modern history at Oxford from 1894. He is widely known as an Icelandic scholar, and with Vigfusson edited the 'Corpus Poeticum Boreale' (1883); 'Icelandic Reader'; and 'Icelandic Antiqua.' He is the author of 'Early England up to the Norman Conquest'; 'Alfred the Great and William the Conqueror'; 'Old Stories from English History' (1894); 'History of England to 1509.'

**Powell**, **John Wesley**, American geologist: b. Mount Morris, N. Y., 24 March 1834; d. Haven, Maine, 23 Sept. 1902. He was educated at Illinois and Wheaton colleges, studied also at Oberlin, made researches in natural history and geology, at the outbreak of the Civil War enlisted as a private in the 20th Illinois volunteers, became before the close of the war lieutenant-colonel of the 2d Illinois. In 1865 he was appointed professor of geology and curator of the museum at Illinois Wesleyan University.



but later became professor of geology in Illinois Normal University. He conducted in 1868 a perilous exploration of the grand cañon of the Colorado, and in 1870 took charge of the newly established geological and topographical survey of the Colorado River of the West. By this survey nearly 100,000 miles of the Colorado Valley were carefully explored. The work was subsequently transferred to the Interior Department; by 1874 there were four surveys in the field; and this led in 1879 to the establishment of the organization known as the United States Geological Survey, in the formation of which Powell was largely instrumental. From 1881 to 1894 he was director of the survey. He also made particular study of American ethnology, and obtained the organization of the Bureau of Ethnology, which he trained on a high plane of scientific efficiency. His studies of the Indians are deemed of great value. As administrator of the survey, which included also economic geology, geography, and palæontology, he was very successful. Latterly he devoted considerable attention to philosophy and psychology. He secured valuable legislation in connection with the land laws affecting the development of the arid West. Among his writings are: 'Exploration of the Colorado River' (1875); 'Report on the Geology of the Uinta Mountains' (1876); 'Introduction to the Study of Indian Languages' (1880); 'Studies in Sociology' (1887); and 'Truth and Error' (1899).

**Powell, William Byrd**, American physician and cerebral physiologist: b. Bourbon County, Ky., 8 Jan. 1799; d. Cincinnati, Ohio, 13 May 1866. He became noted by reason of his work, 'The Natural History of the Human Temperaments' (1856), announcing the theory known as Powell's life-line, and his novel views concerning the results of marriage within near or prohibited degrees of consanguinity. He was graduated from Transylvania University, at Lexington, Ky., in 1820 and from the Transylvania Medical School in 1823. In 1835 he was appointed professor of chemistry in the Medical College of Louisiana, holding that position for several years. In 1843 he began a sojourn among the American Indians, adopting their dress and manners in order to study their habits, dispositions, longevity, etc., and secured the crania of many warriors and chiefs. In 1847 he organized at Memphis, Tenn., the Memphis Institute, and held the chair of cerebral physiology in the Eclectic Medical Institute of Cincinnati 1856-8. He bequeathed his head to his literary executor to be preserved with his collection of crania.

**Pow'elson, Wilfred Van Nest**, American naval officer: b. Middletown, N. Y., 15 Sept. 1872. He was graduated from the American Naval Academy in 1893 and was then sent by the government to study naval architecture at the University of Glasgow. While serving on the Fern at Key West he was ordered to pursue examinations regarding the destruction of the Maine in the harbor of Havana and his published report stating that the Maine was sunk by an exploded mine was much discussed by scientific periodicals. He was promoted lieutenant in March 1901.

**Pow'er (William Grattan), Tyrone**, Irish actor: b. near Kilmacthomas, county Waterford,

1795; lost at sea 1841. He made his début as Romeo in 1813 at Cardiff, Wales. In 1821 he appeared in London, where he made a hit as Larry Hooligan O'Halloran in 1824, and henceforth devoted himself to impersonations of Irish characters in which he was inimitable. He visited the United States in 1833 and in 1840, and in 1841 embarked for Europe on the President, which was never again heard of. He published: 'The King's Secret'; 'The Lost Heir'; 'Impressions of America' (1835); etc.

**Power**, in arithmetic, and in the algebra of real numbers, the product obtained by multiplying a given number by itself a specified number of times. If  $x$  is the given number, and  $n$  is the number of times that  $x$  is taken as a factor in forming the product, then the product that is finally obtained is

$$x \times x \times x \times \dots \times x \times x \times x$$

( $n$  factors altogether)

This is called the " $n$ th power" of the number  $x$ , and is represented by the symbol  $x^n$ . Assuming for the moment that  $n$  (which is called the "exponent" of the power) is positive and integral (since this is the only case in which the foregoing definition is applicable), we easily obtain the following general laws which the powers of numbers must fulfil:  $x^m \cdot x^n = x^{m+n}$ ;  $(x^m)^n = x^{mn}$ ;  $(xy)^n = x^n y^n$ . To extend the conception of a "power" so as to permit of the use of fractional and negative exponents, we may assume that the foregoing laws hold true of all real exponents, and from them we may seek the interpretations that must be given to an expression of the form  $x^n$ , when  $n$  is fractional or negative. First, if we make  $m = 0$  in the equation  $x^m \cdot x^n = x^{m+n}$  we have  $x^0 \cdot x^n = x^n$ ; and hence we conclude that the symbol  $x^0$  must be interpreted as representing unity in all cases. Again, if we make  $n = -m$ , we have, from the first of the general relations given above,  $x^m \cdot x^{-m} = x^{m-m} = x^0 = 1$  and hence we must interpret the expression  $x^{-m}$  as signifying the reciprocal of  $x^m$ . We may ascertain the significance of a fractional exponent by means of the second general relation, above. Thus in the identity  $(x^m)^n = x^{mn}$ , let

us put  $m = \frac{1}{n}$ . Then we have  $(x^{\frac{1}{n}})^n = x^{\frac{n}{n}} = x^1 = x$ . Hence  $x^{\frac{1}{n}}$  must be interpreted as representing that quantity which, when raised to the  $n$ th power, will yield  $x$  itself. That is, we must

interpret  $x^{\frac{1}{n}}$  as equivalent to  $\sqrt[n]{x}$ . In a similar manner it is easily shown that the symbol  $x^{\frac{m}{n}}$  must be interpreted as equivalent to  $\sqrt[n]{x^m}$ .

The significance of a power, when the exponent and the number itself are both imaginary, is considered in the theory of functions, but this generalization is too difficult for sound treatment in the present article. For this aspect of the subject, and for the discussion of the development of functions of a variable in a series whose terms are powers of that variable, consult: Harkness and Morley, 'Introduction to the Theory of Analytic Functions,' and 'Treatise on the Theory of Functions.'

**Power**, in mechanics and physics, the rate at which work is performed; or (what is the same



## POWER HOUSES

thing), the quantity of work that is performed *per unit of time*. In ordinary engineering practice in the United States and England, the unit of work is the "foot-pound"; a foot-pound being defined as the quantity of work that is performed when a force equal to the weight of one pound of matter is exerted through a distance of one foot. (See MECHANICS.) Nothing is here specified, it will be observed, as to the *time* in which this work is done. A small motor, for example, might require ten seconds to accomplish it, while a more powerful one might perform it in a very small fraction of one second. The work that is performed by a given motor or engine in one second, or in one minute, is therefore the true measure of the "power" that is being developed. James Watt adopted the "horse-power" as the unit of power for steam engines and other large motors, and this has been universally adopted, since his time, in all English-speaking countries. He estimated that a strong horse is capable of performing 33,000 foot-pounds of work per minute; and although it is known that the horse cannot work continuously at this rate, his definition has never been modified, and in steam and hydraulic engineering a "horse-power" is still understood to signify the performance of 33,000 foot-pounds of work per minute, or (what is the same thing) 550 foot-pounds per second. The horse-power of an engine or a water-wheel is therefore determined by observing how many foot-pounds of work it is performing per minute, and dividing this number by 33,000. In the centimetre-gram-second system of units, which is in extensive and increasing use in modern physics, the unit of work is the "erg," and the unit of power is the "watt"; a watt being defined as the power that is developed when 10,000,000 (that is  $10^7$ ) ergs of work are performed per second. The watt is employed in practical electrical engineering, as well as in experimental physics; it being then defined as the rate at which work is being done in a circuit in which the current is one ampere, and the electromotive force is one volt. This change in definition is merely a matter of convenience, since it may be shown that the two definitions amount to precisely the same thing. A horse-power is approximately equal to 746 watts.

Consult: Everett, 'Units and Physical Constants.' See also the article UNITS in this encyclopædia.

**Power Houses.** With the growth of electrical distribution, the generating station has become a highly specialized structure which demands consideration both from the electrical and mechanical view points. In the first instance it presents peculiar requirements as to location, differing widely according to its purpose. Broadly one may divide power houses into two general classes, those designed for the utilization of water power and those using heat engines as prime movers. The former are nearly always power transmission stations connected by high tension lines with the centre of distribution and not themselves burdened with direct distribution of energy to consumers. The latter are generally within the area of distribution, and the centres of distributing net works. In the cases where power is transmitted considerable distances from stations of the second class they are still gen-

erally to be regarded as distributing stations as regards the requirements of location.

**Location.**—The location of hydro-electric power houses is usually determined by purely hydraulic considerations. The area within which they may be economically placed is limited by the topography and the chief requirements are as follows: First, the location must be such as to keep the power house free of floods under all conditions of stream flow. Second, within this limitation the location must be such as to utilize the maximum possible proportion of the available head. Third, in the interest of regulation the station must be placed so that it may be subject to the minimum variation of head. In plants working under high hydraulic heads, high enough to utilize impulse wheels conveniently, these conditions are easily met. At low heads there is often difficulty in placing the power house clear of floods and above any possible backing up of the tail water.

The location of a station driven by heat engines of one sort or another is usually kept as nearly as may be at the centre of the electrical distribution. Since for the delivery of any given load at a fixed percentage of loss the weight of conductor required varies directly with the square of the distance from the load, the reason for a central location is obvious. Assuming, for example, an electrical load uniformly distributed over a circular area, the most economical location of the power station, so far as the conductors are concerned, is at the centre. Transference of the station to a point at the edge of the area approximately doubles the cost of the distributing system. The causes which may justify removal from the central position, are local conditions as to cost of real estate, of fuel, and of water. The first item is part of the capital charge which may be taken as an offset to change in the cost of distribution; the last two affect the operating expense, and the change in these with change of location must be capitalized for comparison with the concurrent change in the cost of distribution.

**Fuel.**—Fuel is by far the largest single item of expense in ordinary electrical power production, and a power house must be so located, on a railway spur or waterway, that it can receive its supply without incurring serious charges for cartage or other handling of fuel. This necessity usually compels a location somewhat out of the centre of distribution. Water supply is more easily secured, but occasionally it becomes an important factor in location. In cases where the principal office of the power station itself is to furnish energy at high voltage for a distribution from substations, the cost of conductors is relatively a smaller consideration and commonly a location meeting the requirements just laid down can be secured without serious increase in the cost of the conducting system.

**Equipment.**—The electrical equipment of a modern power station usually consists of a small number of electric generators directly coupled to their prime movers, whether hydraulic, steam, or gas operated. Except in small plants generators driven through intermediary belts, ropes, or gears are rare, since these introduce added complication, cause some loss of energy, cannot well be used for large power, and serve no use-



## POWER HOUSES

ful purpose of themselves, save now and then in giving the generators some specially valuable advantage in speed. In such case they should be used without hesitation if the conditions permit. The day of stations equipped with numerous small dynamos has passed, and for good cause, since the small machines are more costly and less efficient for a given total output, and they require also more space and more care.

Hence the number of generating units should generally be reduced to the minimum that will satisfy the following condition, viz.: that the total number should be such that one unit can go out of service without seriously overloading the others, dividing its load among them. Good modern generators usually are able to carry 25 or 30 per cent. over their normal rated loads for some hours without serious heating, so that ordinarily four or five generators suffice. If the load upon the plant is normally moderate, two or three generators may serve admirably until such time as the normal full load nears the rated capacity of the machines. On the other hand more than five or six generators are seldom advantageous unless the total capacity of the power house is very large, so large that it cannot readily be derived from so few generators.

As generators are now often made of 5,000 to 10,000 kilowatts output, the case just mentioned is unlikely to arise save under the following conditions. First, in a hydro-electric plant at low head the available wheel speeds for units of the size mentioned may be so low as to demand a generator of very disadvantageous design. When this case arises it is often better to split up the plant into smaller units, the gain by so doing more than compensating the loss. Second, it may be necessary in the same power house to install generators for serving several quite independent lines, or for radically different kinds of service, as for furnishing both alternating current and direct current. Then the number of machines for each service must be determined in the way just noted, and the total number will be considerably increased.

Broadly, however, large stations should differ from small ones only in the capacity of individual units, so that if a 2,000 kilowatt plant is equipped with four 500 kilowatt units, a 20,000 kilowatt plant would be equipped with four 5,000 kilowatt units. In either case the same allowance for reserve capacity would naturally be made, but evidently the larger plant would have the advantage not only of greater economy in the larger units but of reduced attendance cost per unit of output, and would also cost less per unit of output.

Large power plants then evidently can produce electrical energy at a lower cost than small ones. As the size is increased, however, the relative gain is diminished so that a size will finally be reached at which further increase in capacity ceases to be beneficial. Indeed since a very large station usually implies a large area served, the average distribution losses will be reduced by serving it from several interconnected power houses, so that the maximum economical capacity of a single power house is less than would be determined by considering only the effect of size on fuel and labor.

For example, if a certain district requires 100,000 kilowatts, it is altogether probable that two 50,000 kilowatt plants will serve it more

economically than a single gigantic power house, and unless the district is of moderate area, four 25,000 kilowatt stations would probably do even better, provided they could all be well located. In other words a power plant of 25,000 kilowatts or thereabouts comes so near to giving maximum economy of operation that the difference is easily offset by lessened losses in distribution. The only cases in which size may be economically increased without limit are those in which the plants must for one reason or another lie far without the area served, as in great hydro-electric plants like those at Niagara or in plants using coal at the mines for transmission of power on a colossal scale.

In any power house adequate provision for reserve capacity evidently can be most easily made if the equipment throughout is of a single kind so that everything may be as far as possible interchangeable. Similar units of uniform size are therefore advisable throughout the entire plant unless there is some good reason to the contrary.

The equipment of a power house may be divided into four parts: the prime movers, the electric generators, the accessory apparatus, and the switchboard from which the output is regulated and distributed. The power house structure must be planned for advantageous location of all of these, and in addition, if steam is the motive power, there must be ample provision for the storage of fuel.

*Design and Arrangement.*—In point of design hydro-electric power houses present by far the simplest problem. In these the prime movers are the water wheels which are relatively simple and compact, the generators are directly coupled to the shafts of these, and the output is delivered to a small number of lines so that the switchboard is relatively simple. As most such plants are for high voltage, the power house must often provide place for the transformers which raise the voltage from that of the generators to that of the line. Less frequently such transformers are found in steam-driven plants.

Structurally the ordinary power house consists of two parallel halls with a common dividing wall, one containing the generating units, the other water wheels or boilers as the case may be. The generator room contains, or has annexed to it, space for the switchboard connections and for the transformers, if any, while the boiler or wheel room has annexed to it space on the one hand for fuel, on the other for the hydraulic connections. Usually the plant comprises only a single story, although more rarely ground space is gained by superimposing some of the parts.

One may now pass to consideration of the concrete arrangements usually adopted, the hydro-electric case being taken up first, as the simpler in design.

Fig. 1 shows the ground plan of a typical hydro-electric power station using as prime movers water wheels under high head. Here A is the receiver terminating the supply pipe and provided with branches to the several wheels. At very high heads these branches are sometimes made farther back spreading finger-wise from a terminal chamber to secure a straighter run to the wheels. B, B, B are the water wheels, directly coupled to and on the same level with the generators C, C, C. The pipes from the



## POWER HOUSES

water supply enter the lower part of the wheel cases and discharge into the tail race below the power-house floor. The wheel gates are controlled by the governors D, D, D. The generators are revolving-field, 400 kilowatts, three-phase machines, giving 13,000 volts at the terminals at 500 revolutions per minute. Their fields are excited by two 25-kilowatt direct-driven exciters, E.E., each of which is regulated by a separate hydraulic governor. The switchboard is located on the floor level at F, and the line wires leave the power house just above and behind the switchboard. Room is provided for a fourth generator, and a traveling crane running lengthwise the power house is available for handling the machinery if necessary. The material of this power house is brick, on concrete foundations, with a steel truss roof covered with reinforced concrete slabs and then with roofing felt and asphalt, as the location is in a cold climate.

The design here followed is thoroughly simple and normal. At higher hydraulic head the

this simple design serve well up to very much larger capacities. In case the necessary width becomes too great to be conveniently covered by a single roof, separate roofs are placed over the wheel rooms and generator rooms, and in mild climates the wheel cases and tail race may sometimes be left uncovered.

It is necessary even in hydraulic plants to make the power station as nearly fireproof as possible and hence brick, steel, and concrete are the most suitable materials of construction. Wood, even if treated by some fireproofing process, should be sparingly employed. For floors concrete, reinforced when necessary, is probably the best material. The transformers and switchboard are the danger points, from the standpoint of fire risks. The former should be placed so that even if they burn out no exterior damage will result. If, as is usual in high voltage plants, they are oil-insulated, provision should be made for disposing of the oil harmlessly in the rare case where it ignites from an extreme short circuit. Transformer oil is very difficultly inflam-

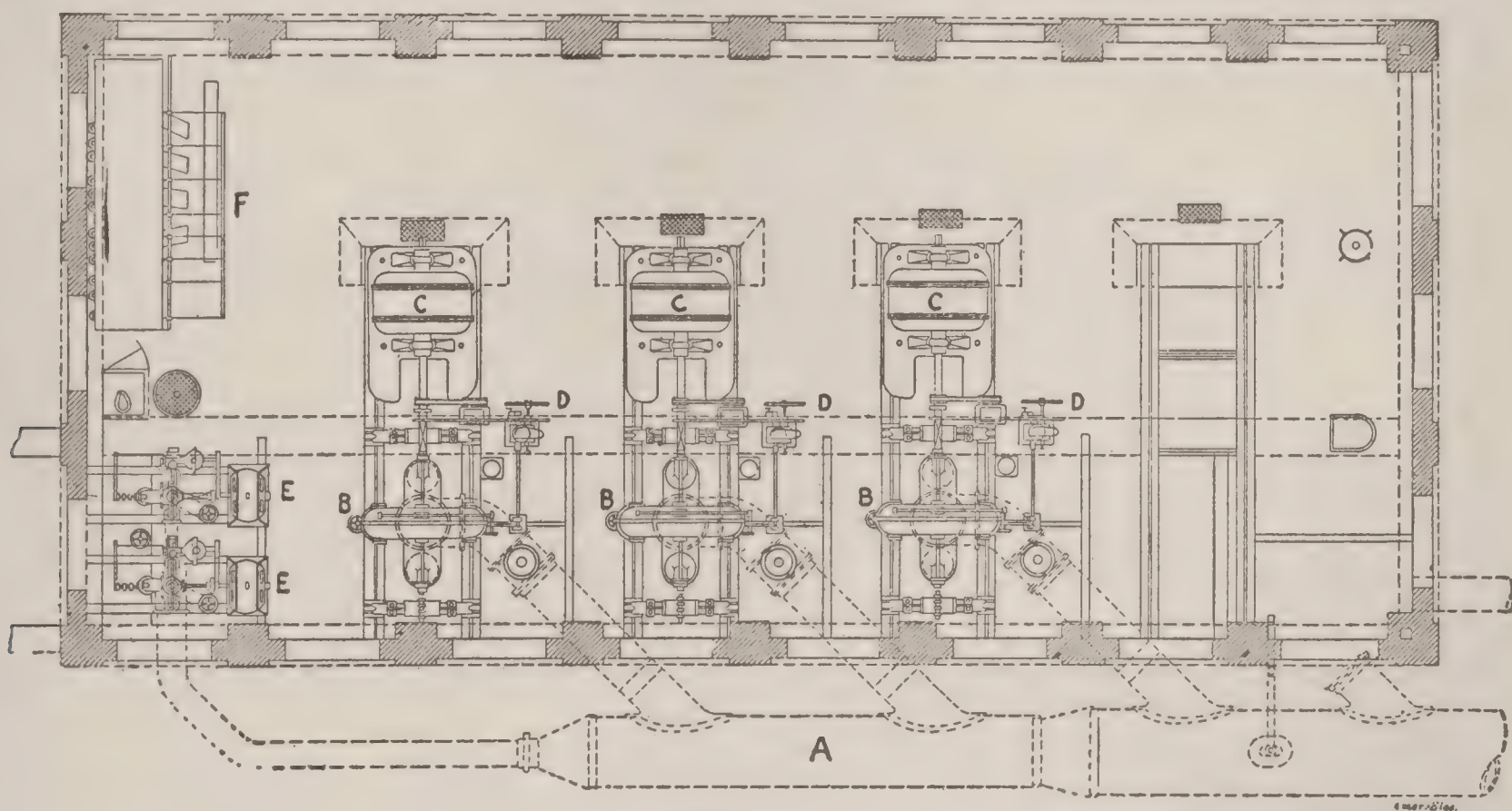


FIG. 1.

somewhat unusual turbines here used would be replaced by impulse wheels in the same situation; at lower head by considerably bulkier turbines which would require a wider tail race and power house for their accommodation. In this case the inner tail-race wall would usually carry a partition wall separating the wheel room from the dynamo room proper and provided with water-tight fittings for the turbine shafts to pass through.

In case raising transformers were to be used in such a plant the generators would be for perhaps 2,000 volts, the switchboard would preferably be turned around, facing the exciters, and the station would be extended far enough to the left of the cut to accommodate the transformers and the necessary accessories; or, if more convenient from the nature of the ground, space could be gained by widening the power house enough to accommodate the row of transformers. The size of the power house of Fig. 1 is about 40' x 85', and slight modifications of

mable, but it can be fired, and oil transformers should be guarded by pits with drains, so that the oil may not run about if it escapes from the cases. Sometimes the transformer cases are provided with drain valves from which the oil can be quickly run off outside the station.

The connections between generators and switchboard are generally made by cables laid under the floor in tile ducts, so as to keep the overhead space free for the crane. The higher voltage wires from the transformers should be gotten out of the building by a very short route overhead or through very capacious ducts. In any case great care should be taken to locate all cables carrying heavy currents where a burn-out of one will not involve others.

In very large stations, both hydro-electric and steam driven, the switchboard is frequently placed in a gallery overlooking the generator room. This position is in itself undesirable as adding enormously to the complication of the wiring, but in very large stations sometimes be-



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comes advisable. In such case the larger switches are not manually operated, but are worked by electric or pneumatic power controlled from the switchboard. The switches themselves are then located under or behind the gallery, and are commonly oil insulated and inclosed in masonry or concrete cells. With three or four generators and one or two main lines to be fed the switchboard is sufficiently complex, but when in addition numerous feeding lines must be controlled the complication becomes something frightful and a large amount of space is required for the switching apparatus, so large and so subdivided for safety that manual control is practically out of the question. In large high voltage power stations the transformers are sometimes in a room entirely separated from the main station and provided with an independent high voltage switching equipment, a procedure which probably adds nearly as many risks as it avoids. On the whole a plant with few units and relatively simple equipment is likely to give the most reliable service at the lowest cost.

Steam-driven stations are very differently proportioned owing to the great space necessary for boilers and their accessories. Fortunately

here, and in such case the switchboard would be located in the generator room itself, arranged much as shown. In most American stations of recent design the fuel is fed to the furnaces by automatic stokers, which, upon the whole, do the work more uniformly and economically than it can be done by hand firing, especially where using low-grade coal. The fuel is also commonly brought by automatic conveyers into the pockets from which the stoking apparatus is supplied. In an increasing number of cases, too, the tall chimney common to power houses is replaced by a low stack and the furnaces are worked by artificial draft furnished by a blower. This device has the advantage that it enables the furnaces to be hard driven at times of specially severe load. At moderate and uniform load its economy is rather dubious, but in certain power plants which are subject to periodical overloads the artificial draft has proved advantageous.

The greatest recent change in power-house design has come through the introduction of the steam turbine. As this machine normally runs at a rotative speed eight or ten times as great as that of a reciprocating engine of similar output, both turbine and generator are of large out-

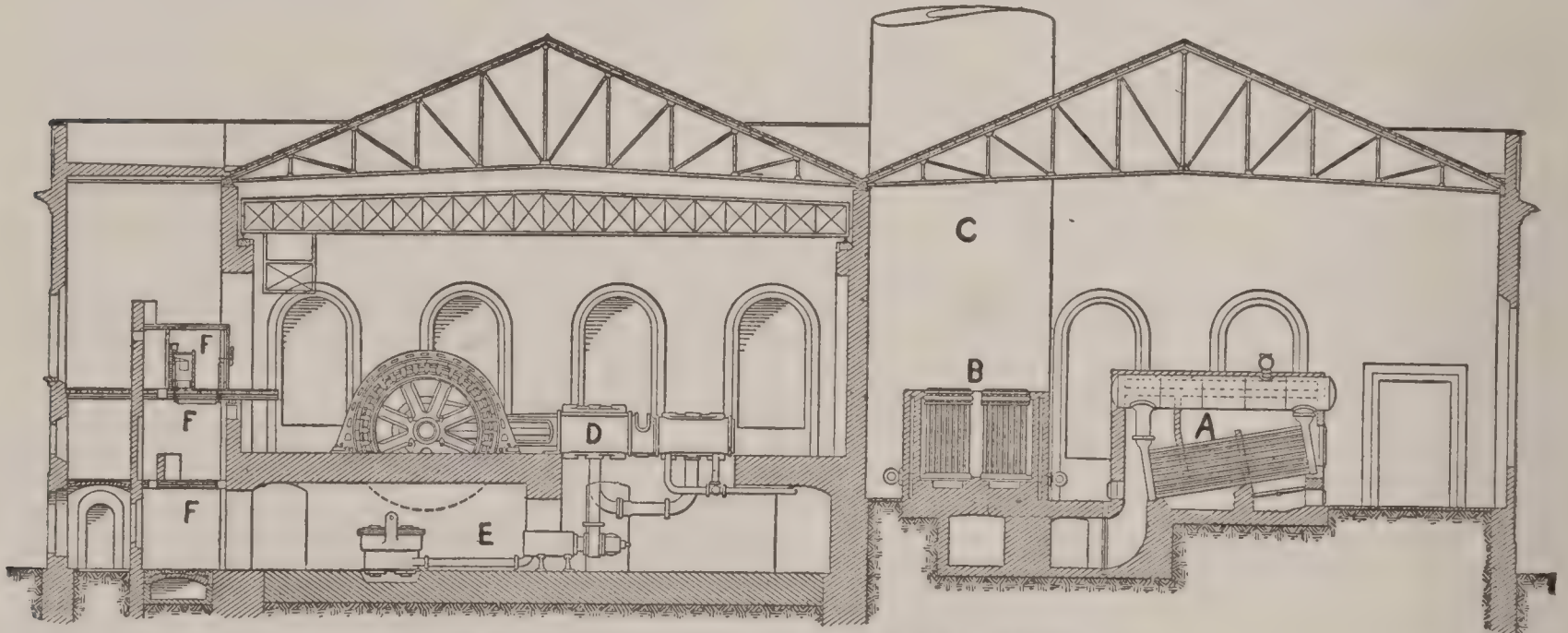


FIG. 2.—TRANSVERSE SECTIONAL ELEVATION OF POWER-HOUSE.

the boiler equipment can be stowed without much waste space, but it is a curious thing that while the engine units have increased very greatly in capacity in recent years, the boiler units remain almost unchanged, so that one may find a single direct-connected generating fed by perhaps half a dozen boilers. Fig. 2 shows a typical steam-driven plant in elevation. Here the boilers are arranged in a single row at A, the smoke flues with economizers are at B, discharging into the stack C, which rises near the centre of the station. The engines are at D and a low basement E contains condensers, pumps, and so forth. Beyond, an addition in three stories is built out for the switchboard and accessories. There are three generating sets in this particular station each rated at 750 kilowatts, and eight boilers arranged in pairs. Two engine-driven exciters furnish field current, since the generators here, as very often in recent power houses, are polyphase machines at high voltage, in this instance 13,000 volts. In plants where economy of space is important the type of engine chosen is frequently the vertical cross-compound, instead of the horizontal tandem compound found

put for their dimensions. Many recent turbo-generators are made with vertical shaft, the generator being superimposed upon the turbine, and the weight being carried by a water-step supplied by a pressure pump. Thus arranged a 5,000 kilowatt turbo-generator will go into a space about 20' x 20', and has a height over the foundation of about 30'. Were this the only thing to be considered the generator room of a power plant thus equipped could be reduced to absurdly small dimensions, but the steam turbine for the best results requires a surface condenser to give at least 28" vacuum, together with its pumps and accessories. An attempt to crowd the turbines closely together also leads to inconvenience in the steam piping in large plants, which must still contain long rows of boilers, so that the full apparent economy of space is seldom realized. As the turbines give an efficiency quite comparable with that of compound condensing engines under the usual conditions of pressure and superheating, and at light loads do relatively rather better, they have come to be very extensively used in power houses of recent design.

Fig. 3 shows a plan of a typical turbo-gener-



## POWER HOUSES

ator station. As it is for electric railway service the generator room is widened to permit the installation of a row of rotary converters with their transformers. In other respects the design is entirely normal and a very good example of its kind. Fig. 4 shows the elevation

As in nearly all recent stations the boilers are of the water-tube sort, generally chosen for its comparative immunity from explosion and its ability to respond easily to a call for forced output. As a glance at Fig. 4 shows, there is a large coal pocket over the firing-floor fed by

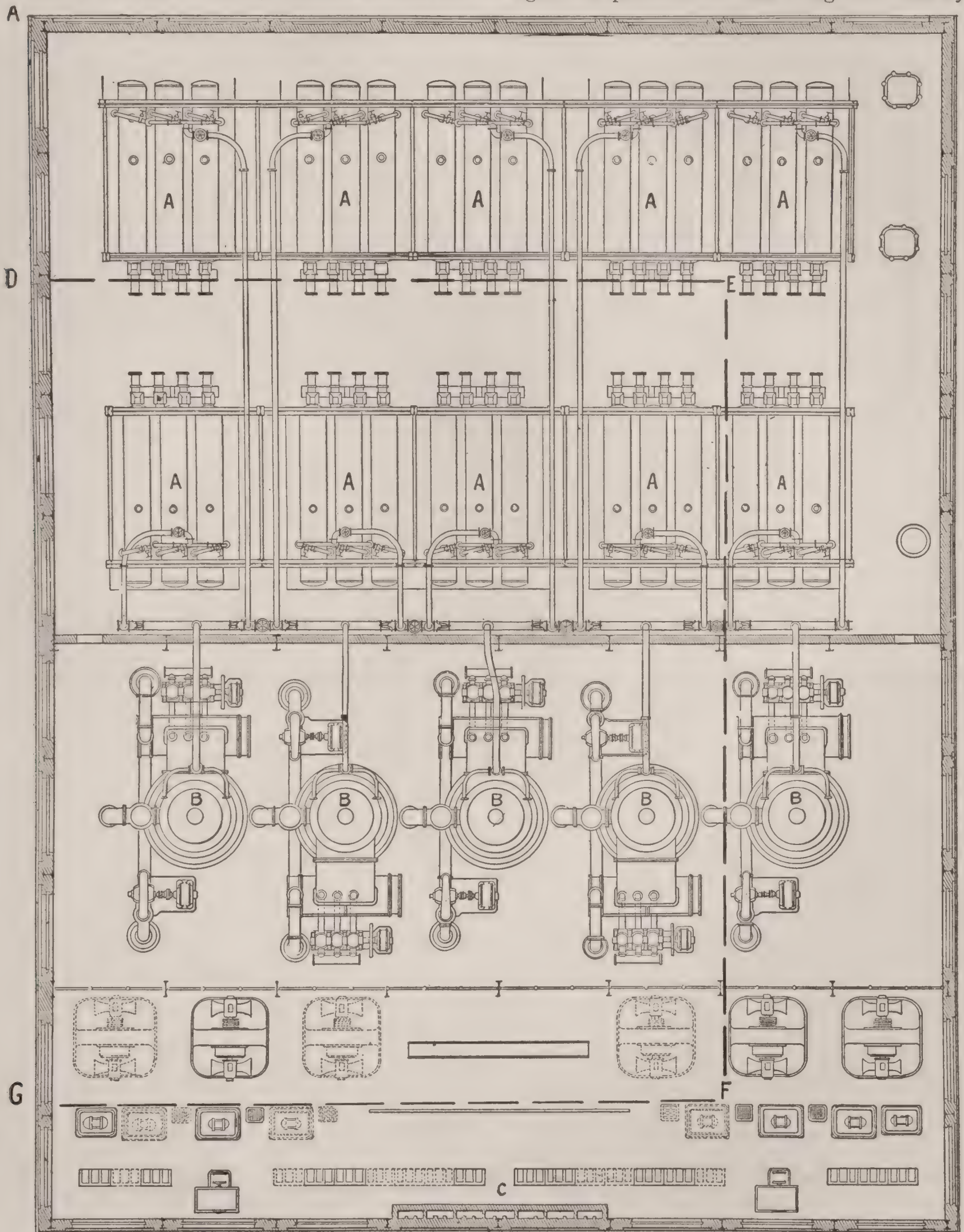


FIG. 3.

of the same station. The batteries of boilers are lettered A, the turbo-generators B, and the switchboard space C. There are five 2,000 kilowatt turbo-generators, and 10 boilers arranged in two rows with the firing floor between them.

automatic conveyors, and itself feeding the automatic stokers through a series of chutes. The ash is also automatically delivered to the chutes immediately beneath the firing floor, and falls into ash cars in the basement. This basement



# POWER HOUSES

also accommodates the engine-driven blowers for the forced draft. These arrangements reduce the labor expense to a minimum and render the boiler room exceedingly compact.

The generator room, owing to the vertical

turbines, is also compact, but considering the area required for condensers and pumps the gain in space is rather less than the dimensions of the turbines would suggest. The ability of the turbine to run on comparatively slight foundations

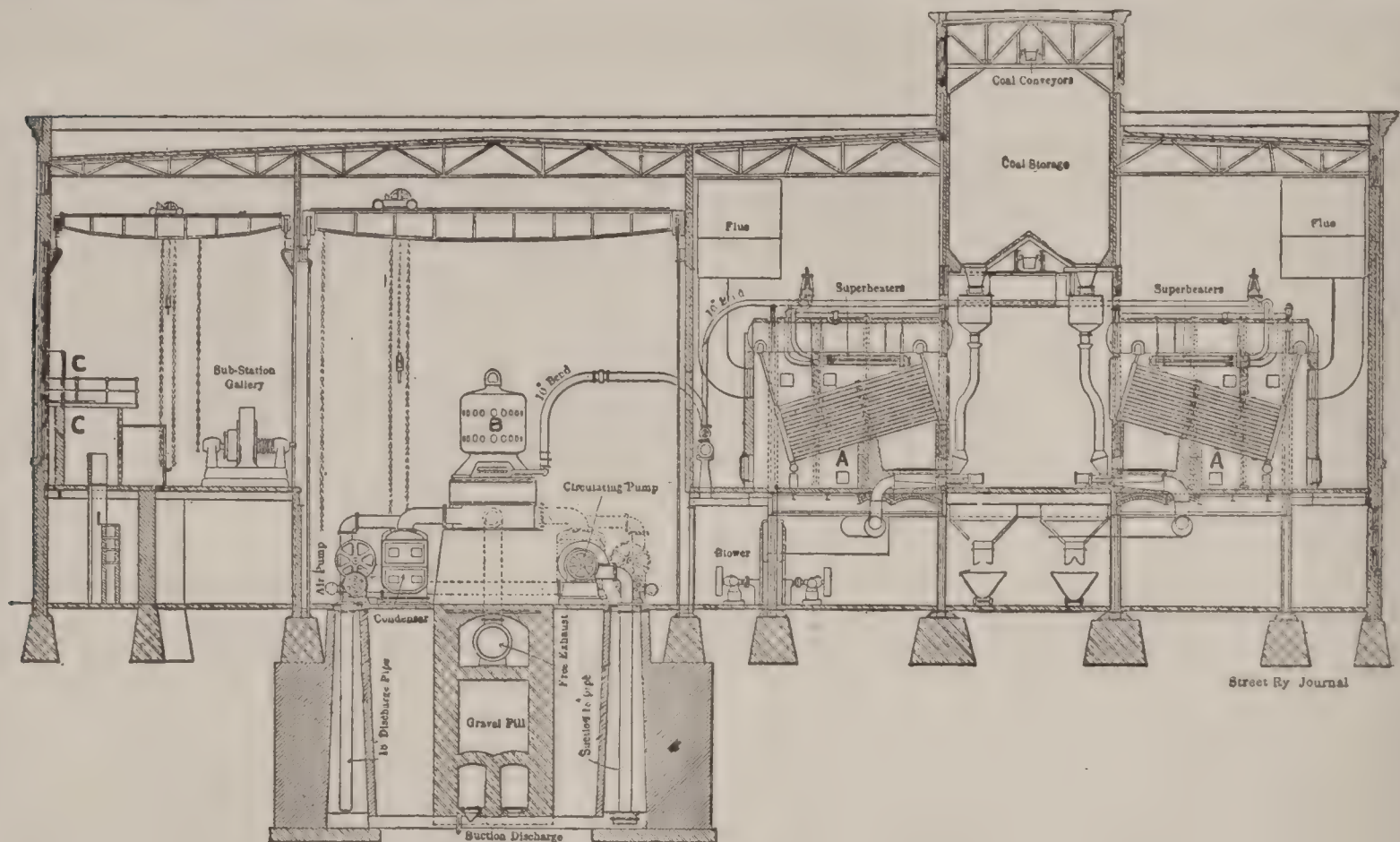


FIG. 4.

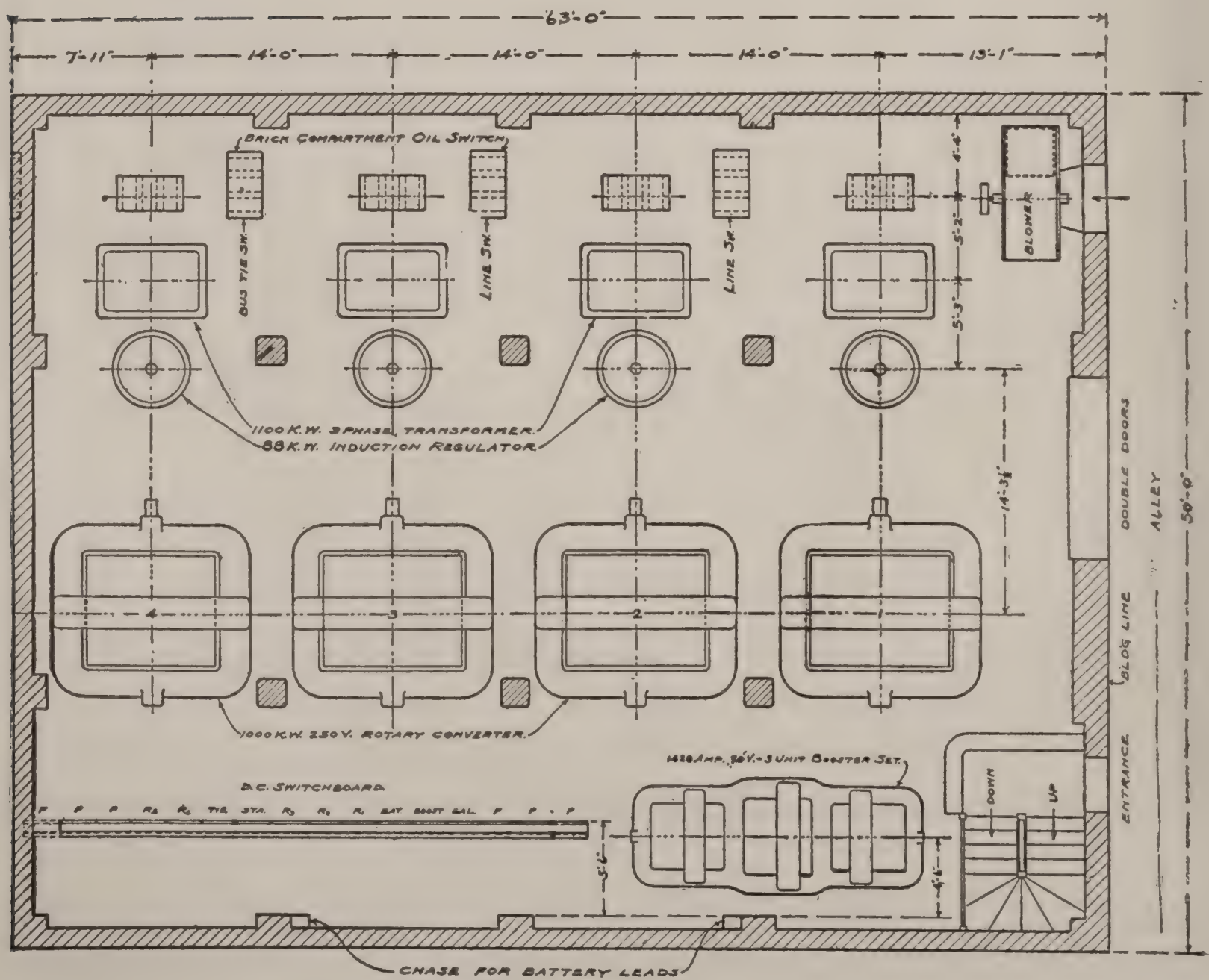


FIG. 5.



## POWER HOUSES

is, so far as station design is concerned, more valuable than the gain in floor space.

The exciting current for the turbo-generators is furnished by two engine-driven and two motor-driven exciters, but later types of turbines have exciter armatures on their own shafts, so as to be entirely self-contained. It will be noted that the placing of the boilers in two rows is necessary to take advantage of the compactness of the turbo-generators. This is also the case when large vertical engines are used and is a result of the relatively small capacity of individual boilers. With turbo-generators of smaller capacity, say 750 kilowatts each, the station plan would be somewhat as indicated by the dotted line D E F G, and the relative arrangement of parts would remain about the same. The station here shown is situated on tide water so that sea water is available for condensation and the coal is unloaded by machinery directly

sub-stations. The modern power house is almost always fitted with alternating current generators which transmit current either for general distribution or for conversion into direct current for supplying electric railways or the old direct current lighting systems. Such conversion must probably be regarded as a makeshift, but at present a necessary one. The high voltage current from the power house is transmitted through cables or over aerial lines to the sub-stations, and there the voltage is lowered by reducing transformers to the amount appropriate for the rotary converters, generally not far from two-thirds of the derived direct current voltage. The sub-station must, therefore, accommodate the reducing transformers, the rotary converters, regulating apparatus, switchboards for both alternating and direct currents, and sometimes a storage battery and its accessories. The structure, therefore, becomes practically a power

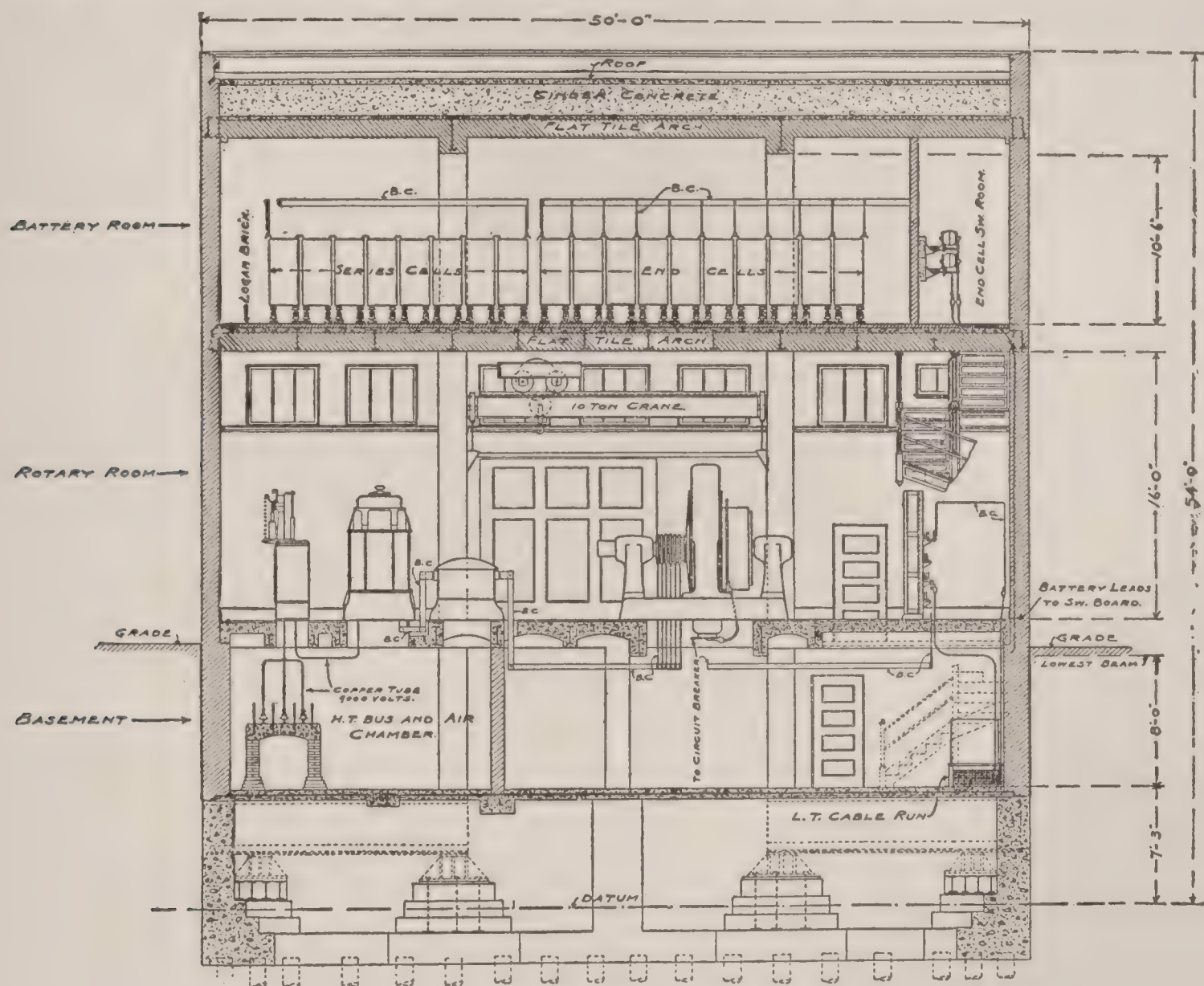


FIG. 6.

from the vessel. The building is 161' x 121' and has, therefore, a little less than two square feet of area for each kilowatt of generating capacity, a fair figure for a large station. If real estate is costly further space can be saved by double decking the station as far as possible. Some stations have been built, for instance, with two stories of boilers, and by such devices and the use of large generating units, the ground space can, if necessary, be brought to or a little below one square foot per kilowatt. It is doubtful, however, whether so great striving for compactness is good policy save in very rare instances.

*Sub-Stations.*—An account of power houses would be incomplete did it not take notice of

house for general service, less only the prime movers. Figs. 5 and 6 show in main floor plan and elevation a recent sub-station for city lighting and power service which is a masterpiece of compactness. It is a modern steel building two stories above grade and with a basement for the cable entrances and exits. The main floor contains, as Fig. 5 shows, arranged in order, the high-tension bus and main switches, the three-phase transformers, the regulators, and the rotary converters, of which there are four, each of 1,000 kilowatt capacity. The same room contains the booster set for charging the batteries at a variable voltage somewhat higher than that of the rotaries, and the switchboard, also a blower set for ventilation. Large apertures are



## POWER, TRANSMISSION OF

left under the rotary converters and transformers so that a liberal air supply may be drawn in from below and exhausted by the blower. The second floor contains the storage batteries and their special switching arrangements. On account of possible leakage of acid from the batteries the floor construction is peculiar. The basis is tile arch over steel beams. Then comes a layer of concrete coated with asphalt, then a floor of hard-baked brick, glazed all over, laid with narrow interstices which are finally filled with hot asphalt.

Sub-stations for railway service do not usually have the storage battery, and are generally less compactly arranged, but after about the same general plan. The sub-station shown here covers only 3,150 square feet for its 4,000 kilowatts capacity. Ordinarily the switching arrangements in a sub-station are so intricate as to require a rather liberal allowance of space. The same principles of location and subdivision of units hold for sub-stations as for power houses in general, with the advantage that the location is not dependent on water and fuel supply. Sub-stations for the receiving ends of power transmissions for general service differ from those just described in the lessened importance of rotary converters. The ordinary distribution from a high voltage transmission service is very largely by alternating currents, and is accomplished by sub-stations designed accordingly. The high voltage current is received in large reducing transformers which in number, size, and location are to be treated as so many alternating current generators fortunately exempt from the necessity of rotation. Regulating apparatus is an important feature of stations of this class, and being inductive can be applied with very small loss of energy to the exact regulation of voltage on individual feeders.

For arc light service constant current transformers are very widely used, taking energy from the lower voltage side of the reducing transformers. This service requires a special switchboard, and is generally set apart in the sub-station. Owing to the absence of rotating machinery in any considerable amount the sub-station for general service is compacter and requires less in the way of foundations and special construction than the sub-station of Fig. 5. Otherwise the principles of location and design are unchanged.

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**Power, Transmission of.** In mechanical engineering problems are continually arising which involve the transmission of power from one part of a machine to another, or from one machine to another machine, or from one locality to another locality that is perhaps at a considerable distance. Between the different parts of a given machine, or of a given mill, the transmission is often effected by means of a rotating shaft, which is subjected to a torsional moment. In mill work the shaft is rigid, and is made of solid steel, or of steel tubing; while in small machines (as in dental drills and the like) the shaft is often flexible, so that the point of application of the power can be varied at will, without disturbing the source from which the power is drawn. In mill practice it is essential that the alignment of the shafting shall be as good as possible,—that is, that the centre

line of each shaft shall be as nearly straight as it can be made. It is also essential that the “journals,” or bearings which support the shaft, shall be properly designed, and well lubricated. If attention is paid to these points, transmission by shafting may be quite efficient; but if the alignment is poor, or the journals are poorly designed, or the lubrication is inadequate, a great deal of energy may be absorbed by the shaft, and dissipated in the form of frictional heat.

In transmission by shafting, the speed remains invariable, and if (as is usually the case) a change of speed is desired, it must be effected by the use of gearing or belting, or some similar device. The efficiency of transmission by gearing depends very largely upon the perfection of the gearing, and it falls off rapidly when the teeth of the gear-wheels begin to show the effects of wear to any material extent. According to data given by Lewis, the efficiency of a pair of good spur gears may range from 90 to 98 per cent, the former result being given for a velocity, at the pitch line, of 3 feet per minute, and the latter for a velocity of 300 feet per minute.

Belting is employed more commonly than gearing, for transmitting power from one shaft to another. The resistance of a belt to slipping is independent of the width of the belt, so long as the total stress upon the belt is constant. It depends chiefly, in this case, upon the arc of contact between the belt and the pulley; and a belt will slip just as readily upon a pulley four feet in diameter as upon one that is two feet in diameter, if the arc of contact (measured in degrees) is the same in both cases, and the surfaces of the two pulleys are in the same condition. The laying out of a successful system of belting, for use in mill work, calls for a considerable amount of practical experience with belts, since it must be admitted that many of the formulæ that have been given do not correspond satisfactorily with experience. It was formerly taken for granted, for example, that the sum of the tensions on the two sides of a belt remains constant, the only effect of running the belt being to increase the tension on one side of it, and to simultaneously decrease the tension on the other side by an equal amount. Lewis and Bancroft found that this is not the case; and hence any formula which assumes it to be true must be regarded as inaccurate. Webber gives the following practical rule for ordinary leather belting of single thickness: A belt one inch wide will safely transmit one horsepower, when run at a speed of 600 feet per minute; and the power transmitted will be proportional to the width of the belt, and to the speed at which it is run. This rule gives no information with regard to the proper tension; but it implies that the tension may be safely increased until the belt actually does transmit the computed horse-power. (Consult Cooper ‘Treatise on the Use of Belting,’ and also Kent, ‘Mechanical Engineer’s Pocket Book.’) Wire ropes, as well as ropes of hemp, cotton, or rawhide, are now employed to a considerable extent in the place of belts, when large amounts of power are to be transmitted. The principles involved are similar to those which apply to ordinary belting, but the ropes, instead of passing



## POWER

over smooth pulleys, run in grooves that are turned in the pulleys. (Consult J. J. Flather, 'Rope Driving'.)

Compressed air is employed in the transmission of power in many cases, especially in the operation of rock drills, and in mining generally, the air serving, in such cases, not only to operate the machinery, but also to aid in the ventilation of the mine. The compressed air may be delivered to the point at which the power is wanted by means of pipes directly from the compressors, or it may be stored at high pressure in tanks, from which it is drawn as wanted. Locomotives are used in mining, for example, which derive their power from large tanks of compressed air that take the place of the ordinary steam boilers of other locomotives; these tanks being charged at convenient points along the line of travel. Power is also transmitted hydraulically, when, as in cranes, presses and elevators, it is desired to exert great force in some slow-moving piece of machinery.

A great deal of attention has been given, in recent years, to the economical transmission of power by electricity, and the various problems that are involved have been solved so satisfactorily that enormous quantities of power are now transmitted electrically, in some instances to a distance of from 50 to 75 miles. The mechanical energy that is to be transmitted is first converted into electricity by means of a dynamo; and the electricity thus generated is led along a conductor (usually of copper) to the point where the power is to be used, it being there re-converted into mechanical energy by means of electric motors. In certain shops and mills, the power is transmitted in this way from the engine room to the various machines that are to be operated, each machine being provided with its own separate motor. Installations of this kind are especially successful when the work is of such a nature that the machines are idle for a considerable part of the time, because there is no loss, in electrical transmission systems, when the circuit is interrupted and no current is flowing; whereas in a mill that is fitted up with shafting and belts the shafting runs all the time, and the losses due to its friction go on all the time, whether the machines are running or not. The use of individual motors, as described, is also advisable in plants where the machines are run at high speeds, since the desired speeds can be attained electrically, without the losses incident to the use of pulleys and belts, of trains of gears, or any other method of direct mechanical multiplication.

In the transmission of power by electricity to considerable distances, the chief losses are those due to direct leakage of electricity along the line, and to the dissipation of energy in the form of heat in the conductor. The losses due to the former cause can be kept down to a reasonable limit by paying proper attention to insulation, though the problems that are here involved are very serious, when the potential of the conductor is maintained (as is often the case) at 10,000 volts or over. The loss due to the development of heat on account of the resistance of the conductor can theoretically be diminished as much as we please, by merely increasing the size of the conductor; but conduc-

tors sufficient in size to render the heat loss negligible are too expensive to be commercially practicable. Lord Kelvin, in an attempt to determine the most economical size of conductor for electrical transmission, came to the conclusion that the maximum economy is attained when the conductor is of such a size that "the annual interest on the capital outlay is equal to the annual cost of energy wasted." Under ordinary conditions, this is found to lead to the conclusion that the most economical current-density in the conductor is about 380 amperes per square inch of sectional area of the conductor. For the case in which a given horsepower is to be delivered at a given distance, the condition is somewhat different, and not so simple. Professors Ayrton and Perry, who have investigated this case, have given somewhat complicated formulæ for determining the most economical cross-section of the conductor. (See Kent, 'Engineer's Pocket Book,' and the references there given.) In long distance transmission it is customary to adopt, for the transmission line, a far higher potential than is desired for the operation of the machinery at the delivery end, since this artifice makes it possible to transmit a given quantity of electrical energy over a given conductor with a smaller heat loss than would be involved if the transmission were effected at a lower potential. When the transmitting current is alternating, the reduction of potential at the delivery end may be effected by means of a transformer; but when the transmitting current is direct, it is customary to employ a "motor-generator," which consists of a motor, actuated by the transmission current, coupled on the same shaft with a dynamo, which gives out a current adapted to the work to be done. The motor-generator is also used to transform an alternating transmission current into a continuous current, when the continuous current is desired for delivery purposes. Some of the problems of electrical transmission have been solved on a very large scale at Niagara Falls, where the water power is now partially utilized for mechanical purposes. A portion of the power that is developed in the turbine houses is transmitted electrically to Buffalo, for the operation of electric railways and for other purposes, and the remainder is utilized, also in the electrical form, in factories in the more immediate neighborhood of the falls. The longest electrical transmission line in the United States extends from Redlands, Cal., to Los Angeles, a distance of about 80 miles.

For the general principles governing electrical transmission, consult Kapp, 'Electric Transmission of Energy'; see also Perrine, 'Conductors for Electrical Distribution.'

**Power, Utilization of.** The economical production of manufactures and the convenient adaptations of time- and labor-saving devices in all the various lines of constructional work have exerted a wonderful influence in the upbuilding of American industries. Among other significant features the present tendency is marked by the adaptation of compressed air and the application of electric power to machine driving. In the use of compressed air, the facility of adaptation to various requirements which are in many cases additional to the supply of motive power, is a valuable feature peculiar to this system and one



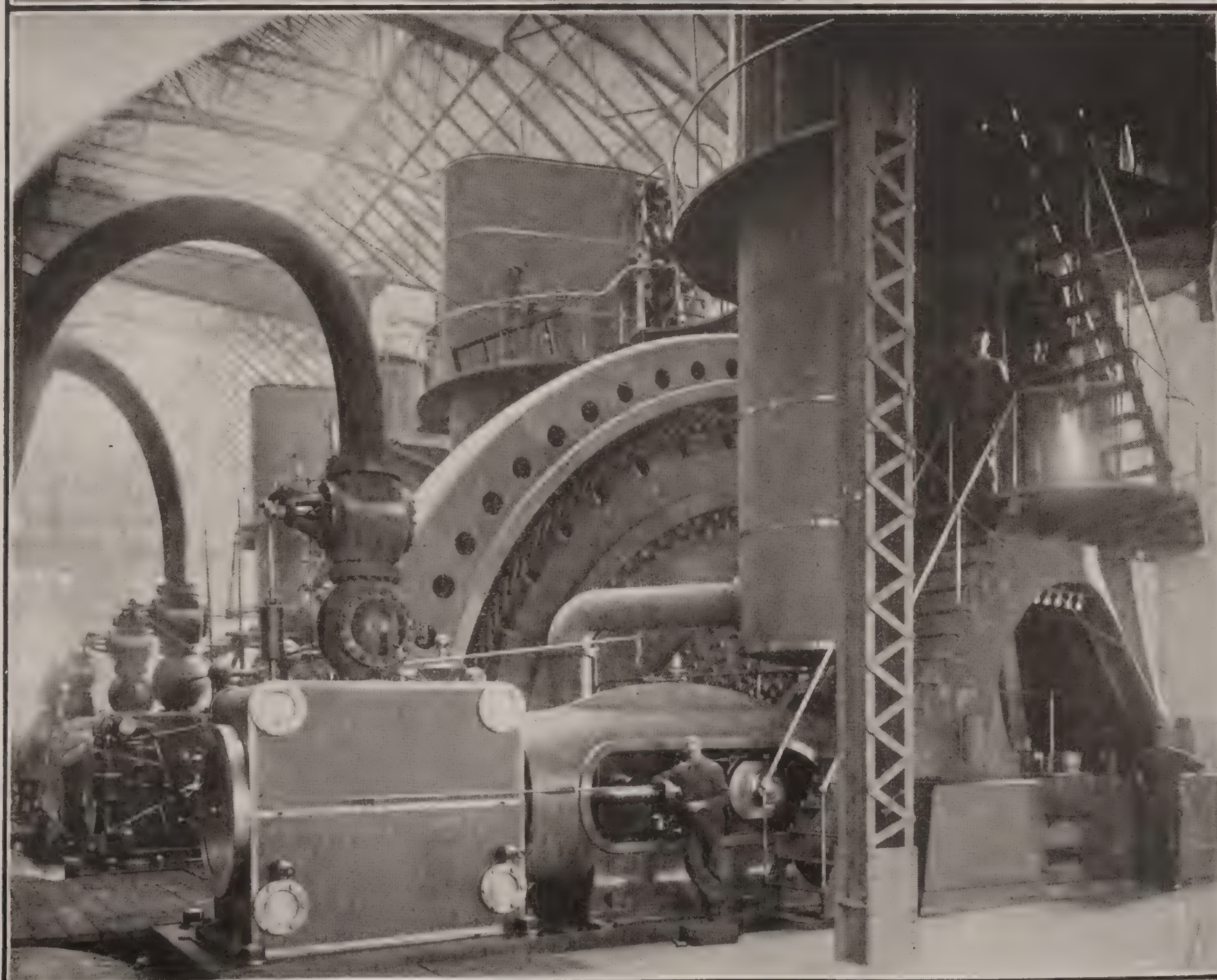
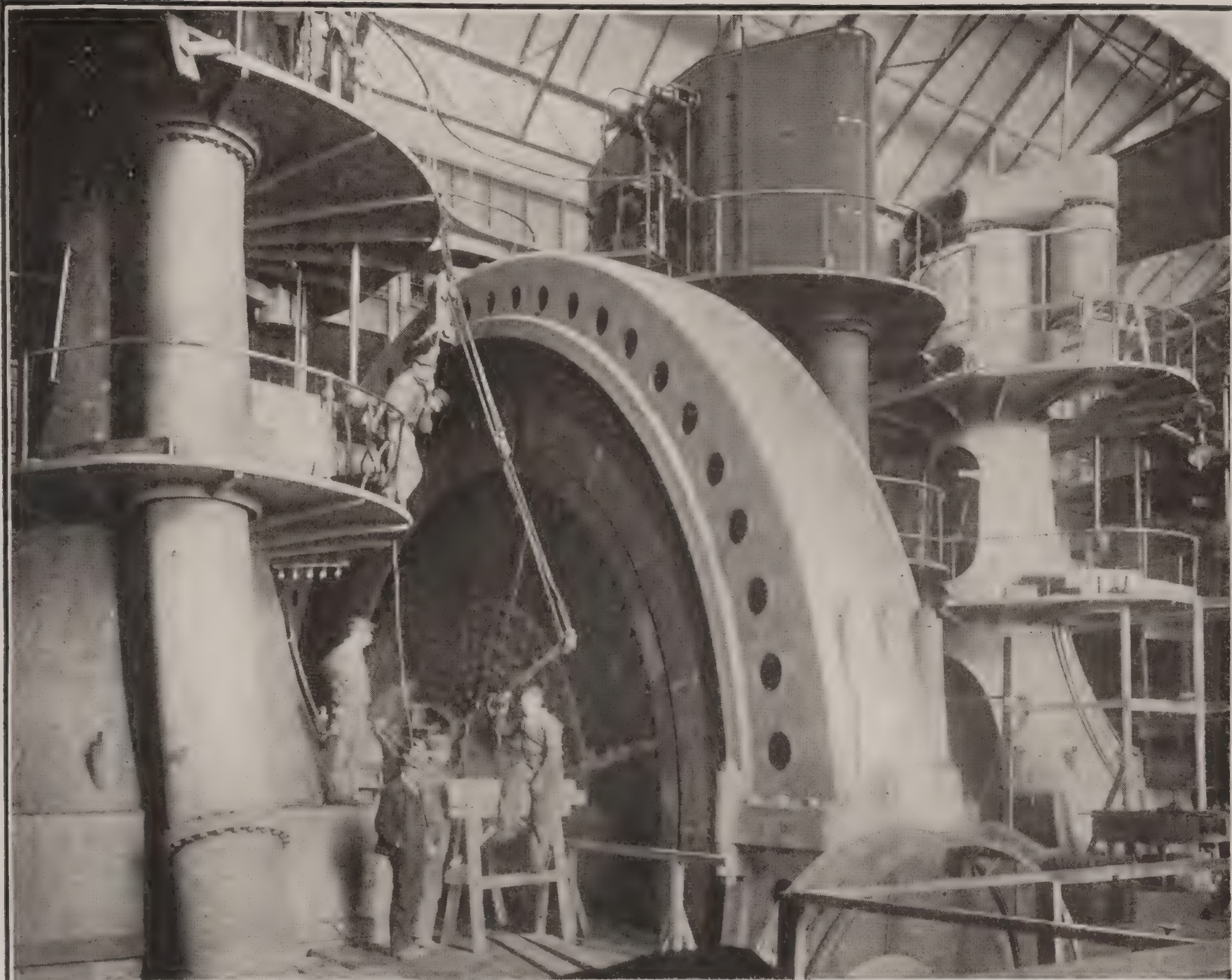
## POWER

which is susceptible of extension along many lines. The labor cost in most machine shops and other works is so much greater than the cost of power that any expedient by which the labor cost may be appreciably reduced is justified, even though the efficiency of the agent itself be low. Whenever new methods or agencies cause an increased production with a given outlay for labor, we shall find these methods superseding the old, even though the cost of the power required be greater than before. The saving of power is a consideration secondary to the advantages and economical output obtained by its use. While economy in the use of power should therefore be secondary to increased output, yet careful attention to details will often greatly reduce the useless waste of power. Engineers have recognized that there is a very great percentage of loss due to shaft friction, which, in railroad and other shops where the buildings are more or less scattered, may be as great as 75 or even 80 per cent of the total power used. In the ordinary machine shop this loss will probably average from 30 to 50 per cent. No matter how well a long line of shafting may have been erected, it soon loses its alignment and the power necessary to rotate it is increased.

*Power Waste.*—Manufacturers are realizing the loss of power which ensues from the present system of transmission, and we find a general tendency to introduce different methods by which a part of this loss will be obviated. Among these are the adoption of hollow and lighter shafting, higher speeds and lighter pulleys, roller bearings in shaft hangers, and the total or partial elimination of the shafting. Independent motors are often employed to drive sections of shafting and isolated machines, and among these we find steam and gas-engines, electric motors, compressed air and hydraulic motors, although the latter have not been used for this purpose to any appreciable extent. In the choice of motors, until quite recently the steam-engine has heretofore been used, especially where the units are relatively large. An interesting example of this is noted in the sugar refinery of Spreckels, in Philadelphia, in which there are some 90 Westinghouse engines about the works, many of them being of 75 and 100 horse-power each; others of 5 and 10 horse-power only. A similar subdivided power plant involving 42 engines was erected several years ago at the print works of Dunnell at Pawtucket, R. I. It was only a comparatively few years ago when several large and economical Corliss engines were replaced at the Baldwin Locomotive Works by a greater number of small, simple-expansion engines, which actually required about 15 per cent more steam per horse-power hour than the Corliss engines. This loss, however, was only apparent, for by increasing the number of units and locating them at convenient centres of distribution much of the shafting and belting could be dispensed with and an actual saving of power was obtained. Later, these simple engines were replaced by a number of compounds, some 18 being in service; subsequent tests on these showed a saving of 36 per cent over that obtained by the use of the simple engines. More recently, however, the electric motor (q.v.) has superseded the steam-engine for this work, as its economy and convenience over the latter are now thoroughly recognized.

*Electric Power.*—The statistics of American manufacturing, compiled by T. C. Martin for the United States Census Office, show that at the time of the last census (1900) electric power was less than 5 per cent of all that was in use in such plants, or about 500,000 horse-power out of a total of 11,000,000; but, as Mr. Martin states, things are to be judged by tendencies rather than by the *status quo*, and these electric motor figures exhibit an increase of 1,900 per cent during the decade. The introduction of electric power in machine shops and factories was at first looked upon with disfavor and was opposed by many manufacturers, but the innovation obtained a foothold, and advantages which were at first unforeseen were found to attend its use, so that now it is being very generally adopted for a wide variety of work. A considerable difference of opinion exists as to whether individual motors should be used with each machine, or whether a number of machines should be arranged in a group and driven from a short line shaft. There are well-defined conditions to which each system is best adapted, but there are wide limits between which there appears to be no general rule, and we find both methods occupying the same field. For isolated machines and for heavy machines that may be in occasional use, the individual motor is particularly well adapted, as it consumes power only when in operation. It is, however, necessary that each motor thus connected shall be capable of supplying sufficient power to operate its machine under the heaviest as well as lightest loads. In certain cases, moreover, the load is liable to very great irregularity, as for instance in metal-working planers, in which the resistance offered by the machine at the moment of reversal of the platen is far higher than at other times, and may be so great as to endanger the armature of the motor. Under these conditions it is necessary to use a motor of much larger capacity than the average load would indicate. Ordinarily in machine driving the motor is shunt-wound, and the current through the field coils is constant under all conditions of load; but to obtain the best results with that class of machinery in which the load is intermittent and subject to sudden variations, the motor should be compound-wound so as to increase the torque without an excessive increase of current in the armature. In many cases with individual motors, owing to wide variations in power required, the average efficiency of the motor may be very low; for this reason a careful consideration of the conditions governing each case indicates that for ordinary machine-driving, especially with small machines, short lengths of light shafting may be frequently employed to good advantage, and the various machines, arranged in groups, may be driven from one motor. By this method fewer motors are required, and each may be so proportioned to the average load that it may run most of the time at its maximum efficiency. When short lengths of shafting are employed the alignment of any section is very little affected by local settling of beams or columns, and since a relatively small amount of power is transmitted by each section, the shaft may be reduced in size, thus decreasing the friction loss. Moreover, with this arrangement, as also with the independent motor, the machinery may often be placed to better advantage in order to suit a given process





Front View of a 12,500 Horse Power Engine, Showing the 42-Foot Alternator.

100,000 H. P. POWER STATION.—SIDE VIEW, SHOWING THE HORIZONTAL HIGH-PRESSURE CYLINDERS AND THE COMPLETE ENGINE.







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of manufacture; shafts may be placed at any angle without the usual complicated and often unsatisfactory devices, and a setting-up room may be provided in any suitable location as required, without carrying long lines of shafting through space. This is an important consideration, for not only is the running expense reduced thereby, but the clear head-room thus obtained, free from shafting, belts, ropes, pulleys, and other power-transmitting devices, can be more easily utilized for hoists and cranes, which have so largely come to be recognized as essential to economical manufacture.

*Distribution.*—In arranging such a system of power distribution the average power required to drive is of as much importance as the maximum, for in a properly arranged group system the motor capacity need not be the equivalent of the total maximum power required to operate the several machines in the group, but may be taken at some value less than the total, depending upon the number of the machines and the average period of operation. On the other hand, as already shown, the motor capacity of independently driven machines must not only equal the maximum power required to drive the machine at full load, but it must be capable of exerting a greatly increased momentary torque. In any case large units should be avoided, for the multiplication of machines driven from one motor entails additional shafting, counter-shafts, and belting which may readily cause the transmission losses to be greater than those obtained with engines and shafting alone, besides frustrating some of the principal objects of this method of transmission.

As far as the efficiency of transmission is concerned, it is doubtful whether, in a large number of cases, motor-driving *per se* is any more efficient than well-arranged engines and shafting. As already pointed out, the principal thing to be kept in mind is a desired increase in efficiency of the shop plant in turning out product, with a reduction in the time and labor items, without especial reference to the fuel items involved in the power production. On account of the subdivision of power which results from the use of many motors, there is less liability of interruption to manufacture, and in case of overtime it is not necessary to operate the whole works, with its usual heavy load of transmitting machinery. Another advantage is the adaptability to changes and extensions; new motors may always be added without affecting any already in operation, and the ease with which this system lends itself to varying the speed of different unit groups is a very potent factor in its favor. When power is delivered to the machine by direct connected motors, a serious difficulty is often experienced in obtaining speed variation, which is so necessary with a large proportion of the machines in common use. A certain amount of variation can be obtained by rheostatic control—a wasteful method; or by using a single voltage system with shunt field regulation; but the variation in either case is very limited. This, however, may be increased by using a double commutator if space will permit. The three-wire, 220-volt system, offers many advantages for both power and lighting systems, and is very frequently employed. Variations of speed may be obtained with this system by using a combination of field regulation

with either voltage, and, in rarer cases, by the use of a double commutator motor. A method which has been used recently with considerable satisfaction involves the use of a three-wire generator, with collector rings connected to armature winding similar to that of a two-phase rotary converter. Balancing coils are used, and the middle points of these are connected to the third wire, which is thus maintained at a voltage half way between the outer wires. This system is simple and economical, and possesses all the advantages of the ordinary three-wire method; it permits similar variations in speed by field regulation with either voltage; and if still wider ranges are desired a double commutator motor may also be used.

In other recent installations the four-wire multiple voltage system is used, which permits of very wide variations of speed in the operation of the tool. This system gives excellent results and removes one of the objections urged against direct-connected motor-driven tools, namely, that such machines are not sufficiently flexible in regard to speed variation, and that such variation can only be obtained by throwing in resistances which cut down the efficiency of the motor, or by varying the strength of field which reduces the torque. The multiple voltage system, however, has some serious disadvantages. It cannot usually be operated from an outside source of power without rotary transformers; the generating sets and switchboard are complicated, and the total cost of installation is expensive; yet with these draw-backs the system is growing in favor, as it has manifest advantages which outweigh the objections. Storage battery power has been used to some extent to obtain multiple control and is suggestive of interesting possibilities, but in its present form it is not altogether desirable for this purpose. In many of the larger sizes of certain metal-cutting machines it is probable that marked changes will be produced in the immediate future, and the indications are that direct-connected motors with wide variations of speed and power will be incorporated in the new designs.

The recent improvements in the manufacture of certain grades of tool steel have shown indisputably that the present designs of machine tools are not sufficiently heavy to stand up to the work in order to obtain the economy of operation which results from the use of such steels. Higher speeds, heavier cuts and greater feeds may be obtained if the machines will stand the strain, but in most cases the capacity of the machine is not commensurate with the ability of the tool to remove metal. With cutting speeds of 100 to 200 feet per minute, it is evident that the power requirements will be much greater than for the ordinary machines of to-day, which have a cutting speed of from 10 to 30 feet per minute. Here then is an interesting field for the direct-connected motor with ample power and speed variation for any work which it may be called upon to perform.

*Compressed Air.*—Reference has been made to the use of compressed air power, and its facility of adaptation to various requirements, but it is evident from an inspection of some of the devices in use that enthusiasm for new methods, rather than good judgment, has controlled in many of its applications. For some years compressed air was used only in mines,



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where it produced marked economies in underground work. Later, compressed air was introduced into manufacturing lines, and to-day its use in railroad and other machine shops, boiler shops, foundries, and bridge works is being widely extended. In the Santa Fé railroad shops at Topeka there are over five miles of pipe in which compressed air is carried to the different machines and labor-saving appliances throughout the works. In such shops air is used to operate riveting machines, punches, stay-bolt breakers, stay-bolt cutters, rotary tapping and drilling machines, flue rollers, rotary grinders, rotary saw for sawing car roofs, pneumatic hammers, chisels and caulking tools, flue welders, boring and valve-facing machines, rail saws, machine for revolving driving-wheels for setting valves, pneumatic painting and whitewashing machines, dusters for car seats and the operation of switching engines about the yard. It is also used in the foundry for pressing and ramming molds, and for cleaning castings by the sand blast; but its greatest field of usefulness is its application to hoisting and lifting operations in and about the works. New applications of compressed air are constantly being made, and each new use suggests another. This has a tendency to increase the number of appliances which are intended to be labor-saving devices, but in many cases the work could be done just as well and much more cheaply by hand. The success and economy which has attended the use of compressed air in so many lines of work has led to its adoption in fields which are much better covered by electrically operated machines. While compressed air has been used under certain conditions very satisfactorily to operate pumps and engines, printing-presses, individual motors for lathes, planers, slotters, dynamos, and other work, it does not follow that it is always an economical agent under these various uses, or that other methods could not be used even more satisfactorily in the majority of cases. It has been proposed to use individual air motors in machine shops and do away with all line shafting, except possibly for some of the heavier machinery. This use of compressed air seems entirely outside the pale of its legitimate field; the general experience thus far indicates that rotary motors are not at all economical and generally are not as satisfactory as electric motors. Exceptions are to be found in the small portable motors for drilling and similar operations, to which electricity is not at all adapted and where compressed air has been found to give excellent results. Although these tools are very successful, they are still rotary motors, not exempt from some of the objectionable features which seem to be inseparable from them. It is not surprising, therefore, to find a tendency to employ reciprocating pistons and cranks in these portable machines, and such tools are now in use weighing only 40 pounds capable of drilling up to two and a half inches diameter. In most cases no attempt has been made to use compressed air power efficiently; its great convenience and the economy produced by its displacement of hand labor have, until recently, been accepted as sufficient, and greater economies have not been sought.

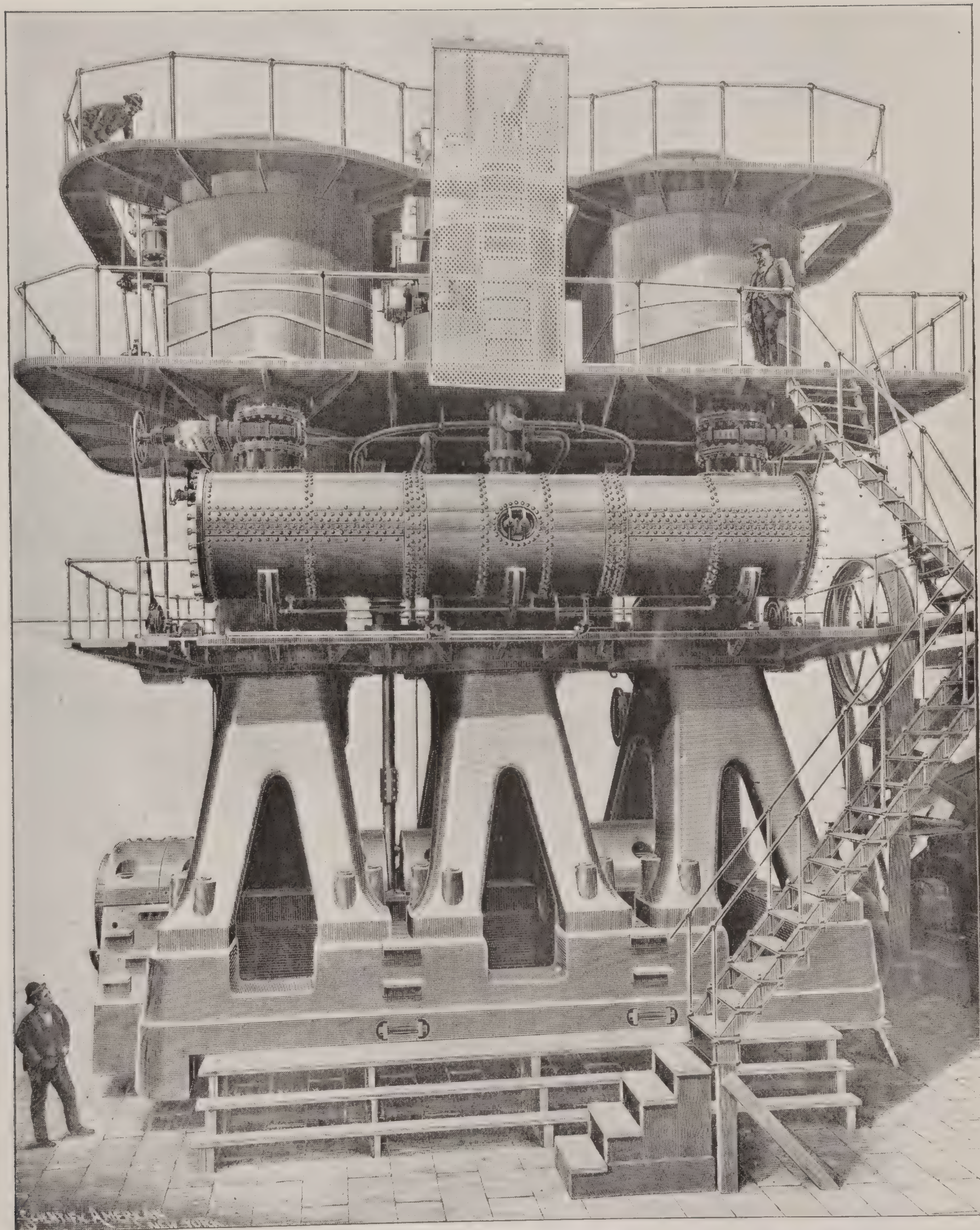
In the matter of compression, very inefficient pumps are still in use, but manufacturers generally have found that it pays to use high-grade

economical compressors. The greatest loss is that in the air motor itself. In a large number of cases it is impracticable or, at most, inconvenient to employ reheaters, and the air is used very generally at normal temperature for the various purposes to which it is applied. To obtain the most satisfactory results, the air must be used expansively, but usually where the demand for power is intermittent no attempt has been made to reheat the air, and as a result the combined efficiency of compressor and motor is quite low, varying in general from 20 to 50 per cent. While low working pressures are more efficient than high, the use of such pressures would demand larger and heavier motors and other apparatus which is undesirable.

The advantages of higher pressures in reducing cost of transmission are also well recognized, and the present tendency is to use air at 100 to 150 pounds instead of the 60 or 70 pounds of a few years ago. By reheating the air to a temperature of about 300° F., which may often be accomplished at small expense, the efficiency is greatly increased; in some cases this has been shown to be as high as 80 per cent. While the lower pressures are yet more efficient, the loss due to higher compression is not serious. If the compressed air be used without expansion, it will be seen that there is a material loss in efficiency; but, on the other hand, if it be used expansively without reheating, trouble may be experienced, due to the drop in temperature below the freezing point. If moisture be present, this will cause the formation of ice, which may clog the passages if proper precautions are not taken to prevent it. The low temperature will not in itself cause trouble; if, therefore, the moisture which the compressed air holds in suspension be allowed to settle in a receiving tank, placed near the motor or other air apparatus and frequently drained, less trouble will be experienced from this cause. The greater adaptability of compressed air to various purposes causes its use to increase along with that of the electric motor, for it has a different field of usefulness, independent of power transmission; at the same time, when the requirements are properly observed in its production and use, its economy as a motive power in special cases compares favorably with other systems. But compressed air possesses so many advantages that, however inefficient it may be as a motive power, its application to shop processes will be continually extended as its usefulness becomes better known. See PNEUMATIC TOOLS.

*Hydraulic Power.*—Mention has been made of the use of hydraulic motors as a factor in the subdivision of power, but these are being used to such a limited extent for this purpose that they will not be considered here. There is, however, a growing field of usefulness for hydraulic power in manufacturing operations which is peculiar to this agent alone, namely, its use in forging and similar work. Where hydraulic power exists for this purpose it is also generally used for a variety of purposes which could be accomplished just as well, and often more economically, by steam or compressed air; but in forging operations where heavy pressures are required hydraulic power is infinitely better than either. The compressibility of air is an objection in many lines of work, and it is now





THREE-CYLINDER COMPOUND ENGINES OF THE NEW YORK EDISON POWER STATION.  
One high-pressure cylinder,  $43\frac{1}{2}$  inches diameter; two low pressure,  $75\frac{1}{2}$  inches diameter; stroke, 5 feet.







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well recognized that the effect of a hammer blow is oftentimes merely local. As H. F. J. Porter has so ably shown, the pressure applied in forging a body of iron or steel should be sufficient in amount and of such a character as to penetrate to the centre and cause flowing throughout the mass; as this flowing of the metal requires a certain amount of time, the pressure should be maintained for a corresponding period. Hydraulic pressure, instead of a hammer, should, therefore, be used to work it into shape. Under its action the forging is slowly acted upon and the pressure is distributed evenly throughout the mass, whereas under the high velocity of impact of the hammer the metal does not have time to flow, and thus internal strains are set up in the mass, which may cause serious results, especially with certain steels which have not the property of welding. The quality of the steel is very much improved by the processes of hydraulic forging, and we find a marked tendency to substitute this method in a wide variety of work in which presses are employed varying in capacity from 20 tons to 14,000 tons. It is an interesting fact that the magnificent 125-ton hammer made by the Bethlehem Steel Company now lies idle, while the work for which it was intended is done by a 14,000-ton hydraulic press operated by an engine of 15,000 horsepower. In these works all forgings, except small pieces, are done on hydraulic presses, the largest hammer in actual operation being only of six tons capacity. The pressure used is 7,000 pounds per square inch, but the present tendency indicates the use of a so-called low-pressure transmission service under a pressure of 400 or 500 pounds, with an intensifier at the press which raises the pressure to 2,500, 5,000, 7,000 pounds, or whatever may be required. In this case the lifting and lowering of the ram of the press is effected by low-pressure water, so that the cylinder always remains filled, and the high-pressure is only brought to bear the moment the dies come in contact with the pieces to be forged. The intensifier is built in multiple, which permits of a variable force to suit the work to be done; its action and control are extremely simple, and results are produced which show a marked increase in speed, and a decided economy in operation. Some of the recent German hydraulic forging machines equipped with intensifier operate at a speed of 40 to 70 strokes per minute on finishing, and 20 to 30 strokes per minute for the heaviest work. The success which has attended the use of hydraulic power in forging is causing it to be applied to other and similar work to an increasing extent. In boiler works, railroad and locomotive shops, bridge works, and shipyards it is used along with compressed air, but where heavy pressures are desired hydraulic power is greatly to be preferred; hence we find it operating machines for punching and shearing heavy plates and sectional beams, riveting machines, stationary and portable, flanging and bending machines, tube upsetting machines, wheel and crank-pin presses, lifting jacks, and hoists of all kinds. For heavy boiler work hydraulic riveting seems especially well adapted, as an intensity of pressure can be brought to bear upon the plates which is obtained by no other method.

*Transmission.*—In the transmission of power by compressed air, within reasonable limits, the

loss in transmission if the pipes be tight need not be considered, for although there is a slight loss in pressure due to the frictional resistances of the pipes, yet there is a corresponding increase in volume due to drop in pressure, so that the loss is practically inappreciable. It has already been stated that compressed air as now used without reheating is not at all efficient as a source of motive power, since the combined efficiency of compressor and motor, even under favorable conditions, is not more than 50 per cent of the available energy put into the compressor. In other cases the efficiency is as low as 20 per cent. There should be no comparison between the cost of power by compressed air and its brilliant rival, electricity, since each has its own field of usefulness. With a three-wire 220-volt system, which is very suitable for ordinary shop transmission when both light and power are to be taken off the same circuit, the combined efficiency of generators and motors working intermittently with fluctuating loads will be about 60 per cent of the power delivered to the engine. For greater distances than those which obtain in plants of this character the loss in transmission will be greater, and higher voltage must be employed in order to keep down the line loss. While it is possible to put in conductors sufficiently large to carry the current with any assumed loss, yet the cost of the line becomes prohibitive with low voltage. Where cheap fuel is available it is found in most cases that electric power can be generated at the works more cheaply than it can be purchased from a central station; especially is this the case if the exhaust steam be used for heating purposes. In isolated plants the cost of transmission is very small as compared with the total cost of generation; whereas in the average central station the cost of transmission, which includes interest and depreciation on pole line, may constitute a large percentage of the operating cost. In those localities where the cost of fuel is high, electric power can often be purchased more cheaply from a central station which obtains its power many miles distant and transmits it electrically to a convenient distributing centre, where it is used for power and light. The recent development in electrical transmission is very marked, and one constantly hears of some new achievement more wonderful than anything previously accomplished. Distances have been gradually increased until it is now possible to transmit electrical energy economically and in commercial quantities up to 150 and even 200 miles. There has been a steadily increasing tendency to raise the line voltage in such transmissions, and to-day we find in successful operation voltages as high as 40,000 and even 60,000 as compared with the 4,000 and 6,000 volts of a few years ago. The possibility of electrical transmission thus permits of the utilization of available sources of power at great distances from the centre of distribution; but while it is interesting to know that a certain amount of power may be transmitted a given distance with a high degree of efficiency, it is more important to know whether the same amount of power could be obtained at the objective point more economically by other means.

*Petroleum Fuel.*—It has been suggested that the future of long-distance transmission depends largely upon the development of oil as a fuel; but at the present time the outlook



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for oil fuel in general competition with coal or long-distance transmission is not encouraging. While the development of the Texas and Southern California oil fields has increased the visible supply and brought about increased activity in the use of liquid fuel, yet it is doubtful whether the advantages would be sufficient to cause it to come into general use as a fuel, since with a limited production and an increased demand for this and other purposes the cost would be correspondingly increased.

A number of railroads contiguous to the oil-producing centres have equipped their locomotives to burn this fuel, and it is used to some extent to fire marine boilers, and with great satisfaction,—since its displacement for a given heating value is only about one half that of coal, and the labor cost is materially reduced. It is also used quite extensively in certain sections of the country as a steam producer in power plants, but it is hardly possible that liquid fuel will be a serious competitor of coal. At present, as far as power for manufacturing plants is concerned, it is largely a question of transportation, whether oil can be laid down and handled at a given point more cheaply than coal. It is probable, however, that oil fuel will supply a local demand in certain sections where transportation charges, and possibly insurance, will permit its use at a low cost, and it is in this connection that it may become a competitor of electrical transmission.

*Gas-engines.*—One interesting phase of the power problem which forcibly presents itself at the present time is the vast possibilities possessed by the modern combustion engine, which includes the various types of gas- and oil-engines. While its use as a motor in industrial establishments has been somewhat limited, yet there is a marked tendency to employ the gas-engine in manufacturing works, and consideration of its advantages and cost of operation, together with its high thermal efficiency and possibility of still further improvement, indicates that, for a great many purposes, both steam-engines and electric motors may be ultimately replaced by gas-engines. That the gas-engine in both large and small sizes has reached a point in its development where it can fairly rival the steam-engine in reliability and satisfactory running qualities, there can be no question. In point of fuel economy, a gas-engine of moderate size is on a parity with the largest triple-expansion steam-engines, and will give a horse-power on less than one pound of fuel. The high price of gas in this country has contributed largely to those causes which have prevented a more common use of the gas-engine as a motor. For this reason the gas-engine has generally been used, not so much because of its high efficiency as a thermo-dynamic machine, but rather on account of its convenience and saving in labor. It is true that natural gas is cheap, but it is equally true that natural gas is not generally available. Fortunately the manufacture of producer gas has reached a high state of development, and there are now in successful use several processes by which power gas can be made from cheap bituminous coals as well as anthracite and coke. The leanness of such gases renders them less effective per cubic foot of gas, as compared with the richer coal gas or even water gas; but this difference is more than com-

pensated for by the low cost of production. It is upon such power gas that the commercial future of the gas-engine as a general motor depends.

A prominent factor in gas-engine practice which has attained a high degree of development in European practice is the small gas-producer. These generators are very simple in operation, and furnish a convenient and economical means of obtaining power at a much lower rate than with the ordinary city lighting gas. The economy of these small producers is shown by tests which give one horse-power on a 16 horse-power engine with a consumption of only 1.1 pound of fuel. For engines above 40 horse-power one horse-power can be obtained on seven eighths pound of fuel. The successful employment of large combustion engines with blast furnace gases as the explosive medium, utilizes vast sources of power which a few years ago were allowed to go to waste or, at most, were used very inefficiently. The high thermal efficiency of the gas-engine has long been recognized and the possibility of further development is a promising factor in this field. The already accomplished efficiency of 38 per cent reported by Professor Meyer, of Göttingen, greatly exceeds the maximum theoretical efficiency of the steam-engine and more than doubles its actual best obtainable working efficiency. With higher compression even greater efficiencies may be expected. But with high compression there is danger of premature explosion, due to the generation of heat in compressing the gas in the presence of oxygen; for this reason Herr Diesel compresses the air separately. Under a pressure of 500 pounds or more, which is used in the Diesel motors, the air becomes very hot and readily ignites a charge of liquid fuel which is injected into the compression chamber. There is no explosion; combustion occurs while expansion goes on, and the heat generated disappears in the form of work. In England, during the year 1901, there were in use, or under construction, 327 gas-engines capable of supplying 182,000 horse-power. This gives an average of about 560 horse-power per engine. As compared with this, the last United States Census Report states that, during the census year 1899, there were constructed in the United States 18,500 combustion engines having a total capacity of 165,000 horse-power, or only about 9 horse-power per engine. Although this country has lagged somewhat behind Europe in adopting large gas-engines, there is evidence that this state of affairs will not exist very long, for a number of firms are now in the field building gas-engines from 1,000 to 4,000 horse-power capacity. The use to which these large engines are put is about equally divided between the operation of blowing engines for blast furnaces and the driving of dynamos for general power distribution. While the gas-engine in the larger sizes is thus used extensively for the generation of electric light and power, a growing tendency is observed to use the gas-engines direct as motors. A number of railroad and other machine shops have been equipped with moderate sized gas-engines suitably located about the works, and in addition, thousands of horse-power are used in the smaller sizes for a wide variety of purposes, including village waterworks, isolated lighting stations, and manufacturing plants of all kinds. With the possibilities of high thermal efficiencies we may look with much hope upon the still higher



development of cheap fuel gas processes that will bring the gas-engine into very general succession to the electric motor for power purposes, for it will doubtless be found that gas transmitted from a central gas-making plant at a manufacturing works into engines located at points of use will effect a material saving in the utilization of power over any existing methods. It is not to be presumed that the gas-engine will displace either the electric motor or the steam-engine; each has its legitimate sphere of usefulness, and each will be more highly developed as the result of direct competition. Yet the economies already obtained indicate that the field of the gas-engine will be gradually extended into that of the steam-engine and the electric motor.

*Steam-turbines.*—Many of the questions involved in this consideration are at the present time in a transitional stage. The reciprocating steam-engine has reached a high state of development, but it is not probable that it has attained its highest degree of perfection. While an economy of less than  $9\frac{1}{2}$  pounds of steam per horse-power hour has been obtained, even better results may be anticipated; the use of high pressure superheated steam in compound, jacketed engines involves more perfect lubrication, and this may demand modification in existing valve types; however this may be, the outlook is promising for still higher efficiency; whether this will mean cheaper power than can be obtained in other ways will depend upon many conditions. In any case, and especially with intermittent or variable loads, it is not so much a question of maximum efficiency as it is economy of operation.

From this point of view the present activity in the construction and development of the steam-turbine is of interest to engineers and power users. The steam consumption of a modern steam-turbine of moderate size compares very favorably with that of the better class of large reciprocating engines, but what is of greater importance is the evident superior steam economy under variable loads. The steam consumption per horse-power hour varies little from one third to full load; at over-loads the economy, as shown by numerous tests, may be even better. This feature predestines the steam-turbine to the special field of electric lighting and power generation, where it must inevitably become a formidable rival of the larger-sized, slow-speed reciprocating steam-engine. The high rotative speed of the steam-turbine is a prominent factor in favor of its adoption in connection with electrical generators, since the cost of the generator end of the equipment ought eventually to be very materially reduced; but for many lines of work the high rotative speed of the present types of steam-turbine is prohibitive, nor can it be adapted successfully to belt-driving, except by the use of gearing. However, it is fair to presume that the attention now being given to its development will evolve a more universal type of motor adapted to general power purposes with large and small units alike.

The economies already obtained with both the steam-turbine and the gas-engine have brought each into a prominence which is at least suggestive of the important developments that are taking place in methods of obtaining and using power.

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**Powers, Hiram**, American sculptor: b. Woodstock, Vt., 29 July 1805; d. Florence, Italy, 27 June 1873. He received his education at the district school, and on the removal of the family to Ohio in 1819 was employed as assistant to a clock-maker. He was subsequently appointed director of the waxwork department of the Western Museum of Cincinnati, an employment he pursued for seven years. In 1835 he went to Washington, and was for some time employed in modeling busts of distinguished men. With the proceeds derived from these efforts, and the aid of Gen. Preston, he was enabled to visit Italy. In 1837 he established himself at Florence, where he resided until his death. His statue of 'Eve Tempted,' which excited the approval of Thorwaldsen, was produced in 1838; in 1843 was modeled the still more popular 'Greek Slave,' of which six copies in marble, and innumerable casts and reduced copies, are in existence. Among his other statues the most notable are: 'The Fisher Boy' (1846); another 'Eve Tempted' (1850); 'America' (1854), destroyed by fire in 1866; 'Il Penseroso' (1856); 'California' (1858); and 'The Indian Girl' (1872); and statues of Washington for the State of Louisiana, of Calhoun for South Carolina, of Webster for Boston, and of Franklin and Jefferson. He also executed several ideal busts, such as 'Ginevra' (1840); 'Proserpine' (1845); 'Psyche' (1849); 'Diana' (1852); 'Christ' (1866); 'Faith' (1867); 'Hope' (1869); and 'Charity' (1871); besides busts of Jackson, Adams, Everett, Van Buren, and Longfellow.

**Powers, Le Grand**, American statistician: b. Preston, N. Y., 1847. He was graduated at Iowa State University in 1872 and was engaged in active ministerial work 1874-90. He was commissioner of labor in Minnesota 1891-9, and has since been chief statistician of the 11th Census, in charge of agriculture. He has published 'Minnesota Bureau of Labor Biennial Reports' (1890-9); 'Farmer Hayseed' (a reply to 'Coin's Financial School'); etc.

**Powhatan**, pow-ha-tăn', Indian sachem: b. about 1550; d. 1618. This was the name of his tribe; his own was Wahunsonacock. Originally he was at the head of eight tribes, but being a man of great natural abilities, raised himself from the rank of a chieftain to the command of 30 tribes, numbering about 8,000. (See POWHATAN INDIANS.) His dominions included the country between the James and Patuxent, and extended into the interior as far as the falls of the chief rivers. One of his abodes was a village of a few wigwams near the present site of Richmond. A large guard of warriors usually attended him, and his dwelling was watched at night by sentinels. After the extension of his power northward, he dwelt mainly at Werowocomoco, on York River, in the present county of Gloucester, a few miles from Jamestown. He was disposed to look with dislike upon the coming of the whites. Capt. John Smith, in 1607, was held for some time by Powhatan as a prisoner, and according to the tradition, when Smith had been condemned to death, the sachem yielded to the entreaties of his daughter Pocahontas (q.v.) and spared his life. Two years later Powhatan was crowned "Emperor of the Indies" by Smith and Capt. Christopher Newport, during a visit which they paid



## POWHATAN INDIANS — POZZUOLI

him in quest of supplies. Smith afterward made an unsuccessful attempt to capture Powhatan in order to obtain a supply of corn, and in revenge for this Powhatan prepared to exterminate the English, but was foiled by the watchfulness of Pocahontas. The quarrels between Powhatan and the English did not cease until the marriage of his daughter to John Rolfe (q.v.), after which he was their firm friend. Smith's description of Powhatan represents him as a "tall, well-proportioned man, with a sour look, his head somewhat gray, his beard so thin that it seemed none at all, his age near sixty, of a very able and hardy body to endure any labor."

**Powhatan Indians**, an American confederation of 30 tribes living south of the Potomac River about the time of the settlement of Jamestown. The entire confederation numbered 8,000. There are no known descendants of any of these tribes. The chief was also called Powhatan (q.v.).

**Pow'nall, Thomas**, English statesman, colonial governor, and author: b. Lincoln 1722; d. Bath 25 Feb. 1805. He was graduated at Cambridge in 1743, 10 years later emigrated to America, became private secretary to Governor Osborn of New York, and in 1757 was made governor of the colony of Massachusetts Bay. Having been recalled at his own request, he succeeded Sir Francis Bernard as lieutenant-governor of New Jersey in 1760. He was also appointed to the governorship of South Carolina; but without going to that colony, in 1761 he returned to England, was made comptroller-general of the expenditures of the army in Germany, and in 1768 elected to Parliament. He earnestly opposed the measures of the government against the colonies. After being three times returned to Parliament, he retired in 1780, and passed the remainder of his life in antiquarian studies. In the sphere of scholarship he achieved a greater reputation than that which he won in the field of politics. His writings have a wide range of subjects, and among his principal works are: 'Administration of the Colonies' (1764); 'A Topographical Description of the Middle Colonies' (1776); 'A Memorial to the Sovereigns of Europe on the State of Affairs between the Old and the New World' (1781); 'A Memorial to the Sovereigns of America' (1873); 'Notices and Descriptions of the Antiquities of the Provincia Romana of Gaul' (1788); 'A Memorial to the Sovereigns of Europe and the Atlantic' (1803); 'Intellectual Physics'; 'Principles of Polity'; and a 'Treatise on Old Age.'

**Poynings, poin'ingz, Sir Edward**, English statesman: b. 1459; d. 1521. He was active in the Kentish revolt against Richard III. in 1483 and two years later came to England in the train of the Earl of Richmond, afterward Henry VII. He went as lord deputy to Ireland in 1494, and while there summoned a Parliament at Drogheda which at his instigation gave to the English crown and Privy Council direct control of Irish administrative affairs. The act passed on this occasion is known as the Poynings Law. (See IRELAND, *History*.) He was recalled in 1496 and was subsequently warden of the Cinque Ports.

**Poyning's Law, or Statute of Drogheda**, an act of the Irish Parliament, passed in 1495,

whereby all general statutes before that time made in England were declared of force in Ireland. It was so named from Sir Edward Poynings, deputy of Ireland under Henry VII.

**Poynter, poin'ter, Sir Edward John**, English painter: b. Paris 20 March 1836. He received his early education in Westminster School and in Ipswich, and was the pupil of Gleyre in Paris from 1856 to 1859. In 1860 he returned to London and was elected Royal Academician in 1876. His paintings in oil and water colors are distinguished by originality of conception, faultless drawing, and strong color qualities, and the most remarkable of them are: 'Israel in Egypt' (1867); 'The Catapult,' an incident in the siege of Carthage (1868); 'Faithful unto Death'; 'Proserpine'; 'Perseus and Andromeda' (1872); 'The Fortune Teller' (1877); 'Rhodope'; 'The Golden Age'; 'Zenobia in Captivity' (1878); 'The Visit of the Queen of Sheba to Solomon' (1890). During the years 1872-3 he was engaged in frescoing the walls of Saint Stephen's Church, Dulwich. He also furnished designs for the decoration of the interior of the dome of Saint Paul's Cathedral with subjects from the Apocalypse, as well as for the mosaics in Westminster palace. On the death of Sir John Millais in 1896 he was elected president of the Royal Academy and the same year was knighted. He also published: 'Ten Lectures on Art' (1879).

**Poynting, poin'ting, John Henry**, English scientist: b. Monton, Lancashire, 9 Sept. 1852. He was educated at Owens College, Manchester, and Trinity College, Oxford, was assistant to Prof. Balfour Stewart in the physical laboratory at Owens in 1876-9, and in 1880 was appointed to the chair of physics at Mason College (now Birmingham University). He has contributed papers on electrical theory and the mean density of the earth to the 'Philosophical Transactions' and the 'Proceedings' of the Royal Society; published his Adams prize essay on 'The Mean Density of the Earth' (1891); and (with J. Q. Thomson) 'A Text-book of Physics.'

**Pozzo di Borgo, pöt'sō dē bōr'gō, Carlo Andrea**, COUNT, Russian diplomat: b. Alata, Corsica, 8 March 1764; d. Paris 15 Feb. 1842. He became an advocate, and in 1791 was elected to the National Assembly, but withdrew from France for safety, and became president of the council under English rule in Corsica. In 1802 he entered the Russian service as councillor of state, and was employed in various missions of importance. After the Russian treaty with Napoleon, he resigned, and traveled widely until recalled by the Emperor Alexander. He thereupon devoted himself to maintaining an energetic prosecution of the war against France. He concluded the alliance with Sweden, and in 1814 visited England for the purpose of influencing British policy. His services were fully recognized. He attended with the emperor the Congress of Vienna, was ambassador to France in 1830-4, and to Great Britain in 1834-9. Consult Vuhrrer, 'Notice Biographique sur le Comte Pozzo di Borgo' (1842).

**Pozzuoli, pöt-soo-ō'lē**, Italy, a city on the gulf of the same name, six miles west of Naples, at the western foot of the Solfatara and in a volcanic country known to the Romans as the



Phlegræan Fields. Near by is the Avernian Lake famed as the entrance to Hell both in Virgil's sixth *Æneid* and in early Christian legend, which pointed out here the place where Christ descended into Hell. Remains of Cicero's villa are near the town, which is particularly famed for its amphitheatre, where 30,000 spectators could sit and in which there were naval battles as well as the ordinary gladiatorial contests. The so-called Serapeum is an archaeological puzzle and may have been a town hall; traces of the action of sea water on several pillars not now touched by high water seem to prove that the coast, possibly from volcanic disturbances, has undergone marked and recurrent changes. The only other ruin of importance is that of the temple of Augustus, the site of which is occupied by the cathedral, which preserves six of the original Corinthian columns. Pozzuoli is a good fishing-port; exports the volcanic sands called *pozzuolana*, which are used in making cement; has important mineral baths in the vicinity; and is the site of an ordnance factory, a branch house of Armstrong & Co., which makes armor plate and cannon for the Italian government. Pop. (1901) 22,907.

Pozzuoli was founded by Greek exiles from Samos 528 B.C., as *Dicæarchia*, but the Italians called it *Puteoli*, "the wells," because of the sulphurous cavities in the earth, and this name stuck to the Roman colony founded here in 194 B.C. The city became the greatest port of Italy and an entrepôt for Oriental commerce; goods were sent overland hence to Rome and the dangerous navigation of the coast of Latium avoided. Even after Ostium was built the port retained its importance, and its beautiful coast and curative springs and baths made it a famous resort.

**Pradier**, *prä-dē-ā*, **James**, French sculptor: b. Geneva 23 May 1792; d. 14 June 1852. He went to Paris in 1809, and studied design under Meynier, and sculpture in the studio of Lemot. In 1813 he gained the prize of the Academy for a bas-relief of Philoctetes and Ulysses, and this work procured his admission to the French Academy at Rome. Here he studied the antique, and returned to Paris with two statues, one of a Bacchante and the other of a son of Niobe. In 1821 he went again to Rome, where he remained till 1823, and brought back a beautiful statue of Psyche, which he had made out of part of the shaft of an ancient marble pillar found at Veii. From this period he worked constantly at Paris, and produced a great number of larger and minor sculptures, including a Venus, a most lovely group of the Three Graces, a plaster statue of Jean Jacques Rousseau, after which the casting at Geneva has been made, and Cyparissus with his goat and a huntress. Admitted to the Institute in 1827, he afterward executed, among other works, a Prometheus, a Faun and Bacchante, a Phidias, the bas-reliefs on the pediment of the chamber of deputies, the allegorical figures of Lille and Strasburg in the Place de la Concorde at Paris, the Industry in front of the exchange, the Flora, which he considered one of his most successful works, the twelve colossal Victories on the monument of Napoleon in the Hotel des Invalides, the Atalanta in the exhibition of 1851, and the Sappho exhibited in 1852. The execution of his works ranks him a sculptor of the

first order, but he is deficient in originality of conception, his monotone borders on insipidity, and he sometimes strives to give life to his creations by a touch of meretriciousness.

**Pradilla**, *frän-thēs'kō prä-dēl-yä*, Spanish painter: b. Villanueva de Gallego, in the province of Saragossa. His initiation into art came through his employment as a decorator of theatres, but in 1863 he arrived at Madrid where he devoted himself to the study of the old masters, became a pupil of Serri and completed his artistic education in the Spanish Academy of Fine Arts at Rome. His first signal achievement in art was 'The Rape of the Sabines'; followed in 1878 by 'Joanna the Mad, following the Coffin of Philip the Fair, her Husband'; this was awarded a medal at the World's Exposition at Paris the same year. His next important work was 'The Surrender of Granada to Ferdinand and Isabella,' a picture remarkable for spirited delineation of character, life-like action and grandeur of style. At the Exposition in Munich (1883) it was awarded first medal. In addition to these larger works he has produced numerous small genre pictures, illustrating modern life, and indicating keen observation, and subtle power of individualization. Among these is 'Market Day at Vigo'; 'High Mass in the Pilgrims' Chapel at Guia,' and 'Pilgrimage to the Shrine of Our Lady of Good Counsel.' These small canvases are masterpieces of their kind and have won for him a European reputation.

**Prado**, *prä'thō*, **Mariano Ignacio**, Peruvian politician: b. Huanaco 1826. He engaged actively in a revolution which in 1854 overthrew General Echenique and led the opposition to President Pezet in 1865 which resulted in Pezet's resignation and his own election to the presidency. He then formed an offensive and defensive alliance against Chile, and declared war with Spain. A Spanish attack upon Callao was repulsed 2 May 1866, but his own position having been declared unconstitutional, he was obliged to leave Peru in January 1868. Returning several years later he was elected president in 1876 and in 1879 declared war against Chile. Prado went to Europe in the same year, for the purpose, as was then stated, of obtaining a loan and iron-clads, and in his absence the presidency was seized by Pierola. He returned to Lima in 1886, but ceased to be active in politics.

**Pradt**, *dō-mē-nēk dü-foor dē prä't*, French prelate: b. Allanches, Auvergne, France, 1759; d. Paris, France, 1837. He entered the priesthood, and at the outbreak of the French Revolution was grand-vicar to the archbishop of Rouen. He represented the clergy of Normandy at the constituent assembly where he supported the clerical and royalist parties, and after the Convention fled to Hamburg. He returned to France in 1799, gained the favor of Napoleon, became his first almoner in 1804 and later bishop of Poitiers. In 1808 he was made archbishop of Mechlin and an officer of the Legion of Honor, but in 1812, when sent as ambassador to Warsaw failed in his mission, thereby incurring the displeasure of Napoleon, who removed him from his office as almoner and ordered him to his diocese. He later sold his right to the archbishopric to the king of the Netherlands. Deprived of his office of chancellor he became simply the Abbé de Pradt and engaged



in bitter attacks on the banished Napoleon, and after vain attempts to gain influence with the Bourbons began to write in favor of constitutional freedom and against the abuses of the clergy. Among his works are: 'Antidote au Congrès de Rastadt' (1798); 'Histoire de l'Ambassade dans le Grand Duché de Varsovie' (1815); 'Des Colonies et de la Révolution actuelle de l'Amérique' (1817); 'L'Europe et les Colonies depuis le Congrès d'Aix-la-Chapelle' (1821); etc. Consult De Lastic-Rochegonde, 'Dominique de Pradt' (1897).

**Praed, prād, Mrs. Campbell.** See PRAED, ROSA CAROLINE MURRAY-PRIOR.

**Praed, Rose Caroline Murray-Prior,** English novelist: b. Bromelton, Queensland, 27 March 1852. In 1872 she was married to Campbell Mackworth Praed (d. 1901) and in 1876 went to London where her Australian stories soon made her well known. Among her many popular fictions are: 'An Australian Heroine' (1880); 'Moloch' (1883); 'The Head Station' (1885); 'December Roses' (1892); 'Outlaw and Lawmaker' (1893); 'Nulma' (1897). She published 'My Australian Girlhood,' an autobiography, in 1902, and with Justin McCarthy (q.v.) has written 'The Right Honorable' (1886); and 'The Ladies' Gallery' (1889), novels of political and social life.

**Praed, Winthrop Mackworth,** English poet: b. London 26 July 1802; d. there 15 July 1839. He was educated at Trinity College, Cambridge, was elected to a Trinity fellowship in 1827, and in 1829 was admitted to the bar. In Parliament he sat for Saint Germans in 1830-2, for Great Yarmouth in 1834-7, and for Aylesbury from 1837. Praed made some successful speeches in the House, and was requested by Wellington to write for the *Morning Post*, a defense against certain attacks on the Duke in the *Times*. His political writing was too restrained wholly to reach its mark; but his verse is marked by a lightness of touch and a metrical ease and finish which in more recent times finds its closest resemblance in the work of Austin Dobson. He excelled in *vers de société*, though he displayed, as in the 'Red Fisherman,' an imaginative force which suggests broader fields. The best edition of Praed's poetical works is the authorized one of 1864.

**Præ'fect,** the title of various functionaries of ancient Rome. Of these the most important was the *præfectus urbi* or *urbis*, or warden of the city, originally called *custos urbis*. The name *præfectus urbi* does not seem to have been used till after the time of the decemvirs. During the kingly period and the early years of the republic the *custos urbis* exercised within the city all the powers of the chief of the state in his absence; he convoked the senate, held the comitia, and on any emergency might take such measures as he thought proper. When the office of *prætor urbanus* (see PRÆTOR) was instituted the wardenship of the city was merged in it; but the conservative spirit of the Romans still induced them to appoint annually a *præfectus urbi* for the time during which the consuls were absent from the city to celebrate the *Feriae Latinae*, a festival held on the Alban Mount. Under Augustus, however, the office ceased to be a sinecure. The *præfectus urbi* was a permanent magistrate whom the emperor invested with all

the powers necessary to maintain peace and order in the city. He had under him a sort of police called *milites stationarii*; and the powers of the office were gradually so far extended that at last there was no appeal from his sentence except to the emperor. The *præfectus prætorio* was the officer who commanded the troops who guarded the emperor's person. (See PRÆTORIAN GUARDS.) The office was first instituted by Augustus, and was at first only military, and had comparatively little influence attached to it; but under Tiberius it became second only to that of the emperors. From the time of Severus to that of Diocletian the præfects had the superintendence of all the departments of the state — the palace, the army, the finances, and the law; they also had a court in which they decided cases. In addition to these functionaries there were the *præfectus aquarum*, charged with the regulation of the water supply of the city; the *præfectus ærarii*, who had charge of the public treasury; the *præfectus vigilum*, who commanded the night-watch; with others of less importance.

**Præmunire,** prē-mū-nī'rē, the opening words of the writ issued preparatory to the prosecution of certain offenses supposed to imply legal contempt toward the sovereign or the government — *præmonere* or *præmunire facias* A. B. (Cause A. B. to be forewarned that he appear before us, etc.) The first statute of præmunire was passed during the reign of Edward I., and was intended to repress the papal encroachments on the rights of the crown, and several subsequent statutes before the Reformation greatly extended the number of penal acts under this title, and by still later statutes acts of a very miscellaneous nature have been rendered liable to the penalties of præmunire, as knowingly and wilfully solemnizing, assisting, or being present at any marriage forbidden by the Royal Marriage Act; asserting by preaching, teaching, or advisedly speaking that any person other than according to the acts of settlement and union has any right to the throne, or that the sovereign and Parliament cannot make laws to limit the descent of the crown; to assert that both or either of the Houses of Parliament have or has a legislative authority without the sovereign; and so on. Cathedral chapters in England which refuse to elect the bishop nominated by the Crown are liable to be prosecuted on præmunire. The punishment is forfeiture and imprisonment during the sovereign's pleasure.

**Præneste,** prē-nēs'tē. See PALESTRINA.

**Præ'tor,** originally the official title of the consuls at Rome. When the patricians were compelled to acquiesce in the consulship being thrown open to the plebeians, they stipulated that a new curule magistrate should be appointed from the patricians exclusively, to act as supreme judge in the civil courts. On this magistrate the title of prætor was bestowed. In 337 B.C. the prætorship was thrown open to the plebeians. About 240 B.C., the number of aliens residing in Rome had increased to such an extent that it was found necessary to appoint a second prætor, who should decide suits between aliens or between aliens and citizens. He was known as the *prætor peregrinus*, the other prætor, *prætor urbanus*, having cognizance of suits between citizens only. In 227 B.C., the number was increased to four, the two additional prætors to act as



## PRÆTORIAN GUARDS — PRAGMATISM

governors of provinces. By Sulla the number was augmented to eight, by Julius Cæsar to 10, 12, and eventually to 16. The prætors held their offices for one year, and were afterward sent out by lot as governors of provinces.

**Prætorian Guards**, a body of permanent troops, established by Augustus as Imperial Life Guards, in imitation of the *cohors prætoria*, or bodyguard attached to the person of the commander-in-chief of a Roman army. The Prætorian guards were kept up by successive emperors, and, being under special organization and enjoying several privileges, they became in time so powerful that they were able to raise and depose emperors at their will. They were reorganized by Septimius Severus, and were finally suppressed by Constantine the Great.

**Præto'rium**, (1) the official residence of a prætor or governor of a Roman province: hence, a hall of justice; a judgment-hall; a palace. (2) That part of a Roman camp in which the general's quarters were.

**Praga**, prä'gä, Russian Poland. See WARSAW.

**Pragmat'ic Sanction** (*Sanctio Pragmatica*), a public edict relating to important state business, pronounced by the head of the legislature, and differing from the simple rescript, in that the latter was a declaration of law in answer to a question propounded on behalf of an individual. The pragmatic decree was considered irreversible. In European history the following are the most important pragmatic sanctions. (1) That ascribed to Louis IX. of France, but not brought to light till 1468 and in reality an expansion of that of Charles VII. (2) The ordinance of Charles VII. of France, drawn up at Bourges in 1438, conformably to the decrees of the Council of Basel, and on which rest the claims of the Gallican liberties. It was repealed by Francis I. (3) The decree of the German Diet at Mainz in 1439 which sanctioned the Basel decree. The two last limited the papal power, but were altered by subsequent concordats. (4) The instrument by which the German emperor, Charles VI., being without male issue, endeavored to secure the succession to his female descendants. It was in accordance with this instrument that he settled his dominions on his daughter Maria Theresa. He induced most of the European sovereigns to guarantee it; but Charles Albert, elector of Bavaria, the next heir to his dominions, refused; this caused the Austrian war of Succession after the death of the emperor in 1740. In the Peace of Füssen (1745) Bavaria acknowledged the pragmatic sanction. (5) Charles III. of Spain, when he ceded the throne of Naples to his third son and his successors in 1759, called the law of succession which he prepared for this branch of his family *sanctio pragmatica*.

**Pragmatism**. The term pragmatism, as employed in philosophy at the present time, denotes the general tendency to subordinate logical thinking to the ends of practical life, and to find the test of the truth of ideas in their practical consequences. There are thus two somewhat distinct sides to the doctrine, which we find differently emphasized by different writers. On the one hand, this view points out that thought owes its origin to the needs and demands of the practical life. Thought is thus

a tool or instrument that is always invoked to meet a particular crisis or problem resulting from a concrete situation. Thought, therefore, does not aim at truth in general. Its business is to discover, in concrete circumstances, the best means to the realization of some practical end that life demands.

This side of the doctrine has been chiefly elaborated by Professor John Dewey and those associated with him at the University of Chicago as colleagues or students. These writers have connected their theory with the doctrine of evolution, and support it mainly by arguments and analogies drawn from this source. On the other hand, to decide regarding the truth or falsity of any theory or conception, we must also appeal to the practical consequences that result from it. A theory is demonstrated in the only possible way when it is shown that it will "work"; that is, that the results that we wish to obtain in a given situation follow from it. It is only in the light of these results that a conception has meaning. Apart from its practical consequences, a conception is an abstraction without meaning or significance, and consequently without truth or falsehood.

This practical test of the truth of a theory through an appeal to its consequences, is the element in pragmatism that has been mainly emphasized by C. S. Peirce and Professor William James. Peirce first employed the term and outlined the theory in an article in 'The Popular Science Monthly' (January 1878); but the present currency of the position in America and England is largely due to Professor James, who has elaborated and enforced it in his psychology and in a number of popular works and articles. The names of Peirce and James are so closely connected with pragmatism that we quote here the formal definitions of the term which they have written for Baldwin's 'Dictionary of Philosophy.' Peirce describes the doctrine as follows: "The opinion that metaphysics is to be largely cleared up by the application of the following maxim for attaining clearness of apprehension: 'Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have. Then our conception of these effects is the whole of our conception of the object.'" James defines pragmatism: "The doctrine that the whole 'meaning' of a conception expresses itself in practical consequences, consequences either in the shape of conduct to be recommended, or in that of experience to be expected, if the conception be true; which consequences would be different if it were untrue, and must be different from the consequences by which the meaning of other conceptions is expressed. If a second conception should not appear to have other consequences, then it must really be only the first conception under a different name. In methodology it is certain that to trace and compare their respective consequences is an admirable way of establishing the differing meanings of different conceptions."

**Bibliography**.—W. James, 'Principles of Psychology' (1890), chaps. xii. and xxii.; 'The Will to Believe' (1896); 'Philosophical Conceptions and Practical Results' (1898); John Dewey, 'Studies in Logical Theory' (1903); 'Personal Idealism,' essays edited by H. Sturt (1902); W. Caldwell, 'Pragmatism'; 'Mind'



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(October 1900); James Seth, 'The Utilitarian Estimate of Knowledge,' 'Philosophical Review,' July 1901; J. Royce, 'The Eternal and the Practical,' 'Philosophical Review,' March 1904.

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**Prague**, prāg, Austria-Hungary, the capital of Bohemia, and the third largest city of the empire, 217 miles by rail northwest of Vienna, and 118 miles southeast of Dresden. Its site is a regular basin, traversed by the river Moldau, from the banks of which the city's buildings rise in terraces, till they are terminated and enclosed by hills of considerable height. Of nine bridges including two railway viaducts the most striking is the Karlsbrücke, dating from 1357-1503, and reconstructed after damage by a flood in 1892; it is 543 yards long with tower gateways at each end, and the buttresses adorned with statues of John of Nepomuk and other saints. The mediæval fortifications and ramparts have been gradually demolished since 1866, and their sites occupied by pleasure grounds, boulevards, dwellings, etc. Among the chief quarters of the town are the Altstadt, Josephstadt, and Neustadt on the right, and the Kleinseite and Hradschin on the left bank. Outside the line of the old walls lie the suburbs Karolinenthal, Smichow, Wyschehrad, Bubna, and others. The Altstadt and Josephstadt lie along the right bank toward the north. The streets of the Altstadt are narrow; it is the principal seat of trade and business, and contains some of the best stores, besides numerous churches, ecclesiastical and educational establishments. The Neustadt encloses the Altstadt on the northeast, east, and southeast. Though newer than the other, it is still very ancient, having been built by the Emperor Charles IV. in 1348. On the opposite side the Kleinseite forms the aristocratic quarter, the chosen abode of the Bohemian nobles, and the site of several remarkable palaces. The Hradschin, to the west and south of the Kleinseite, occupies the side of a steep hill, is of less extent, and contains fewer houses than the other quarters, but the chief public edifices. Among these are the old castle, or palace of the Bohemian kings, situated in the Hradschin; the Gothic cathedral, also in the Hradschin; the Clementinum, the seat of the theological and philosophical faculties of the university and the Carolinum, devoted to the faculties of law and medicine; the Teynkirche, a Gothic church, historically interesting as the place where the Bohemian estates made George Podiebrad their king, and containing the grave of the celebrated astronomer Tycho Brahe, who spent his last years at Prague; the palace of Wallenstein, originally a structure of great magnificence, but now much dilapidated; the Alte Rathaus (old townhall), an irregular Gothic edifice of the 15th century, with a dungeon beneath in which the Emperor Wenceslas IV. was confined for 15 weeks; the chief synagogue of the Jews, probably as ancient in date as the end of the 12th century; the military hospital, a large and magnificent edifice, originally erected by the Jesuits as a college; the theatre, the opera house, the national museum, museum of natural history, picture gallery, the technical high schools, Landesbank (1896), municipal savings bank (1894), central market hall (1896), the new Ritterakademie (1896),

etc. The university, founded in 1348, had 10,000 students at the beginning of the 15th century; but subsequently it had a long period of inactivity. It received a new constitution in 1881, having now two co-ordinate sides or sections, one German and one Czech, with respectively 156 and 140 teachers, and 1,470 and 2,361 students. It possesses a library of 195,000 volumes and 3,800 manuscripts, a fine observatory, museums of zoology and anatomy, a botanical garden, etc. The manufactures consist of gold and silver embroidery, silk, woolen, cotton, and linen goods, buttons, hats, leather, paper, soap, refined sugar, vinegar, liqueurs, refined salt, gloves, sugar of lead, stearine and tallow candles, machines, musical and mathematical instruments, firearms, porcelain, jewelry, etc. The trade is of great importance; Prague, owing to its central position, and to its facilities of transport by river, roads and railway, being the great entrepôt for all the traffic of the kingdom. It has also several important fairs, particularly one for wool, which lasts seven days, and during which a great amount of business is done; that of St. Wenceslas, the old patron saint of Bohemia; and that of St. John Nepomuk, though these two are rather religious festivals than fairs, and are more crowded with devotees than dealers.

Prague is supposed to have been founded in 722 by the Duchess Libussa. In 1348 Charles IV. founded the university, the first which Germany possessed, and it soon acquired such celebrity through the teachings of such zealous rectors as Hüss and Jerome that it was resorted to from all quarters of Europe. In 1424 Prague was taken by the Hussites and almost destroyed, but after their submission to the emperor in 1433 the town was rebuilt. It suffered severely in the Thirty Years' war, and in 1620 a battle was fought at the White Mountain in the neighborhood, in which the Elector-palatine Frederick V. was defeated by the Emperor Ferdinand II., and compelled to renounce his crown. In 1631 the city was captured by the Saxons, who were driven out a few months later by Wallenstein. In 1742 it was taken by the French and Bavarians, and two years later capitulated to Frederick the Great. After the Seven Years' war the city made rapid strides, and enjoyed peace and prosperity until 1848, when the Austrian government caused it to be bombarded for two days, owing to the marked democratic demonstrations excited by the meetings of the Slavonic Congress within its walls. During the Austro-Prussian war in 1866 the city was occupied by the Prussians, and here the treaty of peace was signed on the 23d August. Pop. (1900) 201,589, the majority Czechs.

**Prahran**, prä-rän', Australia, a town in the state of Victoria, four miles southeast of and suburban to Melbourne (q.v.). It is a separate municipality and in 1879 was made a city. Pop. (1901) 41,161.

**Prairie**, a treeless region in the Mississippi Valley, adjacent to the forested area, so called since the time of the early French explorers. The eastern border of the prairie region is an irregular line crossing Minnesota and Wisconsin in a southeasterly direction, and extending into western Indiana, thence crossing Illinois and Missouri southwesterly to the Indian Territory and eastern Texas. From this forest line the prairies extend westward from 200 to 600



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miles to the Great Plains, into which they merge quite imperceptibly. In general we may say that the characteristics of the prairies are intermediate between those of the adjacent forests on the east and the plains on the west. The soil, climate, rainfall, etc., of the prairies are much like those of the western edge of the forests. As we go westward the soil becomes more sandy, the climate more "continental" and the rainfall less, approaching the conditions which prevail on the plains.

The soil of the prairies is usually dark in color and rich in organic matter. It is composed of very fine particles, and when dried after wetting becomes very hard. It contains much finely divided sand, and is generally somewhat deficient in clay. While very rich and often of great depth, it is by no means inexhaustible, and the better classes of farmers have found it profitable to add fertilizers from time to time.

The climate of the prairies is somewhat more severe than that of the adjacent forest areas, on account of the free sweep of the winds which intensify the cold of winter as well as the heat of summer. The annual rainfall is about thirty inches, diminishing somewhat as we go westward, and this is so distributed that by far the greater portion falls in the spring and summer.

Although the prairies are usually spoken of as treeless, this is not strictly true, since the streams are always fringed with trees, the treeless areas extending over the higher lands from stream to stream. Yet since these forest fringes are often confined to the deep narrow valleys in which the streams flow, they are often scarcely noticeable as one looks over the landscape. The vegetation of the prairies naturally divides itself into that of the open country, and that of the woodlands. In the open country the grasses constitute the dominant vegetation, since they are mostly perennial, and very tenacious of life. The species which are most common are grama (*Bouteloua oligostachya*, *B. curtipendula*, *B. hirsuta*), buffalo grass (*Bulbilis dactyloides*), drop-seed grass (*Sporobolus*, of several species), wild June grass (*Koeleria cristata*), blue-stem (*Andropogon*, of several species), switch grass (*Panicum virgatum*), beard-grass (*Aristida*, of several species), Muhlenberg grass (*Muhlenbergia*, of several species), sand-grass (*Calamagrostis*), porcupine-grass (*Stipa spartea*), Eaton grass (*Eatonia*), spear-grasses (*Poa*), fescue grasses (*Festuca*), bromae-grasses (*Bromus*), wheat-grasses (*Agropyrum*), and wild-rye (*Elymus*), each of many species. Altogether about 150 native species of grasses grow upon the prairies, affording fine pasturage and hay for stock. In those portions of the prairies where the rainfall is abundant these grasses constitute a continuous sod which completely covers the surface, but where there is less rain they are in isolated clumps or bunches, and are then called "bunch grasses." In all prairies there are other plants which grow intermingled with the grasses, the most conspicuous of which are the golden-rods (*Solidago rigida*, *S. serotina*, *S. canadensis*, and other species), asters (*Aster patens*, *A. sericeus*, *A. multiflorus*, and other species), sunflowers (*Helianthus annuus*, and other smaller species). A few shrubs are found scattered over the prairies, adding to the variety of the vegetation, most noticeably the wild roses, redroot (*Ceanothus*), and shoe-string (*Amorpha canes-*

*cens*), the last so called on account of its long tough roots which trouble the plowman.

The woodlands are usually found bordering the water courses. In some cases they constitute broad areas extending for many miles on each side of the streams, while in others they are narrow belts but a few rods in width, or even mere fringes along the stream-banks. The trees of the prairies are all of species which have wandered away from the eastern forests, and pushed up the streams to a greater or less distance. There are more species along the eastern side of the prairies, and their number decreases as we go westward. The common species are oaks, hickories, walnuts, willows, cottonwood, elms, maples and ashes. As a rule these trees are not as tall as those which occur in the heavy forests eastward, and they generally grow with more spreading tops. Occasionally, however, trees of gigantic dimensions are found in sheltered situations. Careful observation of the trees on the prairies shows that where they are protected from fires, stock and other adverse influences, they generally reproduce so rapidly as gradually to extend the forest areas. In many places the forest belts along the streams are widening, and also pushing up the valleys. Since the stoppage of prairie fires this natural spreading of the forests has gone on rapidly, so that there is to-day more forest-covered land in some parts of the prairie country than when it was first visited by white men.

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**Prairie Chicken, or Pinnated Grouse**, a familiar western gamebird (*Tympanuchus americanus*). The genus *Tympanuchus* (or *Cupido*) is particularly well characterized by a large patch of naked yellow skin on each side of the neck, ordinarily concealed by a tuft of narrow pointed feathers attached to the skin at its anterior border. Beneath this patch is an air-sac connected with the respiratory system and which can be inflated until the skin is distended to the size and form of half an orange. The head-crest is small, the tail is rather short, rounded and formed of 18 rather stiff quills, and the tarsi are incompletely and lightly feathered to the toes, which are naked and conspicuously webbed at the base. The plumage is plain, the colors being various browns and yellows with white and black, finely mottled above and more boldly barred transversely below. The neck-tufts of the male are 2½ to 3½ inches long, those of the female being considerably shorter. A full-grown male prairie-chicken is fully 18 inches long, but the females are smaller.

The changes in the centre of population of the prairie chicken as related to human settlement of the country are interesting and still in progress. Formerly it ranged throughout all open country between the Appalachian and the Rocky Mountain systems, and from Manitoba to the Gulf coast. As the country has become more thickly populated it has disappeared from many regions and the eastern limit of its range has moved more and more westward. At the same time the clearing of the forests has provided much new open country which it has been prompt to occupy, replacing other species of grouse less adapted to life on bare prairies, and becoming abundant in many places where, as in parts of Minnesota, the land is cultivated in



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large tracts. In this way its range has extended westward and northward as it has been curtailed eastward. Like most of the grouse the prairie chicken is gregarious, living in flocks which become very large in the winter, when the birds show a disposition to wander. Throughout most of its still wide range this species is not in any true sense migratory; but a definite northward and southward movement takes place in the upper part of the central Mississippi Valley, although according to some experienced gunners and ornithologists, this is limited to the females, the males being quite stationary. In the spring parties of the males congregate at dawn on knolls, perform various antics, and from time to time inflate and empty the air-sacs, thus producing a loud booming noise which is said to be audible, in the stillness of the time and place, for a mile. In a few days the females gather, when the cocks engage in fierce battles for the possession of mates, before whom they strut and swell, with drooping wings and spreading tail, with their Cupid's wings elevated and air-sacs inflated almost to bursting, until the conquest is complete. They are monogamous and the nest of grass and weeds is built in a concealed spot on the ground and from 12 to 20 eggs, of a grayish or buff color and either unmarked or speckled with brown, are laid. They are said to hatch in about 25 days and the young, which run at birth, are cared for chiefly by the female which has also performed the labor of incubation. Throughout the summer and early autumn they remain in family parties, but later gather in larger flocks. The food consists of various kinds of berries, nuts, seeds, shoots and buds, and insects. With the development of the prairie region as a great grain-growing country the prairie chicken has come to be especially abundant in the cultivated districts and to adopt wheat and other grains as special articles of diet. The vast numbers of grasshoppers which they destroy should, however, more than compensate the farmer for any loss of grain which he suffers.

The prairie chicken is so prolific, that, in spite of the enormous numbers destroyed annually by cold rains, hawks, skunks and other natural influences, and by man, it has held its own and continues to be abundant in many parts of the grain-producing prairie States. It is therefore of far greater commercial importance than all other species of our native grouse combined, and not only are immense numbers consumed within those States but many thousands are shipped to New York and other eastern markets, where its rich and delicate flesh is in demand for table use. Most States have seen the expediency of establishing close seasons and of prohibiting the use of snares and traps in its capture, so that it is now hunted almost exclusively with the shot-gun. Many States have also prohibited its shipment for sale and have limited the number which a gunner is permitted to shoot in one day, usually to 25 or 50. Naturally it is the great game bird of its range. Its great popularity with the masses, however, is probably due to the size of the bag which results from a day's shooting rather than to its gaming qualities, for in speed and other attributes which test the true metal of the sportsman the prairie chicken cannot compare with the ruffed grouse. Early in the season, when

the young are not yet strong of wing and when better cover and warm weather cause the birds to lie close, bags of 50 or even 100 may be made by a good shot on the best hunting-grounds, but with the advance of the season and cooler weather the birds become more alert, harder and swifter of wing, the long quick shots which are now necessary testing the skill of even the most experienced gunner. Still later nothing but the rifle and much hard tramping is likely to yield any returns. As in the case of all similar gallinaceous birds, a strong shooting gun and good dogs are required. Whether the latter be setter or pointer is generally immaterial, as both may be equal in speed, ruse, and training. For this work on the wide, little watered prairies, endurance is a prime qualification and many hunters use their dogs in relays. The best time for the sport is in the early morning and late afternoon, not only because tramping under the noonday sun is very wearying to hunters and dogs, but also because the birds cease feeding at that time and retire to sheltered gulleys and ravines. The species is easily domesticated.

It is very commonly stated that the prairie chicken was found throughout the New England and Middle States a century ago; but ornithologists are now practically agreed that the eastern heath hen is a distinct species, properly called *T. cupido*. At one time it was common, but became practically extinct 75 years ago. At the present time the only colony known to be in existence is one which inhabits the wooded hills and scrubby plains of the island of Martha's Vineyard, where the birds are seldom seen in the thick coverts which this region affords. In general habits the heath hen differs little from its western relative. This remnant of its race is absolutely protected by the Massachusetts game law and a generally sympathetic local sentiment. A third species (*T. pallidicinctus*) is found in the region from Kansas to Texas, and along the Gulf coast the common prairie chicken develops a distinct local race in Texas and Louisiana. In parts of the Northwest the sharp-tailed grouse (*Pediocetes phasianellus*) (q.v.) is called prairie-chicken. See GROUSE.

Consult: Baird, Brewer and Ridgway, 'Birds of North America' (Boston 1887); Sandys and Van Dyke, 'Upland Game Birds' (New York 1902); Elliot, 'Gallinaceous Game Birds of North America' (New York 1897); Elliot, 'Monograph of the Tetraonidæ' (New York 1872); Palmer and Olds, 'Digest of Game Laws,' Bull. No. 16, Div. Biological Survey, U. S. Dept. of Agriculture, Washington 1902.

**Prairie Dog**, a name given to either of the two species of marmot-like rodents of the western plains of the genus *Cynomys*, but especially to *C. ludovicianus*. It is about a foot long, reddish-brown above, lighter beneath. Its habits are eminently social. It forms large communities on the higher and drier parts of the plains, each burrow having a little hillock at its entrance, forming a firm curb about the shaft, which leads steeply down to a series of chambers a dozen feet or more underground, where the animals spend the winter in comfort, sustained by a store of the stems and seed-heads of sunflowers and similar plants.

These colonies were naturally several acres in extent, forming "towns" of crowded burrows;



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and were frequented by weasels, wolves, badgers, snakes, and birds of prey, which preyed upon the rodents and their young, and kept down their numbers. Since the general settlement of the borders and river-valleys of the plains region, the prairie dogs have been so favored by the decrease of their natural enemies, and by the spread of irrigated cultivated lands, supplying them with both water and food in vast abundance, that they have increased enormously, so that at the opening of the present century areas of thousands of square miles in northern Texas, and in the region between the upper Arkansas and Platte rivers, were so infected with the animals as to be practically useless to man. The question of practical relief from this condition has been a subject of much discussion among naturalists, not only, but both general and local governments have been forced to act in assistance of the farmers and cattlemen. The most successful means of extermination seems to be suffocation in their holes by means of bisulphide of carbon, which is placed upon balls of absorbent material and rolled down their burrows. Consult publications of the United States Department of Agriculture since 1891.

**Prairie du Chien**, Wis., city, county-seat of Crawford County; on the Mississippi River, and on the Chicago, M. & St. P., and the Chicago, B. & Q. R.R.'s; about 90 miles in direct line west of Madison. In the vicinity of the city are mineral springs. Prairie du Chien was settled in 1783, but a French fort was built here in 1689 and abandoned a few years later. Another fort was built in 1755. In 1786 the British surrendered this place to the United States, but captured it again in 1812 and retained possession for four years. In 1872 it was incorporated.

It is the trade centre of a fertile agricultural section. The chief manufactures are pearl buttons, barrels, veneer, egg cases, woolen goods, pickles, dairy products. The trade is chiefly in eggs, poultry, farm and dairy products, buttons and its own manufactures. The principal public buildings are the churches and schools; the ruins of Fort Crawford (1825) still remain. The educational institutions are College of the Sacred Heart, for boys and young men; Saint Mary's Institute, for girls; a high school, public and parish schools, and a public library. Pop. (1890) 3,131; (1900) 3,232. Consult: 'Early Days of Prairie du Chien' in the 'Wisconsin Historical Society Collections,' Vol. V.; Durrie, 'Annals of Prairie du Chien.'

**Prairie Fox**, the swift or kit fox (*Vulpes velox*) of the western American plains. See Fox.

**Prairie Grove, Battle of**, an engagement between the Confederates under Gen. Hindman and the Federals under Gens. F. J. Herron and J. G. Blunt, at Prairie Grove, Ark., 7 Dec. 1862. Blunt had been stationed for some time at Cane Hill, when he received information that Hindman, with a force of over 11,000, was advancing northward to enter Missouri. He immediately summoned Herron and his two divisions, then near Springfield, Mo., to his aid. Herron reached Elkhorn, about 12 miles from Blunt's position, on the evening of 6 December, and the Confederates at that time lay between the two Union camps. Early in the morning

of the 7th Hindman moved against Herron; the Confederate cavalry at first had the advantage, but were in turn driven back by Herron, whose entire force came up; Hindman then took up a strong position and awaited attack. Meantime Blunt hastened to Herron's aid, and Hindman thus faced a force superior to his own in both numbers and equipment. The battle lasted the greater part of the day, and the Confederates were finally forced to retreat. The Confederate loss in killed, wounded, and missing was 1,317; the Federal loss, 1,251. The battle was of importance as checking the further advance of the Confederates into Missouri.

**Prairie Rattlesnake**, the massasauga. See RATTLESNAKE.

**Prairie-squirrel**, or **Gopher**, a name for several animals of the genus *Spermophilus*, found in the American prairies in great numbers. See GOPHER.

**Prairie State**, a name applied to Illinois from the fact that the face of the State is mostly a level table-land, elevated from 300 to 800 feet above the sea.

**Prairie Wolf**, or **Red Wolf**, the coyote (q.v.).

**Prajāpati**, Hindu divinity, having the character of a creator, and in some way identical with Brahma, and with those divine personages who, under Brahma, created all things, including gods and demons. Thus there were many Prajāpatis, and the Puranas contain many legends concerning them. Consult: Hopkins, 'Religions of India' (1895); Macdonell, 'Vedic Mythology' (1897).

**Prājñā Paramitā**, the principal Sutra (body of rules or precepts) of the Mahayana School of Buddhists. The words mean in Sanskrit "absolute or transcendental wisdom." See THEOSOPHY.

**Prakrit**, prā'krīt, a general name applied to the old Hindu vernacular; the word means "of natural origin," "vulgar," in opposition to the classic Sanskrit ("elaborated," "perfect") Prakrit is a daughter dialect of the old Vedic Sanskrit, from which it descends with mutilated forms, corruptions, and new constructions. It bears a different name in each district of India where it is current, such as Maharashtri, Sauraseni, Magadhi, etc. Prakrit was early adopted into written literature and its forms fixed, while in the mouth of the common people it is differentiated into numberless dialects, such as Hindi, Bengali, etc. The main source of our knowledge of Prakrit is to be found in the Indian dramas, where women and people of the lower orders are made to speak Prakrit while kings, Brahmins, etc., use Sanskrit. The great Prakrit poem 'Ravanavâha,' was published by Goldschmidt (1880). Little was known of the Prakrit of Jainism, until Jacobi brought out (1878) 'The Kalpauhas of Bhadrabâhu,' a biography of the founders of that sect. Consult: Lassen, 'Institutiones Linguæ Prakriticæ' (1837); Muller, 'Beiträge zur Grammatik des Dechainaprakrit' (1876); Jacobi, 'Ausgewählte Erzählungen in Maharashtri' (1886).

**Pram**, präm, **Christen Henriksen**, Danish poet and critic: b. Lefta, Norway, 1756; d. island of Saint Thomas, W. I., 1821. He studied at Copenhagen and in 1781, as a member of



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the agricultural and commercial college of Copenhagen, he undertook several tours, the results of which were published in the 'Commercial Journal,' founded by him in 1782. In 1815 he was discharged from his office with small pension, and in 1819 became collector of customs on the island of Saint Thomas. His numerous writings embrace a great variety of subjects, both in political and natural science. Among his poetical productions are 'Heroide an Erich'; and 'Starkodder,' a heroic poem, in 15 cantos. Besides the 'Commercial Journal' he founded another, the 'Minerva,' a critical monthly which rendered essential service in the formation of literary taste in the Scandinavian kingdoms.

**Prang, präng, Louis,** German-American engraver, lithographer, and publisher: b. Breslau, Germany, 12 March 1824. His part in the revolutionary movement of 1848 compelled him to leave Germany and he came to this country in 1850. He established himself as a wood-engraver in Boston, later becoming a lithographer, and in 1861 engaged in publishing, making a specialty of color printing. He invented the Prang method of art instruction and published the drawing books and materials used in that course. He is president of the Prang Educational Company of Boston and of the Taber-Prang Art Company of Springfield, Mass. He is author of 'The Prang Standard of Color' (1898).

**Prase.** See QUARTZ.

**Prater, prä'tër,** the most famous promenade of Vienna. See VIENNA.

**Prati, Giovanni, jō-vän'nē prä'tē,** Italian poet: b. Dasindo, near Trent, 27 Jan. 1815; d. Rome, Italy, 9 May 1884. He wrote 'Edmenegarda' (1841), a narrative poem of the Romantic school, which was received with extraordinary favor. Several volumes of lyric poetry, still further increased the poet's reputation, but during the last years of his life he wrote but little. In 1862 he was elected to the Italian parliament and in 1876 became senator. His works include: 'Satan and the Graces' (1855); 'Count Riga' (1856); 'Rudolf' (1858); 'Ari-ber' (1860); 'Psiche' (1875); 'Iside' (1878); etc.

**Prat'inas,** Greek poet: flourished about 500 B.C. He was a native of Phlius in the Peloponnesus and became famous as a lyrical and dramatic poet. He is credited with originating the satiric drama which he introduced at Athens. Fragments of his lyrical poetry have been collected and published by Bergk in 'Poetæ Lyrici Græci' (1843).

**Prat'incole,** a genus *Glareola* of wading birds of the family *Glareolidæ*, allied to the plovers, inhabiting the temperate and warmer regions of the Old World. About half a dozen species are described in Europe, Asia, Africa, and Australia, frequenting the borders of rivers, lakes, and marshes, in low and in high regions; the food consists of worms and insects, which they pick from the ground or aquatic plants, or take on the wing like swallows; they fly and run very swiftly; the nest is a slight structure on the ground, among the thick herbage of the marshes, and the eggs three or four number. All scream noisily. The collared pratincole (*G. pratincola*, Pall.), plentiful in southern Europe,

is about the size of a blackbird, nine inches long; it is brown above, white on the rump and below; the throat surrounded by a black circle; the base of the bill and the feet reddish.

**Pratique, prä'tëk,** a term used to signify a kind of limited quarantine, which the captain of a vessel is held to have performed when he has convinced the authorities of the port that his ship is free from infectious diseases. See QUARANTINE.

**Prato, prä'tō,** Italy, city in the province of Florence; on the Bisenzio; 11 miles northwest of Florence. It is surrounded by ancient walls and is a well-built, cheerful-looking place. It has a court of justice, cathedral, begun by Nicolo Pisano, and completed after his designs in 1450 with a façade, furnishing a beautiful specimen of Italian Gothic; several other churches, monasteries, convents, an old castle, an ancient prætorium (Palazzo Pretorio), now a prison; a college, called after its founder Cicognini, a public library containing nearly 30,000 volumes, a theatre, and several hospitals; and extensive manufactures of woolen, cotton, silk, straw hats, paper, and articles in brass. Pop. commune (1881) 42,190; (1901) 51,453.

**Prætorius, prä-tō'rē-üs, Michael,** German composer: b. Kreuzberg, Thuringia, 15 Feb. 1571; d. Wolfenbüttel 15 Feb. 1621. Details concerning his life are of the briefest description. He began his career as kapell-meister at Lüneberg, was secretary to the Duke of Brunswick, and later was appointed prior of the monastery of Ringelheim, near Gozlar, with the privilege of making his residence where he chose. He was one of the most prominent composers of his time and also an able writer on musical topics. His most noted literary work is 'Syntagma Musicum' (1614-20), and his compositions include: 'Musæ Sionix' (published in nine parts, containing 1,244 vocal numbers); 'Missodia Sionia' (1611); 'Terpsichore' (1612); 'Puericinium' (1621); etc.

**Pratt, prä't, Anne,** English botanist: b. Strood, England, 1806; d. 27 July 1893. She made a life-study of the nature of plants and her writings reveal a wide knowledge as well as a deep love of nature. Her books are illustrated with her own excellent sketches and achieved great popularity. Among them are 'Flowers and their Associations' (new ed. 1840); 'Chapters on Common Things of the Seaside' (1850); 'Our Native Songsters' (1852); 'Flowering Plants, Grasses, and Ferns of Great Britain' (1854); 'Haunts of the Wild Flowers' (1863).

**Pratt, Charles,** American philanthropist: b. Watertown, Mass., 2 Oct. 1830; d. New York 4 May 1891. He obtained a portion of his education at Wesleyan Academy, Wilbraham, Mass., and in 1851 removed to New York where he engaged with a paint, oil, and glass firm of which he became a member in 1854. When the firm dissolved in 1867 he retained the oil interests and under the firm name Charles Pratt and Company organized a most successful business. He grasped the possibilities of the petroleum trade when the oil fields of Philadelphia were being developed in 1860 and devoted himself to producing the best quality of refined petroleum on the market, Pratt's astral oil becoming world-famous. He acquired an enormous for-



## PRATT — PRATT INSTITUTE

tune and his business was eventually merged in the Standard Oil Company. He afterward devoted himself to philanthropic enterprises and contributed generously to various religious, charitable, and educational causes. His greatest philanthropic work was the founding of the famous Pratt Institute in 1886 in which he embodied his ideas of a thorough and practical education. It was opened in 1887 with 12 students, a number which at the time of his death had increased to over 3,000. The entire cost of the buildings, equipment, grounds and ample endowment was borne by Mr. Pratt and at his death left a further endowment of \$2,000,000. He was public-spirited in every way but firmly declined public office.

**Pratt, Daniel**, the "Great American Traveler," American eccentric: b. Prattville, Chelsea, Mass., about 1809; d. Boston, Mass., 21 June 1887. He was a carpenter by trade, but became mentally unbalanced, and wandered about, a pensioner on general charity. Contributions of his, including certain "proclamations," appeared from time to time in print; and for several years he made a grand tour of New England colleges, delivering in each grandiloquent orations. He believed himself unjustly deprived of the presidency, asserting he had been duly elected.

**Pratt, Ella Farman**, American writer for young people: b. New York; d. Warner, N. H., 22 May 1907. With C. S. Pratt, for a series of years she edited the juvenile periodical 'Wide Awake,' and, more recently, 'Little Folks.' Among her books, many of which were published under her maiden name, are 'Good-for-Nothing Polly'; 'How Two Girls Tried Farming'; 'A Girl's Money'; 'The Cooking Club of Tu-Whit Hollow.'

**Pratt, Enoch**, American philanthropist: b. North Middleborough, Mass., 10 Sept. 1808; d. near Baltimore, Md., 17 Sept. 1896. He was educated at the Bridgewater (Mass.) Academy, entered a commercial house in Boston, and in 1831 removed to Baltimore where he became a wholesale iron merchant and engaged in various financial enterprises which gained for him enormous wealth. He presented to the city of Baltimore in 1882 the Pratt Free Library; gave generously to different churches, libraries, and schools, and founded the House of Reformation and Instruction for Colored Children at Cheltenham, Md., and the Maryland School for the Deaf and Dumb at Frederick.

**Pratt, John Francis**, American scientist: b. Pomfret, Vt., 18 June 1848. He was graduated from Dartmouth College in 1871; studied civil engineering and in 1871 became connected with the United States Coast and Geodetic Survey, being made an assistant in 1884. He led the expedition to Chilcoot, Chilkat, Skagway, and Dyea to determine the southeast boundary of Alaska; conducted an expedition to the east side of Bering Sea and the lower portion of the Yukon River in 1898, and since 1899 has commanded the United States steamship Patterson. He has conducted various expeditions to Alaska and Bering Sea.

**Pratt, Orson**, American Mormon apostle: b. Hartford, N. Y., 19 Sept. 1811; d. Salt Lake City, Utah, 3 Oct. 1881. After a common-school education, he joined the Mormons in 1830, ac-

companied them in the westward migration, and in 1835 became one of the 12 apostles. With Erastus Snow, he was the first to enter the valley of the Great Salt Lake. In 1840-78 he accomplished eight missions to Great Britain, and in 1865 one to Austria. He began in Washington in 1852 the publication of 'The Seer,' a monthly, of which 18 numbers appeared. He was for many sessions a member of the Utah territorial legislature, and seven times its speaker. A scholar in the higher mathematics, he held the chair of that subject for a time in Deseret University, and in 1854 announced his "law of planetary rotation"—that the cubic roots of the densities of the planets are as the square roots of their periods of rotation. Among his works are: 'Cubic and Biquadratic Equations' (1866); 'Key to the Universe' (1879); and 'The Absurdities of Immaterialism.'

**Pratt, Parley Parker**, American Mormon apostle: b. Burlington, N. Y., 12 April 1807; d. near Van Buren, Ark., 13 May 1857. He adopted the Mormon faith in 1830 and in 1835 was elected a member of the first quorum of the 12 apostles. He traveled in this country and in England engaged in missionary work, and established at Manchester, England, the 'Millennial Star.' He was one of the party which explored the valley of the Great Salt Lake in 1847 and 1849, and Parley's Peak and Parley's Cañon were named in his honor. He afterward made a proselyting tour to the Pacific coast and while occupied in a similar tour in the east was murdered near Van Buren, Ark. He wrote: 'The Voice of Warning' (1837); 'History of the Persecutions in Missouri' (1839); 'Key to the Science of Theology' (1854); etc.

**Pratt, Samuel Jackson** ("COURTNEY MELMOTH"), English author: b. St. Ives, Cornwall, 25 Dec. 1749; d. Birmingham 4 Oct. 1814. He was ordained in the English Church, but later went on the stage where his career was not notable and then turned his attention to literature. He translated Goethe's 'Sorrows of Werther' (1813), and wrote among many other works: 'Tears of Genius' (1774); 'Liberal Opinion' (1775); 'Apology for David Hume' (1777); 'Gleanings through Wales, Holland' (1795); 'The Fair Circassian,' a tragedy; 'Cabinet of Poetry' (1808); etc.

**Pratt, Silas Gamaliel**, American composer: b. Addison, Vt., 4 Aug. 1846. He studied in Berlin in 1868-71, and upon his return to America gave his first symphony concert in 1871 and in the following year organized the Apollo Club of Chicago. His opera 'Zenobia' was well received on its presentation in 1882 and in 1884 he was director-general of the Chicago Grand Opera Festival. In 1890 he accepted an appointment as professor of piano at the New York Metropolitan Conservatory. He has published numerous songs, part-songs, symphonies, etc., besides the operas: 'The Triumph of Columbus,' and 'Lucille.' He has also written: 'Lincoln in Story' (1901); and 'Pianist's Mental Velocity' (1903).

**Pratt Institute**, a polytechnic school in Brooklyn, N. Y., established in 1887 by Charles Pratt. Its aim is to promote manual and industrial education as well as cultivation in literature, science, and art. Its organization includes the



## PRATZ — PRAXITELES

following departments: (1) The High School; (2) the Department of Fine Arts; (3) the Department of Domestic Art, including courses in dressmaking, millinery, art needlework and costume design; (4) the Department of Domestic Science, including courses in cookery, serving, and laundry work; (5) the Department of Science and Technology; (6) the Department of Kindergartens; (7) the Department of Libraries, including the library and the library school; (8) the Department of Physical Training. The High School course includes physical and manual training, and prepares for college. The regular courses of the Institute vary in length; mostly they are two or three years in length; the general course in domestic science is only one year, and the general art course four years. Normal courses are given in the departments of Fine Arts, Domestic Art and Domestic Science; evening classes, in the departments of Fine Arts, Domestic Art, Domestic Science, and Science and Technology. The Kindergarten Department provides kindergarten training for children from three to six years old, and also a two years' normal course, and a course for mothers. The library is open for the free use of the public, has a large children's room, and in equipment and management is considered a model library. It contained 76,685 volumes in 1904. The library school offers a one-year general course and a second-year special course, and provides practice work for students in the library (see LIBRARY SCHOOLS). The institute confers no degrees, but grants diplomas for the completion of the high school course and any of the normal courses; and gives certificates attesting the completion of the full-time day courses. It occupies seven buildings (1904), the Main Building, the Science and Technology Building, the Electrical Building, the High School, the Kindergarten Building, the Library, and the Gymnasium. The endowment is large and the tuition fees are small; in 1903-4 the productive funds amounted to \$2,214,328. The students of that year in the regular day courses numbered 1,196, and the students in regular, special and evening courses 3,485.

**Pratz, Le Page du**, lè pāzh dü prāts, French explorer in the New World: b. Holland about 1690; d. 1775. Entering the French army and serving in Germany for a time he was subsequently a member of the French Compagnie d'Occident which acquired a grant of territory near New Orleans, La. Du Pratz led an expedition there in 1718 and made unsuccessful attempts to found a colony. In 1720 he went up the Mississippi and settled among the Natchez Indians. Later he explored the region bordering the Mississippi and Arkansas and was for some years treasurer of the land company at New Orleans. He returned to France in 1734 and his valuable 'History of Louisiana' was printed in 1758.

**Prawn**, a small decapod crustacean of the family *Palæmonidæ*, allied to the shrimps, in which the beak or "rostrum," which projects in front of the carapace, is large, toothed, and of compressed shape. The common British prawn (*Palæmon serratus*) is three to five inches long, shrimp-like in form, half-transparent and often beautifully tinted, and is taken for market in great quantities by means of nets operated on sandy shores. When boiled, prawns become of a

pale pink color, and are highly esteemed as table delicacies in this and in other shapes. Several species occur on the eastern coast of the United States, but are little used.

**Prax'eas**, a teacher of the errors of the Antitrinitarians or Monarchians. Toward the end of the second century, after suffering persecution in the reign of Marcus Aurelius for his open confession of the Christian faith, he came to Rome from his native Phrygia to acquaint Pope Victor with the erroneous teachings and vicious practices of the Montanists, and prevailed upon Victor to recall the letters of communion which he had given to those sectaries. But while at Rome and afterward in Africa he became an apostle of the doctrine of the Monarchians, teaching that in the Godhead is but one Person, who proceeding forth of his own divine essence and called Son, entered the Virgin's womb, was born of her and suffered on the cross: hence the distinctive name of the sectaries who followed Praxeas — Patripassians.

**Praxiteles**, prāks-īt'ē-lēz, Greek sculptor: b. probably about 400 B.C. He was the contemporary of Scopas, and one of the greatest sculptors of ancient times. The date of his death is unknown; but his life must have been long since nearly three score works are mentioned as executed by him. He lived in the age of greatest opulence in Greek art, an age succeeding that of Phidias and one which had outgrown the austere vigor displayed in the works of the earlier master. During the time of Praxiteles the life of the individual was less merged in that of the body politic, and became more highly developed. This fact consequent upon the growth of wealth in private possession made the work of the sculptor in demand for the adornment of private houses instead of temples of worship. Praxiteles worked for private buyers, and many of his statues went to Asia Minor as well as Greece. Antiquity placed the highest estimate upon his statue of Aphrodite, and people traveled in large numbers to Cnidus to see it. Lucian records seeing it there about 150 A.D. The statue has disappeared, but an idea of its form may be derived from a Cnidian coin, bearing its effigy, struck in honor of Plautilla. The greatest of his extant works is the statue of the youthful Hermes bearing on his arm the infant Dionysus. This statue, described by Pausanias, was discovered by German excavators, at Olympia, where it now remains. The face, which is perfectly preserved, gives to posterity a revelation of the exquisite beauty of the Greek face. The mutilated statue of Demeter from Cnidus, now preserved in the British Museum, is probably by Praxiteles; but the Hermes is the only unquestionable one. Pausanias records that Praxiteles regarded his statue of Eros and one of a satyr as his greatest works. This Eros was presented to Phryne, the courtesan, who posed for the Cnidian Venus, and was afterward placed in the temple at Thespiae. There was another Eros at Parium on the Hellespont. The Satyr, represented leaning gracefully with his arm on a support, is preserved in reproduction in the Capitoline Museum at Rome, and furnished Hawthorne with his inspiration for his romance, 'The Marble Faun.' The 'Apollo Sauroktonos' (Lizard-Killer), a motive original with Praxiteles, is also known to



## PRAYA—PRE-CAMBRIAN FORMATIONS

posterity in reproductions in the Louvre and elsewhere. Praxiteles produced in addition to statues portrait busts and genre-scenes, the latter being in the form of sculptured reliefs upon tombs was a special product of the art of his age. His work, which exercised a great influence upon the further development of Greek art, charms by its perfection of grace, and its refined and noble expression of human emotions. Consult: Kekulé, 'Der Kopf des Praxitelischen Hermes' (1881); Klein, 'Praxiteles' (1898).

**Praya**, prä'yä, or **La Praya**, Cape Verde Islands, capital of the group of Portuguese islands; on the southeast coast of the island of Santiago. It has a good harbor and commercial relations with all the cities of the island. Pop. (1903) estimated, 5,000.

**Prayer**, a human address made with the expectation of its being heard and answered to an invisible and omnipotent Supreme Being. In every time and place men have felt their dependence on a higher Being, and have sought his assistance in prayer.

The Scriptures tacitly assume that prayer was offered to God from the beginning of the world; there were sacrifices from the time of Abel, and where there were sacrifices there must also have been sacrificial prayers. It is not, however, until the time of Abraham that prayer first comes distinctly into notice. His devout faith prompted him to build an altar wherever he remained, and to call upon God. He was doubtless a priest within his own family and household, and they participated in his services and obtained the benefit of his intercessions. As the altar appears to have been considered the special place for prayer in the patriarchal age, so was the tabernacle under the Mosaic covenant until the temple was built, which was called the house of prayer. From the time of the dedication of Solomon's temple the Jews appear to have gone there to pray, and to have turned their faces toward it if they were prevented from going there; and this custom prevails among the Jews at the present time, as does the similar custom among the Mohammedans, who turn their faces toward the sacred Kaaba at Mecca. On examining the character of the prayers mentioned in the Old Testament we find that, with the exception of many of the Psalms, they were principally petitions for temporal objects. This is suited to the purposes for which the historical books of the Jewish Scripture were written, as the Mosaic covenant pledged God to confer temporal benefits on his people when they called upon him. We find also that a great number of them are intercessory; thus we have Abraham interceding for Lot, Moses for the people, Samuel for the people and for Saul, David for his nation, Elisha for the dead child, and so on. When we come to New Testament times we meet for the first time with synagogues established as places for the public worship of God, and for reading his word. The leaders in religion—the priests, scribes, and Pharisees—were no longer the faithful servants of God they once were. Christ announced toward the close of his ministry that prayer should be offered to God in his name in order to insure an answer. The posture of the body in prayer is left undecided in Scripture; both standing and kneeling are mentioned, and Christ adopted both postures.

By giving his disciples a form of prayer Christ implied that there are times when these are useful.

Prayer for the dead prevails in the Roman Catholic, Greek, and other Eastern churches. The custom seems to have existed in most of the ancient religions, especially in those of India, China, and Egypt. The doctrine and practice came to the Christian Church through the Jews (2 Maccabees xii. 43, 45). The first of the Christian fathers who mentions prayer for the dead is Tertullian; but he speaks of the usage as well-known and long-established in the church; such prayers are frequently alluded to by St. John Chrysostom, Cyril of Jerusalem, and St. Augustine. In the burial service of the first Book of Common Prayer of the English Church some prayers for the dead appeared, but they were deleted from the second book, and are not found in the subsequent revisions.

**Prayer Beads**, the polished seeds of a West Indian leguminous plant (*Abrus precatorius*) called wild licorice. These seeds were formerly much used for stringing into rosaries, necklaces, etc.

**Prayer Book**, the Anglican Book of Common Prayer. See COMMON PRAYER, BOOK OF; BREVIARY.

**Prayer Book, Common**. See COMMON PRAYER, BOOK OF.

**Prayer, Week of**, a special period of devotion set apart for the first time by the Presbyterian missionaries of Lodiana, India. A call to a universal observance of this week was issued by the missionaries late in 1859, and the appeal met with a hearty response in January 1860; since which time the week of prayer has become a settled institution among Protestants.

**Praying Indians, The**, in American colonial history, the name given those New England Indians who were early won to the Christian faith. During Philip's war they remained friendly to the colonists, a company of them enlisting under Major Gookin in July 1675. They acted as scouts and spies and rendered valuable service against Philip.

**Praying Insects**. See MANTIS.

**Pre-Ad'amites**, those supposed inhabitants of the earth prior to the creation of Adam. The legendary traditions of the East speak of nations and empires existing before Adam's creation, and of a line of kings who ruled over them. In modern times the subject was taken up by Isaac de la Peyrère, who, in a work published in 1655, maintained that the Jews were the descendants of Adam, and the Gentiles those of a long anterior creation, founding his opinions on Genesis iv. 14, 17; and Romans v. 12-14.

**Pre-Cam'brian Formations**. Those geological formations included in the systems below the Cambrian are sometimes grouped under this name. In America they include the earliest formations, namely, those of the Archæan Period (q.v.), and those immediately succeeding them, namely, those belonging to the Algonkian System (q.v.). According to the earlier, European, nomenclature all the Pre-Cambrian formations fell within the Archæan Period, their lower series being called the Laurentian and the higher the Huronian. The latter practically correspond to the Algonkian.



## PRE-EMPTION LAW—PRE-RAPHAELITES

The time occupied by the deposition of the Pre-Cambrian formations extended from the solidifying of the crust of the earth to the beginning of the Cambrian Period (q.v.) and as the first traces of life are found in these formations, and as they already show in the variety of their types evidences of long development, the length of time that elapsed during the building up of these formations must have been very great. See GEOLOGY; CAMBRIAN SYSTEM.

**Pre-emption Law, United States.** The first pre-emption act was passed 3 March 1801; it was a special act affecting the Symmes colonization scheme on the Miami River. Between that time and 1841 about 18 pre-emption acts were passed, all of a more or less special nature. The first general law was passed in 1830. That of 1841, which is now in force, grants, upon considerations of residence and improvement, freedom of entry upon 160 acres of public lands to any person over 21 years of age. One to three years are allowed for payment, and the amount varies with the value and situation of the tract pre-empted.

**Pre-existence**, the doctrine that the soul of an individual had an existence previous to that of the body in which it appears. This opinion was very prevalent in the East, and was held by the Greek philosophers, Pythagoras, Empedocles, and Plato himself. A similar doctrine has found some countenance in Christian times among those who were anxious to explain how the soul becomes united to the body, but could not divine any more plausible hypothesis than that all souls were created before the world, and that each has its proper body allotted to it at the time of birth. In opposition to doctrine of pre-existence is that of traducianism, which teaches that the soul, like the body, is propagated; and creationism, in accordance with which a new soul is immediately created out of nothing by God for each newly propagated body.

**Pre-Raphaelites**, members of the "Pre-Raphaelite Brotherhood" and their followers. The original brotherhood was founded by the association of three painters, Dante Gabriel Rossetti, William Holman Hunt and John Everett Millais. The inspiration, however, which gave life to the Pre-Raphaelites was derived from an artist who never joined the brotherhood, Ford Maddox Brown. In 1848 Rossetti became the pupil of Maddox Brown, a great and original artist whose work was quite neglected at a period when Victorian art in England had sunk to its lowest condition of commonplace prettiness, conventionality and utter want of mysticism or spirituality. Maddox Brown, the practical originator of the new school of English painting, and the bringer-in of a new English Renaissance, had attracted the notice of Rossetti by his powerful picture, 'Parisina's Sleep,' which was exhibited at the British Institution 1845 and was conspicuous for marvelous atmosphere, finish and fidelity of expression. Rossetti became the devoted disciple of this master. Rossetti was a poet, full of dreams and desires, and passionately striving after the true and the beautiful. At the academy schools he met William Holman Hunt, a man of profound religious feeling, yet reserved, hard working and bound on notable and original achievement in art. With them was eventually associated John Everett Millais, already a brilliant and successful artist, and far in advance of his confrères of

equal age in all the skill that comes from knowledge and practice. These men, strangely different in artistic temperament, formed a powerful trio devoted to making a fearless protest against the shallow and insincere banalities of the day. They called themselves Pre-Raphaelites; but, as Holman Hunt has said, "Neither then nor afterward did they affirm there was not much healthy and good art after the time of Raphael; but it appeared to them that afterward art was so frequently tainted with the canker of corruption that it was only in the earlier work they could find with certainty absolute health. Up to a certain point the tree was healthy: above it, disease began; side by side with life, there was death." Their artistic doctrines were indeed to be summed up in the one word *sincerity*; the bond of union between them, as enunciated by one of their number was (1) to have clear ideas to express; (2) to study Nature attentively, so as to know how to express them; (3) to sympathize with what is direct and serious and heartfelt in previous art, to the exclusion of what is conventional and self-parading and learned by rote; and (4) most indispensable of all, to produce thoroughly good pictures and statues.

The three founders of the association which Maddox Brown had originated were subsequently joined by Thomas Woolner, sculptor; James Collinson, painter, who eventually left the brotherhood; Walter Howell Deverell, painter; Frederick George Stevens, painter; and William Michael Rossetti, younger brother of Dante Rossetti, and like the latter, a poet. Maddox Brown declined to join simply because he disliked coteries, and it certainly was not he who gave the doctrine its name of Pre-Raphaelism. But, as his own work was an embodiment of this artistic creed, so his association with the members of it was always close and his sympathy with their work enthusiastic. Millais remained in the brotherhood 10 years (1849-59); he then dropped out, became a fashionable portrait painter and famous for his power in painting children, and such textures as satin and velvet. Holman Hunt kept on an uncompromising adherent to the principles of the brotherhood. But before the work the Pre-Raphaelites had to do was accomplished, they were compelled to run the gauntlet of criticism and ridicule from those whose system and method of painting they were attacking. In the *Times* of 5 May 1854 a letter appeared signed by John Ruskin, boldly praising and defending the new school. It is doubtful, however, whether Ruskin understood the principle of Pre-Raphaelism, and it is a mistake to think that his writings gave the first suggestion for the formation of such a league.

Pre-Raphaelism has become a permanent influence in English art. The generation of English artists which succeeded that in which Maddox Brown lived have followed the guidance of the Pre-Raphaelites, either as to romantic motif, mystic religiousness, or drawing and technique; sometimes in all of these. In certain quarters, however, there has appeared a tendency in a somewhat perverted manner to carry out the traditions of the brotherhood, by an exaggerated mediævalism, a deliberate crudeness or grotesqueness of design, and an insistence on minute detail. Consult: Bate, 'The English Pre-Raphaelite Painters' (1901); Quilter, 'Preferences in Art Life and Literature' (1892).



## PREACHERS — PRECEDENCE

**Preachers, Orders of.** See DOMINICANS.

**Preaching Friars.** See DOMINICANS.

**Préault**, prā-ō, **Auguste**, French sculptor: b. Paris 8 Oct. 1809; d. there 11 Jan. 1879. He began his art studies with a decided tendency toward romanticism and entered the studio of David d'Angers, but soon left it and ever afterward aimed at a naturalistic treatment of art themes. This was proved by the first works he exhibited at the Salon (1833)—'Misery,' a group representing a girl dying in the arms of her mother; and two reliefs, 'Death of the Poet Gilbert in Hospital' and 'Famine.' In the following years he exhibited numerous works, among them the statue 'Undine'; and the relief 'River Amazon'; 'Queen of Sheba'; a sitting figure of Hecuba; the colossal statue 'Charlemagne'; and the statue 'Carthage.' These works were not admitted to the Salon, but in 1848 the opinion of his merits had changed and the doors of the exhibition in the Champs Elysées were opened to him, and he was represented there by his 'Christ on the Cross' (now in the Church of Saint Gervasius); the relief 'Ophelia'; the sepulchral monument of Saint Roque (in the church of that dedication); the statue of 'General Marceau' at Chartres (1850); and the statuette 'French Comedy.' As a sculptor his workmanship was fine, but he sometimes failed to control his fancy and strong feeling for realistic form within that reserve and restraint prescribed by the canons of strictly plastic art.

**Preb'end**, a stipend paid to an ecclesiastic from the foundation funds of a cathedral or collegiate church. Prebendary is the person who holds a prebend. A simple prebend has no more than the revenue which is assigned for its support; but if the prebend has a jurisdiction annexed, the prebendary is styled a dignitary. Prebendaries, as such, have no cure of souls; and therefore a prebend and a parochial benefice are not incompatible promotions. The prebendal stall is the seat of the prebendary in the church, into which he is inducted by the dean and chapter.

**Preble**, prēb'l, **Edward**, American naval officer: b. Portland, Maine, 15 Aug. 1761; d. there 25 Aug. 1807. When 17 he ran away from home and joined a privateer, and on his return entered the Massachusetts State marine as midshipman on the Protector and participated in the attack on the British privateer Admiral Duff which was destroyed. In 1779 he was captured on board the Protector and imprisoned on the Jersey prison-ship in New York harbor. Upon his release he served on the Winthrop and with 14 men boarded an armed British brig and took her out of Penobscot harbor in the face of the enemy's battery. On the organization of the United States navy in 1798 he was one of the first five to be commissioned lieutenant, and in 1799 was promoted captain in command of the Essex with which he convoyed a fleet of 14 valuably laden merchantmen to China. In 1803 he was assigned to the Constitution and given command of the squadron against the Barbary powers. He arrived at Tangiers in October 1803 and speedily forced from the Sultan of Morocco a renewal of the treaty of 1786. The Philadelphia of his squadron was captured while pursuing Tripolitan gunboats and Preble blockaded Tripoli for several months endeavoring to regain or destroy the ship. In July 1804 he

bombarded Tripoli and subsequently conducted six vigorous attacks in which he captured three gunboats and sunk three others. In September the relief squadron under Preble's senior officer, Captain Barron, arrived and Preble was relieved. The treaty was signed in 1805 without further fighting and Preble received a gold medal and the thanks of Congress.

**Preble**, **George Henry**, American naval officer: nephew of Edward Preble (q.v.), b. Portland, Maine, 25 Feb. 1816; d. Boston, Mass., 1 March 1885. He entered the navy as midshipman in 1835, served in the Mediterranean on the frigate United States in 1836-8, was engaged in the war against the Seminoles in 1841-2, and in 1843-5 circumnavigated the world on the Saint Louis, attaining the distinction of landing the first American force in China. In the Mexican War he participated in the battles of Alvarado, Vera Cruz, and Tuxpan; in 1848 was promoted lieutenant and in 1854-5 was engaged in several actions with Chinese pirates. In 1862 he commanded the steamer Katahdin under Farragut at the capture of New Orleans, was commissioned commander in that year and for failure to capture the Confederate cruiser Florida was dismissed from the navy. Investigation proved him blameless, however, and he was restored to his rank, placed in command of the Saint Louis with which he engaged in pursuing Confederate rovers in foreign waters. He was commissioned commodore in 1871, and in 1873-5 had charge of the navy-yard at Philadelphia. In 1876 he received rank as rear-admiral, was in command of the South Pacific station in 1877-8, and in 1878 was retired. He wrote: 'Chase of the Rebel Steamer of War Oreto' (1862); 'History of the American Flag' (1872); 'History of Steam Navigation' (1883); etc.

**Prece'dence**, in official life, the order in which men and women follow each other according to rank or dignity in a State procession or on other public occasions. In England the order of precedence depends partly on statutes, and partly on ancient usage and established custom. Questions arising on matters of precedence depending on usage are hardly considered as definitely settled, and are in a great measure left to the discretion of the officers of arms. The sovereign, of course, is always first in order of precedence, after whom in descending order follow the Prince of Wales, sons of the sovereign, grandsons of the sovereign, brothers of the sovereign, uncles of the sovereign, the sovereign's brothers' or sisters' sons, the Archbishop of Canterbury, the Lord High Chancellor, and so on through the high state dignitaries, the various ranks of the peerage, etc. The order of precedence among women follows the same rules as that among men. By the acts of Union of Scotland and Ireland the precedence in any given degree of the peerage has been established as follows: (1) Peers of England; (2) Peers of Scotland; (3) Peers of Great Britain; (4) Peers of Ireland; (5) Peers of the United Kingdom and Peers of Ireland created subsequent to the Union.

In the United States the most generally accepted order in Washington official life is as follows:

The President,  
The Vice-President,  
President of the Senate,  
Foreign Ambassadors,



PRECENTOR — PREDESTINATION

Chief Justice of the Supreme Court,  
United States Senators,  
Speaker of the House,  
Representatives in Congress,  
Associate Justices,  
Secretary of State,  
Diplomatic Corps (other than ambassadors),  
Secretary of the Treasury,  
Secretary of War,  
The Attorney-General,  
The Postmaster-General,  
Secretary of the Navy,  
Secretary of the Interior,  
Secretary of Agriculture,  
Secretary of Commerce and Labor,  
General Staff of the Army,  
Admirals of the Navy,  
Governors of States.

Then follow the judiciary, army and navy officers, chiefs of departments, foreign consuls, secretaries of legations, etc.

**Precentor** (Latin, *præ*, before; *canere*, to sing), a leader of singing. In cathedrals of ancient foundation of the Established Church of England the precentor is a member of the chapter, and in dignity ranks next after the dean; in cathedrals of the new foundation, that is, those of sees created by Henry VIII. or formed in later times, the precentor is only a minor canon and is removable at the pleasure of the dean and chapter. During solemn functions the precentor's place is on the north side of the chancel, while that of the dean is on the south side. In the Presbyterian churches of Scotland it was formerly the custom that half an hour before the arrival of the minister, the precentor would read to the congregation lessons from the Scripture; when the minister entered, the precentor would give out a psalm and lead the singing; hence his desk, below the pulpit, is still called lectern, or in Scotch dialect *lettran*, that is, reading-desk. In the rural districts of Scotland it is still customary for the precentor to read each verse of a psalm before it is sung.

**Precession of the Equinox.** See EQUINOX.

**Précieuses Ridicules, Les**, *lā prā-sē-ē rē-dē-kül*, a comedy by Molière, produced for the first time 18 Nov. 1659. No one of Molière's comedies is better known than this famous satire on the 'Précieuses,' which can almost be entitled a farce, being an exaggeration of an exaggeration. It is in one act, and is a satire on a style of speech, and an affected taste in art and literature, prevalent among a certain class at that time. When writing it, Molière had in mind the literary lights who assembled at the Hôtel de Rambouillet.

**Precious Metals**, gold and silver are commonly included under this term, though platinum and quicksilver have sometimes been added. However, on the basis of their having sufficient value and being abundant enough for coinage, gold and silver are more accurately described as precious metals. America has contributed largely to the total amount of the precious metals in circulation in the world. The subjoined table exhibits some interesting com-

parisons in the production of precious metals by the United States and by Mexico and Australasia, the three countries which rank highest in annual total production of these metals according to their monetary value.

Fine ounce of gold, \$20.671834 +; fine ounce of silver, \$1.292929 +, coining rate in United States silver dollars.

The United States, therefore, while slightly surpassed in the amount of gold produced, by Australasia, and in silver by Mexico, far surpassed every other country in the total value of precious metals produced in 1902.

The total amount of precious metals for 1902 was for the world, 130,942,660 ounces fine; Mexico, 60,667,760 ounces fine; United States, 59,370,000 ounces fine; Australasia, 11,972,411 ounces fine.

**Precious Star, Order of.** See ORDERS, ROYAL.

**Precious Stones.** See GEMS.

**Precipitate**, in chemistry, a solid body produced by the mutual action of two or more liquids. Thus if sulphuric acid be added to an aqueous solution of barium chloride, barium sulphate is produced, and being insoluble in the menstrua present it precipitates or sinks as a solid to the bottom of the liquid in the vessel. So again, if a solution of potassium iodide be added to a solution of lead chloride, a reaction takes place resulting in the formation of lead iodide and potassium chloride, and inasmuch as the former of these bodies is, under the circumstances, a solid, it is precipitated. As a general rule it may be laid down that if it is possible to produce a solid substance by the action of two liquids on one another, that solid will be produced when these liquids are mixed, and that therefore a precipitate will be formed.

**Predestinarians.** See RELIGIOUS SECTS.

**Predestination** is the doctrine of God's will and counsel as revealed in the decreed redemption of mankind. It includes in its scope two significant facts, namely, his beneficent and all-wise purpose and plan in reference to those who are fore-known and fore-chosen to the enjoyment of eternal salvation; and his fixed, determinate attitude toward those who are permitted to perish in their sins. This doctrine, as thus defined, has been the subject of intense theological controversy, because of the many essential and apparently contradictory personal features involved in it. And yet its history, as it appears in the rise and development of Calvinism over against Pelagianism gives evidence of the logical connection which it has with biblical and metaphysical truth.

The sources of this tenet are set forth in the Old and New Testament Scriptures. From the earliest times of the human race, the God who "upholds, directs, disposes, and governs all creatures, actions, and things, from the greatest

PRODUCTION OF GOLD AND SILVER IN 1902.

	Gold		Silver		Total Value of Precious Metals
	Oz., fine	Value	Oz., fine	Coining Value	
United States.....	3,870,000	\$ 80,006,000	55,500,000	\$ 71,757,600	\$151,763,600
Australasia.....	3,946,374	81,578,800	8,026,037	10,377,100	91,955,900
Mexico .....	491,156	10,153,100	60,176,604	77,804,100	87,957,200
The World .....	14,290,590	295,412,700	116,652,070	215,469,200	510,881,900



## PREDESTINATION

even to the least," is manifestly a potent personal factor in the world. His wisdom and might, his love and grace, are wondrously and sublimely illustrated in the lives and movements of his chosen people. Every stage of their history, in the genesis and growth of their civil and religious institutions, to the closing tragedy of the life of Jesus Christ, furnishes a series of pictures of the divine method of government, as they are painted by his artist hand. Indeed, so evident is his own mind and purpose throughout the execution of his salvatory plan, that his nature, life, and love at once and forever become inseparable elements within the domain of the human universe. And this is fully indicated (1) by the perfection of his nature; (2) in the marks of his infinite wisdom, power, holiness, etc.; (3) in the operations of his will, thought, and counsel; (4) in prophetic utterances and their fulfilment; (5) in the coming of Jesus Christ, the true representative of God; (6) in the unchangeable provisions of the redemption wrought out through him; (7) in the actual salvation of men from their sins; (8) in the establishment, upon a sure foundation, of the *Fact* of eternal life!

The historic birth of this doctrine can be traced to the fertile brain of Origen, who possibly was its first supporter, although he did not fully accept the second portion of it, which consigns the unsaved to conditions of everlasting reprobation. From his time to the Augustinian Age there was little controversy over the sovereignty of God in its relation to man's freedom and salvation. But during Augustine's sway, in the Western Church, the doctrine of man's inability to save himself and his absolute dependence upon God's eternal decree to be saved, was so strongly and vigorously taught that Pelagius, who represented opposite theological tendencies, declared that the true fundamental conception of sin involved man's capacity of choice to be good or evil, apart from God's plan and grace. This controversy was waged with great earnestness—especially in the Greek Church—for half a century, till it was modified under the form of Semipelagianism.

Later theologians divided themselves into two groups, the Infralapsarians and the Supralapsarians. The former taught that the decree of predestination had no effectiveness until after man's fall, while the latter class held that the ultimate end which God had in mind was his own glorification in the salvation of some and in the reprobation of others.

During the Reformation the strongest exponents of the true predestination idea were the Calvinistic thinkers under the leadership of John Calvin (1509), though the Lutherans and Arminians also accepted the doctrine in a less rigid form. Calvin's doctrinal ideas were incorporated in his greatest masterpiece, 'Institutes of the Christian Religion' (1535). The main features of this scholarly production, aside from the dissertations upon church, state, and religion, are embodied in the doctrines of plenary inspiration of the Bible, free-will, and predestination. Here God is the centre and man the object of his voluntary interest and love. But in this relation he is confessedly to be dealt with according to his Creator's established order. Everything in and about him which is out

of harmony with that order must be adjusted or rejected. In this process of correction or of salvation God acts alone. Man is a passive agent without the power of free-will. His predestinated salvation or reprobation depends upon the unlimited might and wisdom of God. Hence predestination is a divine necessity.

This view of predestination was presented more philosophically and clearly by Calvin in his catechism published at Geneva (1545). And it was this treatise, without a doubt, that, a century later, furnished the Westminster divines the foundation outlines for the Standards which they drew up in England's great Abbey of Westminster during the years 1643-8. The three products of that representative body called by the English parliament and made up of the most eloquent, pious, and scholarly divines, lords, commoners, and commissioners from every county of England and the universities of Oxford and Cambridge, are the Westminster Shorter and Larger Catechisms and the Westminster Confession of Faith.

In each one of these the doctrine of predestination is set forth, but more especially so in the third and tenth chapters of the Confession of Faith, which respectively treat "Of God's Eternal Decree" and "Of Effectual Calling." The paragraphs in these chapters that most pointedly outline the doctrine read as follows:

III. By the decree of God, for the manifestation of his glory, some men and angels are predestined unto everlasting life and others fore-ordained to everlasting death.

IV. Those angels and men, thus predestined and fore-ordained, are particularly and unchangeably designed; and their number is so certain and definite that it cannot be either increased or diminished.

As early as in the year 1831 the General Assembly of the Presbyterian Church was confronted with the demand for more liberty in the interpretation of the Creed of the Fathers. The marshaling of the forces who stood for a change in the form of statement, involving the doctrines of election and predestination, continued, as shown by the famous heresy trials of Drs. Barnes, Swing, Smith, and Briggs. After their deposition from the Presbyterian fold, the consideration of a revision of its Standards became a matter of serious importance. In view of this the General Assembly of 1889 resolved to transmit an overture to the presbyteries, asking them to consider the propriety of a revision of the Confession of Faith. The result of this action brought about the sentiment in favor of a revision. The Assembly of 1891 now asked the presbyteries for more suggestions. Again the answer came by a large majority of Presbyterial votes for a revision.

In 1893 the assembly was importuned once more for a new and shorter creed, but it voted to lay the matter aside. The battle of the theological giants did not cease at this. Again they pressed to the front. In consequence, the General Assembly of 1900 appointed a large committee to reconsider the matter of revision. After seven months they reported that "the returns indicated plainly that no change is desired which would in any way impair the integrity of the system of doctrine contained in the



Confession of Faith." In spite of this negating motion, the General Assembly of 1902-3 added the Declaratory Statement to chapters III. and X., which reads as follows:

"With reference to chapter III. of the Confession of Faith: that concerning those who are saved in Christ, the doctrine of God's eternal decree is held in harmony with the doctrine of his love to all mankind, his gift of his Son to be the propitiation for the sins of the whole world, and his readiness to bestow his saving grace on all who seek it. That concerning those who perish, the doctrine of God's eternal decree is held in harmony with the doctrine that God desires not the death of any sinner, but has provided in Christ a salvation sufficient for all, adapted to all, and freely offered in the Gospel to all; that men are fully responsible for their treatment of God's gracious offer; that his decree hinders no man from accepting that offer; and that no man is condemned except on the ground of his sin."

W. FRANCIS BERGER,  
*Presbyterian Clergyman.*

**Pred'icables**, a term of the Aristotelian system of logic, denoting a class of concepts which may be predicated affirmatively of several others; it is now obsolete. The predicables are five in number, namely, *genus*, *species*, *differentia*, *proprium* and *accidens*, and were used in classifying objects on a systematic plan. Every object was conceived of as belonging to some species and that to some genus; objects in the same genus—a dog and a wolf, for example, would belong to different species because of the *differentia* between their characters—the specific *differentia*; a property (*proprium*) would form a ground of difference between members of the same species, *proprium* expressing, not an ultimate distinction, but one resulting from some other character, for example, the peculiarity of the shepherd dog, which is founded in the dog's natural sagacity; *accidens* is something not inherent in the nature of the object, but incidentally present in it, for example, the high value of the diamond.

**Prefect**, or **Préfet**, in European countries the name given a governor or civil commander, specifically, a title given to several officers, military, naval, and civil, in ancient Rome. Thus, in the times of the kings the officer appointed by the king to act as his deputy when he was compelled to leave the city was called the prefect of the city. Later, during the earlier ages of the republic, when both consuls were required for military service, a *præfectus urbi* was named by the Senate to act during their absence. He must have held the office of consul, and he enjoyed during the period of his office the same powers and privileges within the walls as the consuls themselves. In times of dearth or famine a commissioner was appointed to procure supplies, his official title being prefect of corn. In war the whole body of the cavalry was under the command of an officer, also styled a prefect. Under Constantine the prefects became governors of provinces. In France a préfet is the civil governor of a department, having control of the police and extensive powers in regard to municipal administration.

**Preforma'tion**, a theoretical view of embryological development widely held in the 17th century, and especially advocated by Haller. It

asserted that the germ held in infinitesimal proportions all the parts and organs of the being, which were simply unfolded by growth. Hence this theory came to be known in England as the "evolution" theory and in French literature as the *embôitement* theory. One class of thinkers regarded the egg as containing the whole of the embryonic material; another class thought it all contained in the spermatozoon. This whole baseless fabric of philosophy was overthrown by the microscopical researches of Wolf and the other founders of the science of embryology (q.v.).

**Prehn'ite**, or **Edelite**, a mineral, allied to zeolites and usually found with them, pale-green with a vitreous luster, crystallizing in the orthorhombic system. It is a hydrous silicate of aluminum and calcium, having the formula  $H_2Ca_2Al_2Si_3O_{12}$ . It is most frequently found in rocks of the basaltic type and is obtained from a wide area, being found in the copper region of Lake Superior, at Paterson and Bergen Hill, N. J., in Scotland, France, China, and South Africa. It was first found by Colonel Prehn in the 18th century at the Cape of Good Hope. It is cut into gems and slabs, resembling chrysoprase in appearance.

**Prel'ate**, a term used generally of bishops and archbishops of the Anglican communion, but bearing a more precise and specific meaning in the Roman Catholic Church, where it is applied to secular or regular clergy who have a jurisdiction inherent in their office, and not merely delegated by a superior. The title is especially used of the prelates of the pope's court and household who hold higher rank than other prelates.

**Prell**, **prël**, **Hermann**, German painter: b. Leipsic 1854. He studied at Dresden and Berlin under Grosse and Gussow respectively, supplementing this by a course of study in fresco painting in Italy. Returning home he was commissioned to paint the frescoes in the banquet hall of the House of Architects, in Berlin, and for this hall he executed a series of 11 paintings on the 'Main Epochs of the History of Architecture.' His other mural paintings are to be found in the City Hall of Worms ('Justice,' 'Valor,' and 'Henry IV. Granting Privileges to Worms in 1074'); the City Hall of Hildesheim; City Hall of Dantzig; the Breslau Museum; and the Albertinum, Dresden. The Dresden Gallery and the Breslau Museum contain specimens of his easel pictures. He has taught in the academies of Berlin and Dresden.

**Preller**, **prël'lër**, **Friedrich**, German painter, son of the preceding: b. Weimar 1 Sept. 1839; d. 1901. After studying under his father he followed the same departments in art, and his wall-paintings in the new theatre at Weimar (especially his 'Prometheus' and 'Iphigeneia'); and in the Albertinum at Dresden ('Olympia'; 'Pergamus'; 'The Acropolis at Athens'; and 'Ægina') have been much admired. He also produced a series of landscapes—scenes from Italy and Greece, in oil. His 'View of the Monastery of Santa Scholastica' is in the Dresden Gallery. He was professor in the Art Academy at Dresden.

**Preller**, **Friedrich Johann Christian Ernst**, German painter: b. Eisenach 25 April 1804; d. Weimar 23 April 1878. He became acquainted with Goethe in his youth, and received encour-



## PRELUDE — PRENTISS

agement and finally a pension from the 'Duke of Weimar which enabled him to travel and study in Italy where he imbibed more from the classic than the Renaissance art and formulated a pictorial philosophy in which he saw man as the culmination of all earthly beauties. His important works, especially the series suggested by Homer's *Odyssey*, now in the Museum of Weimar, are bold and vigorous landscapes forming a setting for nude figures of heroic mold. To paint such subjects was the necessity of his artistic creed; yet he was obliged from poverty to turn at times to other fields. In 1840 he made a sketching trip to Norway, and frankly adopting the naturalism of Ruysdael he painted landscapes for sale. Even these were vigorous and meritorious in execution, if not fully representing his genius. He made unremitting sketches from nature and left behind him a long series of remarkable drawings. Consult: Roquette, 'Friedrich Preller' (1883); Muther, 'History of Modern Painting' (1896).

**Pre'lude**, in music, a short introductory strain preceding the principal movement, performed on the same key as it, and intended to prepare the ear for the piece that is to follow. It may consist of a series of unconnected chords when the intention is simply to attract the attention of an audience, or to fill a singer's ear with the key in which the piece is written, in which case it is generally improvised. It is, however, usually composed of part of the leading theme, more or less varied toward the close, and is not left to the invention of individual performers. See **MUSIC**.

**Prelude, The**, OR GROWTH OF A POET'S MIND, a poem by William Wordsworth (q.v.), summing up his philosophy of life and poetry, and hence "autobiographical." It was written in 1799-1805, and was intended as an introduction to the 'Recluse,' of which only the 'Excursion' and some fragments were completed. The poem is addressed to S. T. Coleridge, and is a strange and typical admixture of Wordsworth's noblest and his more commonplace and dull.

**Premonstraten'sians**, or **Norbertines**, a religious order, founded by Norbert, canon of Xanten in Cleves, who on account of his zeal as archbishop of Magdeburg in 1127 was canonized. In the forest of Coucy, in a meadow pointed out to him, as he said, by Heaven (*prémontré*, *pratum monstratum*; thence the name of the order), he collected his first disciples (1120). Their order increased rapidly; several nunneries were established with the same rigid rules. The abbot of the original monastery *Prémontré*, near Coucy, was general, and with three other abbots formed the great council of the fathers of the order. The order was introduced into England in 1146, and its members were there regularly known as the White Canons. Before the Reformation they had 2,000 monasteries, among which were 500 nunneries, mostly in Germany, the Netherlands, France, England, and the north of Europe; but the Reformation diminished this number by more than one half in the 16th century. The monasteries in Spain attempted to revive their discipline in 1573 by uniting in a strict observance of their rules, but they remained in communion with those of the common observance. In 1630 this communion of all the monasteries of both kinds was confirmed by new statutes. In the 18th century the

order had no houses in Italy; in France it had 42 monasteries; the nunneries had all disappeared. It now consists of a few houses in Poland and Austria, especially Bohemia, with some recently founded elsewhere, as at Crowle and Spalding in Lincolnshire, and Storrington in Sussex. In the United States the Provincial house of the Premonstratensians was founded at De Pere, Wis., by fathers from the abbey of Heeswijk, Holland. The Very Rev. Bernard Pennings, O. Præm., Prior. The Fathers conduct missions in the archdiocese of Chicago, the dioceses of Green Bay, Grand Rapids, and in Canada. Fathers, 12; scholastics, 2; brothers, 4.

**Prence**, prēns, or **Prince, Thomas**, American colonist: b. Lechdale, Gloucestershire, about 1600; d. Plymouth, Mass., 29 March 1673. He was one of the Leyden band of Pilgrims which settled in Plymouth in 1621 and his wealth soon gained for him considerable influence. In 1634 and in 1638 he was elected governor and was one of the assistants in 1635-7 and in 1639-56. He assisted in the settlement of Nansett or Eastham and from 1657 until his death was governor of Plymouth, the law requiring the residence of the governor in Plymouth being waived in his favor. He was zealous in the religious affairs of the colony, an active promoter of educational matters, and was the real founder of the public schools in New England. Consult Baylies, 'An Historical Memoir of the Colony of New Plymouth' (1866).

**Prentice**, prēn'tis, **George Denison**, American journalist: b. Preston, Conn., 18 Dec. 1801; d. Louisville, Ky., 22 Jan. 1870. He was graduated from Brown University in 1823; studied law, but did not practise, and was editor of the 'New England Weekly Review' at Hartford, a literary journal, 1828-30. He then removed to Louisville, Ky., where in 1831 he became editor of the *Louisville Journal*, in which position he won widespread reputation for political ability, wit, and satire. For many years the *Journal* was a leading advocate in the West of the policy of the Whig party, and at the outbreak of the Civil War maintained with zeal the cause of the Union. A collection of his poems appeared in 1876 and a selection from his newspaper paragraphs under the title of 'Prenticeana' in 1860.

**Prentiss**, Benjamin Mayberry, American military officer: b. Belleville, Va. (now W. Va.), 23 Nov. 1819; d. Bethany, Mo., 8 Feb. 1901. He removed with his parents to Illinois in 1842, served in the Mexican War with rank of captain, and received honorable mention for services at Buena Vista. At the outbreak of the Civil War he reorganized his old company, was appointed colonel, and in May 1861 was made brigadier-general of volunteers. He routed a band of Confederates at Mount Zion, southern Missouri, in December 1861, joined Gen. Grant a few days before the battle of Shiloh and was taken prisoner in that battle, together with most of his command, while stubbornly holding the position to which he had been assigned. He was released a few months later, promoted major-general of volunteers, served as a member of the court-martial which tried Gen. Fitz-John Porter, and in July 1863 defeated the Confederate forces under Holmes and Price at St. Helena, Ark. He resigned his commission in



## PRENTISS — PRESBYTERIAN CHURCH

October 1863 and settled in Bethany, Mo., where he practised law.

**Prentiss, Elizabeth Payson**, American author: b. Portland, Maine, 26 Oct. 1818; d. Dorset, Vt., 13 Aug. 1878. She was married to George Lewis Prentiss (q.v.) in 1845 and after the death of two children turned her attention to literary work. Her most popular work, 'Stepping Heavenward' (1869), reached a sale of over 150,000 in this country besides being translated into French, German, Norwegian, and Italian, where it met with great success. Among her other works are: 'The Susy Books' (1853-6); 'Fred, Maria, and Me' (1867); 'Pemaquid' (1877); 'Gentleman Jim' (1878); etc. Consult G. L. Prentiss, 'Life and Letters of Elizabeth Prentiss' (1882).

**Prentiss, George Lewis**, American Presbyterian clergyman: b. Gorham, Maine, 12 May 1816; d. 1903. He was graduated from Bowdoin College, Brunswick, Maine, in 1835, studied theology in the universities of Halle and Berlin in 1839-41, and was ordained to the ministry in 1845. He was pastor of the South Trinitarian Church, Boston, 1845-51, of the Mercer Street Presbyterian Church, New York, 1851-8, when ill health compelled his resignation. In 1862 he established in New York the Church of the Covenant, and was its pastor until 1873 when he accepted the chair of pastoral theology, church polity, and mission work at Union Theological Seminary. He published: 'A Discourse in Memory of Thomas Harvey Skinner' (1871); 'Life and Letters of Elizabeth Prentiss' (1882); 'The Union Theological Seminary in New York, Historical and Biographical Sketches of Its First Fifty Years' (1889); etc.

**Prentiss, Sergeant Smith**, American orator, brother of G. L. Prentiss (q.v.): b. Portland, Maine, 30 Sept. 1808; d. Natchez, Miss., 1 July 1850. He was graduated from Bowdoin College, Brunswick, Maine, in 1826, removed to Natchez, studied law, and in 1829 was admitted to the bar after which he established a law practice in Vicksburg, Miss., and rapidly gained high rank in his profession. In 1835 he was elected to the Mississippi legislature, where he won a reputation as an orator and in 1837 he was elected to Congress, but upon arriving at Washington to take his seat found it occupied by the Democratic candidate, Col. Claiborne. In a speech of great brilliancy and power, which continued for three days, he argued his case before the House, attracting the attention of the country to the "Mississippi Election Case." The controlling vote was cast by the speaker, James K. Polk, and Prentiss was defeated, but at the polls in the election following was triumphantly elected. His speech against the sub-treasury bill sustained his reputation as an orator, but at the close of his term he declined re-election. In the campaign of 1840 he actively supported Gen. Harrison and in 1845 he strenuously opposed repudiation. He spent the last years of his life in practice in New Orleans, La. Consult G. L. Prentiss, 'Memoir of S. S. Prentiss' (1855).

**Prenzlau**, prěnts'low, or **Prenzlów**, Germany, town in the province of Brandenburg, in Prussia; on the Ucker and Lake Ucker, 57 miles north by east of Berlin. It is divided by the river into an old and a new town, is well built,

and has among its buildings a handsome Gothic church (erected 1325-40), a war monument, and a gymnasium. It has a number of manufacturing establishments, machine shops, woolen mills, tanneries, sugar works, etc. In 1806 a Prussian corps under Prince Hohenlohe surrendered here after the battle of Jena. Pop. (1890) 18,019; (1900) 20,228.

**Preposition.** See GRAMMAR.

**Prerog'ative**, in British history, a term used to denote an exclusive privilege of the Crown, the expression the prerogative being employed for the whole or any part of such exclusive privilege. The prerogative may be confined or limited by the supreme legislative authority, and has in fact been much restricted, notably by Magna Charta (1215), the Habeas Corpus Act (1679), and the Bill of Rights (1688).

**Presbyo'pia.** See SIGHT, DEFECTS OF.

**Pres'byter.** See BISHOP; PRESBYTERIANS; etc.

**Presbyterian Church in the United States of America.** The history of Presbyterianism in the United States is closely interwoven with that of the country at large. The early colonists were, for the most part, those who had crossed the ocean to find a home in the New World, in order to enjoy religious freedom. They came for conscience's sake, rather than for the advancement of their fortunes. They claimed the right to worship God according to the dictates of their own consciences, and to govern themselves in the administration of church order and discipline. They were bitterly opposed to the claims of prelacy. Alike among the Congregationalists of New England, the Dutch of New York, the Scotch-Irish of Pennsylvania, and the Huguenots of the Carolinas, the Calvinistic or Reformed system of doctrine was the prevailing belief. The Shorter Catechism of the Westminster Assembly, embodied in the New England Primer, had a more profound influence in the training of successive generations, than any other book of that period, except the Bible. It was the working creed of the men who laid the foundations of free institutions in America. The organization of the church among the colonists was determined largely by their previous associations in the Old World. The New England colonists were mostly of English-Puritan extraction, and favored the Congregational polity. There were, however, two parties among them; one zealously favoring Independency, the other leaning toward the Presbyterian polity. The former belonged to the school called Brownists, the latter to Barrowism. A strictly Presbyterian colony was established in Salem, Massachusetts Bay, under Roger Conant in 1625. Among those who held to Presbyterian views was Rev. Richard Denton, who came from England in 1630, and settled in Watertown, Mass. Driven out by opposition to his views, he removed in 1644, with some of his congregation, to Hempstead, Long Island, where a church was organized in accordance with the Presbyterian form. The earliest organization of Presbyterianism in the New World was made in the Dutch settlement of New Amsterdam, in New York, in 1628. It was a Reformed Dutch church, and the first Protestant church in America. Other churches of this denomination were organized at an early date



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among the Dutch settlements. (See REFORMED DUTCH CHURCH.) While the Presbyterian element was found in all of the colonies from New England to Georgia, circumstances prevented its separate organization. In New England the prevailing form of government was Independency or Congregational; in New York Presbyterianism was of the Dutch type, and only Episcopacy was allowed among the English. In Virginia, Episcopacy was established by law, and was intolerant toward all forms of dissent. Conditions were more favorable to Presbyterianism in the provinces of Pennsylvania, New Jersey, Delaware, and Maryland. To these colonies came a large number of emigrants from the North of Ireland, and from Scotland. The religious intolerance prevailing under the reign of Charles II. led them to seek refuge from it in the New World. It was among these emigrants that Presbyterianism took its organized form. In answer to a request from one of the scattered groups of Presbyterians, the Presbytery of Laggan, Ireland, sent as its missionary, Rev. Francis Makemie, in 1683. He journeyed in his missionary work as far south as the Georgias, and as far north as New York. He finally settled in Rehoboth, in eastern Maryland, where he organized the churches of Rehoboth and Snow Hill. In 1704 he returned to London, seeking aid for his work, returning in 1705, and bringing with him two additional ministers.

There was also, before the opening of the 18th century, a Presbyterian church in Philadelphia. Rev. Jedediah Andrews was its pastor, in 1701. In 1705 seven ministers, Makemie, Davis, Wilson, Andrews, Taylor, MacMish and Hampton, met by appointment in the city of Philadelphia and organized a Presbytery. It was the first Presbytery in America, and the beginning of the American Presbyterian Church in its organized form. The original minutes of this Presbytery are in the archives of the Presbyterian Historical Society in Philadelphia. This Presbytery was subsequently divided into three, which were included in a Synod. The Synod held its first meeting 17 Sept. 1717, in Philadelphia. In 1741 a division occurred in the Synod resulting, not from doctrinal differences, but from those ecclesiastical passions and unregulated zeal which have so often disturbed the church. One party under the leadership of the Tenents, father and son, and greatly helped by the ministry of the renowned evangelist, Whitfield, was earnestly solicitous for a revival in the church, charging it with formalism and worldly conformity. The other party, the conservative, resisted the charge, and sought to restrain by ecclesiastical action what they considered the immoderate zeal of the revivalists. The parties were known respectively as the New Side and the Old Side. The result of these controversies was the establishment of two independent synods, the Synod of New York, composed mainly of those favoring the New Side, and the Synod of Philadelphia, favoring the Old Side. Both synods unanimously affirmed their adherence to the Westminster Standards. This division lasted 17 years, and was healed by the reunion of the two synods in 1758, under the name of the Synod of New York and Philadelphia. With the reunion came renewed effort and enlarged prosperity. Churches were organized in the Carolinas, Georgia, Kentucky, Tennessee,

Virginia and Western Pennsylvania. This enlargement of the Presbyterian Church had an important bearing on the subsequent efforts of the colonies to secure their independence. The Presbyterians everywhere were foremost in resisting civil and religious oppression, and when the period of the Revolution came, were unanimously in favor of independence, and the establishment of a government on republican principles. Thirteen months before the signing of the Declaration of Independence, in Philadelphia, the Presbyterians of Mecklenburg County, North Carolina, had drawn up and signed a Declaration of Independence from England, and also framed a system of local government. The Scotch-Irish Presbyterians in Western Pennsylvania declared for independence in May 1776. The Presbyterian element was everywhere a determining factor in the War of Independence.

In England, the rebellion was attributed especially to the Presbyterians. Walpole said in the English Parliament, "Cousin America has run off with a Presbyterian parson." At the close of the Revolutionary War, the Synod of New York and Philadelphia met, May 1788, and revised the Confession of Faith and the Form of Government in some minor matters, which were required by the change of allegiance in civil affairs. At the same meeting it was resolved to create a General Assembly, in which all the presbyteries should be represented by their commissioners. This General Assembly held its first meeting in the Second Presbyterian Church of Philadelphia, Thursday, May 1789. At this time the church had 16 presbyteries, 4 synods, 177 ministers and 431 churches. Among the first acts of the General Assembly was one directing that efforts should be made to send missionaries to the frontier. Before the close of the century, numerous churches had been established in the West and South. To prevent collision with the missionaries who went out from the Congregationalists in New England, the General Assembly, in 1802, entered into the Plan of Union with the associated churches of Connecticut, providing for the orderly organization of churches in mission fields. This Plan of Union continued in force until 1836, when it was abrogated by the General Assembly. It provided, in brief, that Congregational churches might settle Presbyterian ministers, and the reverse; and that if a congregation was composed partly of Congregationalists, and partly of Presbyterians, this fact should be no obstacle to their uniting in one church, and settling a minister; and that such a church, though not presbyterially organized, should have a representative in Presbytery. Its operation led to most favorable results in the extension of the church. The opening of the 19th century was a time of widespread religious revivals. "The Great Awakening" began in Kentucky, and it was attended there with some manifestations which met the disapproval of the more conservative element in the Church. In view of the great demand for ministers, some were authorized to preach who had not received a regular classical and theological education. There were also a few who held that the Confession of Faith taught fatalism. This led to the withdrawal of the Cumberland Presbytery, from which has sprung a large and influential body of Presbyterians known as the Cumberland Presbyterian Church. This sepa-



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ration took place 1810. (See *Cumberland Presbyterian Church*.) The first quarter of the century was one of rapid growth for the Church. The tide of emigration poured westward, and new settlements and towns were founded. In all these, the missionaries of the Church found a hopeful and fruitful field for their labors. During this period, the Board of Home Missions was organized (1814). Theological Seminaries for the education of ministers were also established; Princeton (1812); Auburn (1820); Western Theological Seminary, Allegheny, Pa. (1826); Union Seminary, Virginia (1828); Columbia, South Carolina (1828); Lane (1834); Hanover, subsequently removed to New Albany, thence to Chicago, and now known as McCormick Theological Seminary (1829). In 1825 appeared the beginnings of a controversy which ultimately resulted in the disruption of the Church. Various causes led to the formation of two parties, known subsequently as the Old School and the New School. Chief among these causes was the spread of New Haven Theology, or Hopkinsianism, which was supposed to be contrary to the doctrine of the Confession of Faith. It was also charged that through the Plan of Union, Presbyterian order had been subverted, and that innovations in worship were permitted in certain parts of the Church. In 1836 Dr. Albert Barnes, who sympathized with the new theology, was tried for heresy before the General Assembly, and acquitted. The previous year, Dr. Lyman Beecher, professor in Lane Theological Seminary, had been tried for heresy by the Presbytery of Cincinnati, and ultimately acquitted. All these things produced intense excitement in the Church, and widened the breach between the conservatives and the liberals. The Assembly of 1837, which met in Philadelphia, in response to a memorial signed by a large number of ministers and elders representing the Old School party, dissolved the Plan of Union with the Congregational Church, and excinded the synods of Western Reserve, Utica, Geneva and Genesee.

At the meeting of the Assembly in Philadelphia, 1838, the commissioners from the excinded synods presented themselves and asked to be enrolled; this being denied them, they with their friends proceeded to organize the assembly, and withdrew to hold its sessions in the First Presbyterian Church of Philadelphia. With the Old School party remained 140 commissioners, while 136 gave their adhesion to the newly organized Assembly. Thus began the unhappy division which lasted 32 years. Both Assemblies had the same name, and claimed to be the General Assembly of the Presbyterian Church in the United States of America; both held to the same confession and form of government. Both Assemblies engaged zealously in the work of home and foreign missions, and in the establishment of institutions of learning. Both, also, were troubled by questions concerning slavery. As early as 1787, the Presbyterian Church had declared itself in favor of the education of the slaves, and for the adoption of such "prudent methods as would procure eventually the final abolition of slavery." In 1815, the General Assembly adopted a strong anti-slavery document, in which it expressed regret for the existence of slavery in the United States, urged the duty of educating slaves, and expressed the hope for

their speedy emancipation. It further declared the buying and selling of slaves to be "inconsistent with the spirit of the Gospel." These views were more clearly and positively avowed in the New School General Assembly than in the Old School General Assembly. In 1858, in consequence of some decided action taken with reference to slavery and emancipation, six southern synods withdrew from the New School Assembly, and constituted themselves the "United Synod of the Presbyterian Church." In 1864 this Synod united with the General Assembly of the Presbyterian Church in the Confederate States. The passage of the "Spring Resolutions" by the General Assembly (Old School) in 1861 led to the withdrawal from that Assembly of a number of synods, all of which were within the bounds of the Southern Confederacy. This resolution was directed against the rebellion in the South, and called upon all of the members of the Church to support the government in defense of the integrity of the Union. It was bitterly opposed by the commissioners from the synods in the South, and by a small number from the Northern States, on the ground that in passing it the Assembly transcended its prerogatives. The objectors urged that the Assembly had no right to define civil duties. The vote on the resolution stood 156 in the affirmative, and 66 in the negative. The action resulted in the withdrawal of the synods in the seceding States, and the subsequent formation of the Presbyterian Church in the Confederate States of America. In 1866 the General Assembly Old School and the General Assembly New School met at the same time in St. Louis, when steps were taken with reference to the reunion of the two bodies, by the appointment of committees to consider a plan of union. These negotiations terminated favorably, and the basis of reunion, which was the Confession of Faith, after being approved by the presbyteries, was ratified by the Assembly in 1869. In May 1870, the first General Assembly of the reunited Church met in Philadelphia. In 1837, the year preceding the disruption, the ministers numbered 2,140, the churches 2,865 and the membership 220,537. At the time of the reunion, there were 4,238 ministers, 4,526 churches and 446,561 members. Since the reunion, the progress of the Church has been marked and steadfast. Two notable trials threatened for a time to disturb its peace. The first was that of Rev. David Swing, 1874, for alleged heresy with reference to the divinity of Christ. This case was settled by the withdrawal of Dr. Swing from the Church. The second was the trial of Prof. Briggs of Union Theological Seminary, for his advocacy of those views of the "higher criticism" which it was claimed affected the fundamental doctrines of the Christian faith. This trial resulted in the condemnation of his views, his suspension from the ministry, and his subsequent withdrawal from the Church.

The minutes of the General Assembly for 1903 show that the Church has 32 synods, 239 presbyteries, 7,705 ministers, 374 licentiates and evangelists, and 7,822 churches which contributed in the year, for home missions, \$1,293,321; and for foreign missions, \$905,089. Its total contributions for all purposes were \$17,561,377. This branch of the Presbyterian Church in



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America is the largest numerically, and occupies a leading position among the churches of the land. It has been noted for its missionary labors, especially in foreign lands, its zeal for education, and its unshaken adherence to its doctrinal standards. For the prosecution of its work it has Boards of Home Missions, Foreign Missions, Education, Publication and Sabbath School work, Church Election, Ministerial Relief, Freedmen, and Aid for Colleges and Academies. It has also in connection with it, numerous schools, colleges, universities and theological seminaries. The national churches of Mexico and Brazil, both Presbyterian, have been established largely through its instrumentality. It has synods in India and China, and its mission operations are carried on in all parts of the world.

*The Cumberland Presbyterian Church.*—The origin of this branch of the Presbyterian Church is to be found in the great religious revival which swept over Kentucky and Tennessee, at the beginning of the 19th century. The demand at that time for an additional number of ministers in that region, led the Presbytery of Cumberland, in connection with the General Assembly, to license and ordain a number of young men of the Presbyterian Church, who had not received the required classical and theological training, for the gospel ministry. This proceeding was contrary to the rules and traditions of the Church, and was strenuously opposed by those who stood for the old ecclesiastical order. The Synod of Kentucky refused to sanction the acts of the Presbytery, and this decision was finally confirmed in part by the General Assembly. There were also among those engaged in this controversy some divergencies in doctrinal belief, especially with reference to what were claimed to be the fatalistic teachings of the Confession of Faith. The result was the withdrawal of those who were dissatisfied, and the formation of an independent presbytery, called the Presbytery of Cumberland. Those who organized it recognized as their standard of doctrine the Confession of Faith of the Presbyterian Church, but made provision for those who objected that fatalism was taught in it. The growth of this Presbytery was rapid. In three years it grew into a synod, composed of three presbyteries, and numbering 60 churches.

Its first meeting was held October 5, 1813, when it proclaimed a summary of its doctrines. A year later it revised the Confession of Faith, to meet its views regarding the articles to which exception had been taken. These were, specially, the third chapter with reference to the decrees of God, and the article with reference to the salvation of infants. The new church, filled with the revival zeal of its origin, made rapid advances. In 1827 it established at Princeton, Ky., an institution of learning, with a view to securing educated men for the ministry. In 1829 the General Assembly of the Cumberland Church was organized, consisting of five synods. At that time the field occupied by the Church embraced eight States, in which there were 18 presbyteries.

Since the organization of the General Assembly, the growth of the Church has been rapid and permanent. Its synods extend from Pennsylvania to the Pacific, and now number 16. The larger portion of its membership is contained

within the boundaries of the States of Alabama, Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, Tennessee and Texas. For the prosecution of its work it has an Educational Society, Boards of Ministerial Relief, Home and Foreign Missions, Publication, Sunday Schools and Young Peoples Societies. It has under its supervision the following institutions of learning, Cumberland University at Lebanon, Tenn.; James Milliken University at Decatur, Ill., embracing Decatur College and Lincoln College at Lincoln, Ill.; Missouri Valley College at Marshall, Mo.; Trinity University, Texas, and Waynesburg College, Waynesburg, Pa. The Minutes of the General Assembly for 1902-3 show that it has a total membership of 185,113, 2,960 churches, 1,616 ordained ministers, church property to the value of \$5,025,873; and that its total contributions for the year, for all purposes, were \$923,660. During its history, various attempts have been made to restore its union with the Presbyterian Church in the United States of America, but they failed on account of doctrinal differences until 24 May 1906 when, in convention assembled, the former at Decatur, Ill., the latter at Des Moines, Ia., the reunion was accomplished.

*The Colored Cumberland Presbyterian Church.*—Prior to the Civil War, the number of colored people in connection with the Cumberland Church amounted to 20,000. In times of slavery, they worshipped in the same buildings with their masters, a particular portion of the church being assigned to them; but they were not allowed to participate in the government of the church. After the Civil War, it was deemed expedient that these members should be associated in a separate organization. Accordingly presbyteries and synods were formed, which met in a General Assembly, May 1, 1874. This organization, whose statistics are rather indefinite, now reports a membership of 35,000. It has one educational institution, but the poverty of the people has prevented them from obtaining a thoroughly educated ministry.

*The Presbyterian Church in the United States (Southern).*—This Church had its origin at the beginning of the Civil War, and from causes connected with it. The action of the General Assembly, Old School, in 1861 was one of the leading causes. By the passage of the "Spring Resolutions" concerning the Civil War, it had determined for all under its jurisdiction, that their allegiance was due to the national government. A minority held that this action, whether true or false, was beyond the jurisdiction of the General Assembly, and that in making it, the Church was transcending her sphere, and usurping the duties of the state, which alone had the power to define civil duties. A protest was presented against this action, in which it was urged that the Assembly in thus deciding a political question, and in making that decision binding upon those under its care, practically made a condition of church membership which violated the constitution of the Church, and usurped the prerogative of its divine Head. Presbyteries in the seceding States generally coincided with this view, and concluded that a separation from the General Assembly was demanded for the defense of a great truth, and for the protection of the liberty with which Christ had made them free. The organization



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of the Confederate States furnished another reason. It was, in brief, that the changed condition of civil affairs made it expedient and necessary that the presbyteries within the bounds of the Confederacy should be organized as a separate and independent body. Accordingly 93 ministers and elders, representatives from presbyteries, met in Augusta, Ga., December 4, 1861, and constituted a General Assembly, under the name of the General Assembly of the Confederate States of America. They adopted at the same time, as their standards of doctrine, the Westminster Confession of Faith, and the Form of Government as held in the old church. At the close of the war, the name of the church was changed to the Presbyterian Church in the United States. In 1864 the United Synod of the South, composed of the presbyteries and churches which had seceded from the General Assembly (New School), on account of its action concerning slavery, was admitted into the General Assembly of the Confederate States. It consisted of 120 ministers, 190 churches and 12,000 communicants. In 1869 that portion of the synod of Kentucky which had separated from the General Assembly (Old School) in 1867, was received into connection with the Southern General Assembly, bringing with it 13,540 communicants. In 1874 the independent Synod of Missouri, which had separated itself from the Northern Assembly on account of its action concerning civil affairs, united with the Southern Assembly. The churches in connection with this Assembly are almost exclusively in what is known as the Southern States, and for that reason it is commonly called "the Southern General Assembly" in distinction from the Assembly, North. Its missionary and benevolent operations are not conducted by organized boards, but through committees elected annually by the General Assembly, directly responsible to it, and acting under its instruction. It carries on mission work in China, Africa, South America, Greece, Italy and Mexico. Its home mission work is conducted with vigor and efficiency, and includes work among Indians and Negroes, as well as the white population. It has under its care, Union Theological Seminary at Richmond, Va.; the Theological Seminary at Columbia, S. C., and the Theological Seminary at Louisville, Ky. The last named institution, having been joined with Danville Seminary, is now under the joint control of both synods of Kentucky, one in connection with the Northern and the other with the Southern Assembly. This branch of the Church, while holding in common with other Presbyterian Churches, the Westminster Confession and Catechisms, Larger and Shorter, lays special emphasis upon the spirituality of the Church in its functions. It insists that church courts shall be governed by the article of the Confession which says, "synods and councils are to handle or conclude nothing but that which is ecclesiastical." Statistics for this Church in the year 1903 are as follows: Ministers 1,517, churches 3,044, communicants 235,142, Sunday School scholars 155,768, total contributions \$2,227,649.

*The United Presbyterian Church of North America.*—This organization is the result of a union between the Synod of the Associate Reformed Church, and the Associate Synod, commonly known as the Seceders. This union took

place in Pittsburg May 26, 1858. The basis of it was the Westminster Confession of Faith, with a modification of the chapter on the power of the civil magistrate, the Catechisms, Larger and Shorter, and a Judicial Testimony. Most of the articles in this testimony are held in common by all Evangelical churches, but there are five which are special to this denomination. The first declares that slave holding is a violation of the law of God, and contrary both to the letter and spirit of Christianity. The second declares that all secret and oath-bound societies are inconsistent with the genius and spirit of Christianity, and that church members ought not to have fellowship with such associations. The third is a declaration in favor of close communion; none are to be admitted to the sealing ordinances of the Church except such as give their assent to its doctrines. The fourth declares the duty of public social covenanting at special times. The fifth affirms that it is the will of God that the songs contained in the Book of Psalms should be used exclusively in public worship, and that hymns, the composition of uninspired men, should not be employed in such service. In all other respects, the laws, government, and discipline of this church are the same as those of other branches of the Presbyterian Church. It has been distinguished for the careful training of its ministry. It has in its connection two theological seminaries and six colleges. For the execution of its work the United Presbyterian Church has seven Boards, namely, Home, Foreign, Freedmen's Mission, Church Erection, Publication, Education, and Ministerial Relief. Its Foreign Mission work has been extensively carried on in Trinidad, Syria, India, Egypt, and China.

*The Reformed Church in the United States (German Reformed).*—Previous to the Revolutionary War, a considerable number of emigrants from the Palatinate, a district of Germany, emigrated to America and settled in Pennsylvania. They were members of the Reformed Church in Germany, and were men of sterling character and devoted piety. They became important factors in the settlement of Middle and Western Pennsylvania, and also took part in the Revolutionary War. The first German Reformed minister settled among these emigrants was Philip Boehm, who came to America in 1720. In 1747 there were five ordained ministers and 45 organized churches. In 1793, at which time the synod was divided into classes, there were 22 ordained ministers and about 150 churches. Subsequently affiliated synods were organized in Ohio, and in the neighboring States; but it was not until the year 1863 that organic union was established between them. The General Synod was organized November 18, 1863, in Pittsburg, Pa. It holds its sessions triennially. It is a delegated body composed of an equal number of ministers and elders, elected by the several classes, constituting eight synods. The General Synod has under its control the various boards to which are entrusted the work of home and foreign missions, and also that of the Sunday school. The membership of the church is located in the northern belt of the country extending from the New England States to the Pacific slope, and southward as far as North Carolina.

*The Reformed Presbyterian Church in North*



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*America.*—This organization traces its ancestry to the Covenanters, and claims to be a lineal descendant of the Kirk of Scotland. Its name has a twofold significance, and is a resumé of its history. It is called Reformed, to indicate that it was founded on the principles of the Reformation, and Presbyterian, because of its adoption of and long struggle to maintain that form of government. The first presbytery of the Reformed Presbyterian Church in America was organized in 1774. In 1782 the majority of this presbytery united with the Associate presbyteries, and formed the Associate Reformed Church. A few refused to accept the union, and maintained their organization in what was called "praying circles." Ministers having been obtained from Scotland, in 1798 the presbytery was again constituted. In 1809 the Synod of the Reformed Church was organized with three presbyteries, in Philadelphia; through the increase of churches and presbyteries, a General Synod was in time organized. But in 1833 a division occurred by which it was separated into two branches, known respectively as the Synod of the Reformed Church, and the General Synod of the Reformed Church. The distinctive features of the Reformed Church are, first, the Kingly office of Christ in the sense that nations as well as individuals are his subjects, and should acknowledge his authority. Hence Reformed Presbyterians "decline to hold office or to exercise the right of suffrage in any government that does not clearly own Christ as king and his law as supreme." Second, the exclusive use of the Psalms in praise. Third, opposition to secret and oath-bound societies. Fourth, communion restricted to church membership. The cause of the division of the synod into two branches was a difference of opinion concerning the application of these distinctive principles, one party demanding a rigid, and the other a liberal interpretation. The synod of the Reformed Church, representing the "Old Side," is the stronger of the two branches. It has now 112 congregations, 1,127 ministers, 9,304 communicants and 12 presbyteries. The General Synod has a membership of 4,500.

*The Christian Reformed Church.*—The organization of this church took place in 1857. It is lineally descended from the Reformed Church of Holland. About the year 1847 a large number of Hollanders, connected with the Christian Reformed Church of the Netherlands, emigrated to America and settled in Michigan. For a short time they became associated with the Dutch Reformed Church, now the Reformed Church of America; but after a time withdrew on account of what they deemed laxity in doctrine and discipline, and formed an organization of their own. Its membership is to be found mainly in the States of Michigan, Illinois, Iowa and New Jersey, with a few scattered congregations in New York, Ohio, Indiana, Wisconsin and Minnesota. It is rigidly Calvinistic in its doctrines, accepting as its standard the articles of the Synod of Dort, and the Heidelberg Catechism. It is opposed to secret oath-bound societies, and use almost exclusively the Psalms in the service of praise. It uses also a liturgy in the administration of the sacraments, and in the ordination of ministers and elders. Its theological school is in Grand Rapids, Mich. At present (1903) it numbers 161

churches, 110 ministers, 9 presbyteries and over 13,000 communicants. Its General Synod meets biennially, at Grand Rapids, Mich. Its ministers officiate in the English, German, French, Bohemian and Hungarian languages.

*The Welsh Calvinistic Methodist.*—This branch of the Presbyterian body is derived from the Calvinistic Methodist Church of Wales. The first church of this denomination in the United States was organized in Remsen, N. Y., and three years later the first presbytery was constituted. On Sept. 22, 1869, the General Assembly was organized and held its sessions in Columbus, Ohio; and it has met triennially ever since. Its standards of doctrine are the same as those of the parent church in Wales. Its system of government is presbyterian. It has now 6 synods, 162 churches, 88 ministers and 12,146 members. The church exists among the Welsh in 13 States of the Republic.

*The Associate Reformed Synod of the South.*—The origin of this synod dates back to the year 1821. It was the result of a secession from the Associate Reformed Church on account of differences concerning psalmody and communion questions. Its membership is confined principally to the Southern States, and numbers about 12,000. Its doctrinal symbols are the same as those of other Reformed churches.

There are also in the United States several organizations of Presbyterians known respectively as, The Associate Church of North America, The Reformed (Covenanted) and The Reformed in the United States and Canada. The number of their adherents is small, not exceeding 2,000.

*Presbyterian Churches in Canada.*—Presbyterianism in Canada is of Scottish origin, and in it are to be found representatives of every shade of Presbyterianism that has appeared in the British islands. Its early history is marked by divisions, which in course of time have been overcome. In 1831 the Synod of the Presbyterian Church of Canada, in connection with the Church of Scotland, was organized. Meanwhile other Presbyterian ministers, chiefly of the Associate Church of Scotland, organized themselves as the United Synod of Upper Canada. These two bodies were united in 1840. Previous to this union another church had been formed under the name of the United Presbyterian Church in Canada. On 10 July 1844, 25 ministers, in connection with the Church of Scotland, who were in sympathy with the Free Church movement in Scotland, withdrew from the synod, and constituted themselves a separate body, under the name of the Presbyterian Church of Canada. For 17 years these three bodies maintained a separate existence; but in 1861 a union was effected between the United Presbyteries and the representatives of the Free Church, under the name of the Synod of the Canada Presbyterian Church. This synod entered upon a prosperous career, and in 1870 the Supreme Court of this church was for the first time constituted as a General Assembly. In 1866 a union was accomplished between the churches of Nova Scotia and New Brunswick; and in 1868 the synods of Nova Scotia and New Brunswick, in connection with the Church of Scotland, formed one synod. A general union of all the churches took place in the year 1875, into which union, under the name of the Pres-



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byterian Church of Canada, came the Presbyterian Church in Canada, in connection with the Church of Scotland, the Canada Presbyterian Church, the Church of the Lower Provinces, and the Church of the Maritime Provinces in connection with the Church of Scotland. This union was cordial, and it has been followed by marked progress and substantial prosperity. The united Church is vigorously engaged in the work of home and foreign missions, and has five theological seminaries.

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**Presbyterian System, Alliance of the Reformed Churches throughout the World holding the.** Previous to 1870 the desire had been frequently expressed that the various branches of the Presbyterian Churches could be united in some general alliance which would express the generic unity of Presbyterianism. Some attempts had been made in this direction, but the first official step in this country was taken by the General Assembly of the Presbyterian Church U. S. A. at its sessions in Baltimore 1873. As a result of this action, the Alliance was formed by representatives from different Presbyterian Churches in London, England, in the year 1875. The Alliance is composed of representatives from different branches of the Presbyterian Church throughout the world. The action of its General Council is not legally binding upon any of the Churches, but only advisory in its character. It has, however, been enabled through its counsels to regulate the mission work of the Church, and to bring different branches of the Presbyterian family into closer relations, for mutual support. The Alliance has held seven General Councils: the first was in Edinburgh, Scotland, 1877; the second in Philadelphia, U. S. A., 1880; the third, in Belfast, Ireland, 1884; the fourth in London, England, 1888; the fifth in Toronto, Canada, 1892; the sixth in Glasgow, Scotland, 1896; the seventh in Washington, D. C., 1899. The eighth Council will be held at Liverpool, England, in 1904. The churches connected with the Alliance number more than 90, and are located in all parts of the world. The adherents of the Presbyterian and Reformed Churches represented in the Alliance, number about 25,000,000. The following tables

show the number of communicants in America and Great Britain, and the number of adherents in other countries:

## IN THE UNITED STATES.

The Presbyterian Church in the U. S. A.....	1,067,477
The Presbyterian Church in the U. S.....	235,142
The United Presbyterian Church of N. A...	135,651
The Cumberland Presbyterian Church.....	185,113
The Reformed (Dutch) Church in America..	113,499
Christian Reformed Church in N. A.....	18,877
The Reformed (German) Church in the U. S.	255,912
Reformed Presbyterian Church, Synod.....	9,640
The Associate Reformed Synod of the South..	11,903
Reformed Presbyterian Church, General Synod	4,500
The Welsh Calvinistic Methodist or Presby-	
terian Church in the U. S. A.....	13,500
Other Churches.....	2,000
Total .....	2,053,214

## IN CANADA.

The Presbyterian Church in Canada.....	219,570
Church of Scotland in Canada.....	10,000

## IN ENGLAND AND WALES.

The Presbyterian Church of England.....	78,037
The Church of Scotland in England.....	3,800
Calvinistic Methodist or Presbyterian Church	
in Wales.....	160,000

## IN IRELAND.

The Presbyterian Church in Ireland.....	106,053
The Reformed Presbyterian Church in Ireland	4,000
Other Churches.....	2,000

## IN SCOTLAND.

The Church of Scotland.....	668,335
The United Free Church of Scotland.....	495,259
Other Churches.....	5,000

## EUROPE.

Bohemia .....	70,000
France .....	800,000
Germany .....	3,000,000
Holland .....	2,500,000
Hungary .....	2,000,000
Switzerland .....	1,700,000
Other Countries.....	500,000

## MISCELLANEOUS.

Africa .....	400,000
Asia .....	400,000
Australasia .....	700,000
South America.....	60,000

Consult: 'Minutes of the Presbyterian Alliance' (1877-99).

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**Presbyterianism**, a term derived from the Greek word *πρεσβύτερος*, meaning "an elder," defines, primarily, a system of church government. As such, it stands midway between Episcopacy or Prelacy, and Independency or Congregationalism. It affirms that the Church, as to its government, is a theocracy under law to Christ, its supreme and only Head and Law-giver; but the powers of government are vested in the body of believers, and are to be exercised through their chosen representatives called "elders." It denies the claim of one man, or of a special class of men, to rule the Church by virtue of a divine right. In opposition to papacy and prelacy, it asserts the right of the Church to govern itself through its chosen representatives, administering rule and discipline according to the word of God. "The radical principles of Presbyterian Church government and discipline are: that the several different congregations of believers, taken collectively, constitute one church of Christ, called emphatically, The Church;—that a larger part of the church or a representation of it, should govern a smaller, or determine matters of controversy which arise therein; that in like manner a representation of the whole should govern



## PRESBYTERIANISM

and determine in regard to every part, and to all the parts united; that is, that a majority shall govern; and, consequently, that appeals may be carried from lower to higher judiciaries, till they be finally decided by the collected wisdom and united voice of the whole church. For these principles and this procedure, the example of the Apostles and the practice of the primitive Church are considered as authority."

The Presbyterian form of government is essentially republican. It differs from Congregationalism in that it asserts the visible organic unity of the Church in the sense that all local or individual churches are included under one government, in which the majority governs. In accordance with its representative form of government, it has a succession of church courts or judicatories. First in order is the session, or consistory, of the local church, chosen by its members. Next is the presbytery, having jurisdiction over the ministers and churches within a certain limited district. It is composed of the ministers, and one elder from each church in the district. The synod, likewise a representative body, has jurisdiction over the presbyteries; and there must be at least three presbyteries to compose a synod. The boundaries of synods in America are usually, and for the sake of convenience, coterminous with the boundaries of the States in which they are located.

The highest court is called the General Assembly, or General Synod. It is a representative body, composed of an equal number of ministers and elders elected by the presbyteries. The number of representatives from each presbytery varies according to the membership of the presbytery; but each presbytery is entitled to be represented by one minister and one ruling elder. The General Assembly represents all the churches under its care. It exercises administrative, legislative and judicial powers, and its decisions are final and binding upon all the lower courts, when made in accordance with the constitution of the Church. Another characteristic of Presbyterianism is the parity or equality of the ministry. According to its teachings, there are but two permanent official orders in the Church, bishops or elders, and deacons. The first includes both teaching and ruling elders. The term deacon includes the two-fold distinction of male and female. The deacons are those to whom is especially committed the administration of the charities of the church (Acts vi. 3).

Presbyterians claim for their order and form of government, apostolic and scriptural sanction. Some among them have gone so far as to assert that the presbyterian form of government is *jus divinum*, and that none other can be allowed in the church. This extreme position, however, has had but very few advocates.

The general view is, that it is an ancient form of government having apostolic sanction, and that it is agreeable to Holy Scripture. The main argument by which this view is supported is in brief this: The office of elder was established in the Old Testament Church in the earliest time. The elders were a distinct class of office bearers in the Hebrew commonwealth, and ruled in the synagogue or local church. In biblical history they are mentioned as representatives of the people (Exodus iii. 16 and iv. 24; 1 Samuel viii. 4; 2 Samuel v. 3; 1 Kings

viii. 1). They were especially prominent in the synagogue worship, familiar to the Jews from the time of the return from the Babylonian captivity. Each synagogue had a bench of elders, with a presiding officer known as the "chief ruler," to which was entrusted the oversight of the congregation. The "rulers" of the synagogue, mentioned in the gospel narrative, were these elders. The government of the synagogue, with its system of appellate courts terminating in the Sanhedrin, was presbyterian (Edersheim, 'Life of Christ,' Vol. II., p. 552). Jesus Christ and His chosen apostles, the founders of the Christian Church, had been trained in the synagogue and were accustomed to no other form of church government. They knew that it had been previously sanctioned by prophets, priests, and kings, all through the history of the chosen people. It was but natural that the same form of government should be adopted in the new church or "Ecclesia," the body of those "called out" from the synagogue.

That the synagogue furnished the model for the government of the Christian Church, is confirmed by the statements of the Apostles. Acts xiv. 23 and xx. 17-18; 1 Peter v. 1; 1 Timothy iv. 14 and v. 17. It is further claimed that the terms *episcopos* and *presbyteros*, signifying respectively bishop, and elder, are equivalent terms designating the same office. Elders and deacons constituted the office bearers of the early Church. In course of time the "chief ruler" came to be known as *episcopos*, the bishop of the church; but each church had its own bishop or overseer. They were what the Presbyterian pastor is at the present time. Such in general are the grounds upon which Presbyterians claim that their form of government is both primitive, apostolic, and conformed to the New Testament Church order. Whatever may have been the primitive form of church government in the Christian Church, it is a historical fact that from the 3d century what is known as prelacy became the prevailing order, culminating in the papacy. At the time of the Reformation (1692-1700) all the Reformers desired to restore to the people their primitive rights, but there was considerable diversity of opinion as to methods. John Calvin, in Geneva, was the first to organize a representative government in a practical form, by restoring the eldership to the church.

His conception of the eldership was adopted in the Reformed churches of Scotland, France, Holland, and practically in Germany. It was through the struggle to maintain a representative form of government, as against the claims of prelacy, that the term "Presbyterian" was applied to the churches holding that form of government. The Church of Scotland and the Reformed churches of France and Holland are Presbyterian as to their form of government. Most of the Reformed churches have adopted, with slight modifications, the Presbyterian polity. The Methodist Episcopal Church in America, the largest of the Protestant bodies, while Episcopal in name, has become Presbyterian in fact, so far as polity is concerned. In the Protestant Episcopal Church there is now representation from the laity, and the powers of the presbyters have been greatly enlarged. The Lutheran Church in the United States is also Presbyterian in polity.



## PRESBYTERIANISM

*The Doctrines of the Presbyterian Church.*—While the term "Presbyterian" defines, primarily, a polity or form of church government, it is also definitive of a system of doctrine, known as the Calvinistic or Reformed. So far as doctrine is concerned, Presbyterianism and Calvinism are synonymous. It is a popular mistake to suppose that Presbyterians accept all the teachings of the great Genevan reformer, John Calvin; but his statement of the Pauline or Augustinian system of theology is generally accepted by all branches of the Presbyterian family, and is embodied substantially in their Confessions. The five distinguishing features of the Calvinistic doctrine are: the absolute sovereignty of God in creation, providence, and redemption; the fall of man and his utter inability to save himself from the consequences of his transgression; the election from this fallen race by the sovereign grace of God of a certain number unto eternal life; the provision made for their salvation in Jesus Christ: their effectual calling by the Holy Spirit; and their perseverance in divine grace, assured by the indwelling of the Holy Spirit.

The accepted symbols of the Presbyterian faith are, the Canons of the Synod of Dort, 1619 A.D., the Westminster Confession of Faith with the Catechisms, Larger and Shorter, 1648 A.D., and the Heidelberg Catechism, 1563 A.D. (See DORT, SYNOD OF, and WESTMINSTER ASSEMBLY.) These symbols are regarded as subordinate standards. Presbyterians receive the Scriptures of the Old and New Testament as the supreme standard, "the only infallible rule of faith and practice." In America, the most widely accepted symbol of faith is the Westminster Confession, slightly modified from its original form. In the year 1900 a movement was inaugurated in the largest denomination of the Presbyterian Church, for a revision of the Confession of Faith. This movement resulted in the adoption in the year 1903 of an explanatory statement with reference to the third chapter of the Confession of Faith, and in sundry minor amendments. The Assembly also adopted a Brief Statement of Doctrine to be used in the churches under its care. The Confession of Faith as revised still remains the authoritative standard of the church. Ministers and office bearers are required to subscribe to it in the following terms: "Do you sincerely receive and adopt the Confession of Faith of this Church as containing the system of doctrine taught in the Holy Scriptures?" But the only requirement for admission to the communion of the Presbyterian Church is faith in the Lord Jesus Christ, as the divine Saviour of men.

While claiming that their polity is lawful and agreeable to the Word of God, and that their system of doctrine is that taught in Holy Scripture, Presbyterians recognize all other churches holding to the essential doctrines of Christianity as parts of the one Catholic Church.

*History of the Presbyterian Church.*—The history of Presbyterianism begins with the reorganization of the church in the Reformation period, at a council held in Zürich 26 Oct. 1523, at which the principles of primitive Presbyterianism were formally adopted, and thereafter became the distinctive features of the Reformed Churches in Switzerland, France, Belgium, Holland, and Prussia. They were adopted by

the Church of Scotland which, under the leadership of John Knox, separated herself from the papacy. They were also introduced into England about 1572 by Cartwright. In Scotland, and in the North of Ireland, Presbyterianism has continued to be the dominant faith; and from these great centres it has exerted an influence extending throughout the world.

*The Church of Scotland.*—Presbyterianism in Scotland is divided into different branches, chief of which is the Church of Scotland, commonly known as the Established Church. It is the state church, supported by the government.

It was organized in 1560 and legally established in 1592 by the Scottish Parliament. It is, numerically, the largest church in Scotland, and its various enterprises are carried on with great energy and liberality.

*The Free Church of Scotland.*—This branch of Presbyterianism originated in a separation from the Established Church in the year 1843. The immediate cause of the disruption was diversity of views on the subject of patronage. One of the principles of Presbyterian government is, that "no minister should be intruded upon a congregation contrary to its will." By Act of Parliament, the right to appoint ministers to vacant churches had been conferred on certain landed proprietors connected with the parishes. The General Assembly for many years protested against this enactment, but to no avail. The exercise of this legal right in a particular case led ultimately to the withdrawal of a large number of ministers and churches from the establishment, and to the organization of the Free Church of Scotland. But the great underlying reason for this movement was, the determination to maintain the spiritual independence of the church from the civil power, and her liberty to obey the Lord Jesus Christ as the Supreme Head of the Church. The new organization grew rapidly and took a foremost place in missionary and educational work.

*The United Presbyterian Church of Scotland.*—This organization originated 13 May 1847 in a union between the United Secession and the Relief Churches. These churches had originated from doctrinal differences in the past, and the harsh exercise of discipline in the Establishment. The United Church has been distinguished for its missionary zeal and progressive spirit. It has been said of it, that it has done more for the diffusion of the gospel throughout the world than any other denomination of its size, except the Moravians. As early as 1862 negotiations for a union of this branch of the church with the Free Church were commenced, but without success until in the year 1900 the two bodies were united under the name of The United Free Church of Scotland.

Its first General Assembly met in Edinburgh, October 1901. The statistics for the United Free Church for 1902 are as follows: Membership, 495,259; Sunday School scholars, 244,339; Bible Class pupils, 89,889; contributions for all purposes, \$5,250,000. There are in the church 11 synods, 64 presbyteries, and 1,800 ministers.

*The Presbyterian Church of England.*—Presbyterianism in England is associated with the great Puritan movement in that country. It manifested itself in the famous Westminster Assembly, 1643. When prelacy was abolished by



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the Long Parliament, Presbyterianism was established in its stead, 29 June 1647, and for 20 years it was the national church of England. But opposed by Cromwell and Independency, on the one side, and by the Episcopal Church on the other, it was destined to lose its position. After the restoration of Charles II., and on St. Bartholomew's Day, it was dis-established and 2,000 ministers, most of them Presbyterian, were ejected from their parishes. In 1686 Presbyterianism was, by act of parliament, denied civil and religious rights. The passing years brought some amelioration, as a more tolerant spirit pervaded legislation: but from that time until 1850 it had only a feeble existence. Since the latter date, through the union of various scattered churches, Presbyterianism has greatly revived in England. In 1876 these churches were gathered in one Synod and are known as the Presbyterian Church of England. Its membership numbers 79,000.

*Welsh Calvinistic Methodist (Presbyterian).*—This church represents Presbyterianism in Wales. The movement which resulted in the establishment of this church began in 1736. It has now a General Assembly, whose decisions are binding upon the churches in all matters of controversy between them. Its Confession of Faith in all essential articles is in harmony with the Westminster Confession, and with the Thirty-Nine Articles of the Church of England. Its leading Theological Seminary is at Bala, North Wales. It has also under its care a college at Trevecca, South Wales. It has both Home and Foreign Missionary Societies, and a fund for the support of aged and infirm ministers. The above named churches are the principal branches of the Presbyterian Church in the United Kingdom of Great Britain. In addition to these there are in Scotland the Reformed Presbyterian Church, and the original Secession Church of Scotland, with a combined membership of about 5,000; and in England a branch of the Church of Scotland.

*The Irish Presbyterian Church.*—Presbyterian ministers began their work in Ireland as early as 1594, but on account of persecution, Presbyterianism did not obtain a permanent footing there until 1642. It found its home in the northern part of the island, and in the Province of Ulster. Its progress was at first hindered by divisions, and by the presence of Arianism which was openly avowed by some of its ministers. In 1840, the various churches were united in one body under the name of the General Assembly of the Presbyterian Church in Ireland. Since this union the Irish Presbyterian Church has occupied a commanding position in the country. It has at present more than half a million people under its care, 560 congregations, over 600 ministers, 5 synods, and 37 presbyteries. For a time its ministers were supported by the *Regium Donum*—a grant from the state. About thirty-three years ago this grant was commuted into a general fund amounting to \$3,000,000. This is the basis of the Sustentation Fund, the income from which, increased by voluntary contributions from the churches, supports the ministry. The church has large Foreign Missions, and has under its care the Assembly's College at Belfast, and the Magee College, Londonderry. For the last 150 years there has been a constant stream of emigration from the north

of Ireland to America and the British colonies, so that the Irish Presbyterian Church has been largely instrumental in establishing Presbyterianism in other parts of the world.

*Presbyterian Churches in Europe.*—The Reformed churches of the Reformation period in Switzerland, France, Germany, Bohemia, and the Netherlands were generally Presbyterian as to their form of government. In addition to these is the ancient church of the Waldensians, dating from primitive times and now established in various parts of Italy and Switzerland. In later years the Presbyterian Church has been extended to Spain, Hungary, Austria, Russia, and Norway. The number of adherents in Europe is 10,320,000.

*Bibliography.*—*For the Churches of Scotland:* Histories of the Scottish Church by Calderwood, Spottiswoode, Row, Woodrow, Cook, Lee, Grub, Cunningham, and Stanley; Hill, 'View of the Church of Scotland'; Dunlop, 'Book of the Universal Kirk'; and 'Collection of Articles of Faith of Authority in the Church of Scotland.'

*For the Churches of England:* McCrie, 'Annals of English Presbytery'; Skeats, 'History of Free Churches in England'; Brook, 'Life of Thomas Cartwright'; Grosart, 'Representative Nonconformists.'

*For the Churches of Ireland, and Continent of Europe:* 'Records of a General Council of the Presbyterian Churches' (1877-99).

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**Pres'bytery**, in Presbyterian churches, a court of judicature consisting of all the ministers of the denomination within a given district, and of ruling elders, one from each church session. Each meeting is opened with prayer by the moderator. The functions of the court are purely executive, not legislative. It has supervision of all the congregations within its territorial limits, hears appeals from decisions of the several sessions, examines candidates for the ministry, issues licenses to probationers, ordains ministers, and in general guards the spiritual interests of the congregations under its charge in matters whether of doctrine or of discipline.

**Prescott**, prēs'kòt, **George Bartlett**, American electrician: b. Kingston, N. H., 16 Sept. 1830; d. New York 18 Jan. 1894. He studied electricity and telegraphy, and from 1847-58 was manager of several telegraph offices in Connecticut and Massachusetts, becoming in the latter year superintendent of the American Telegraph Company, and in 1866 accepted the same position with the Western Union Company. He was electrician of the International Ocean Telegraph Company in 1873-80, was actively interested in various telephone and telegraph companies, and was one of the promoters of the former. He discovered the electrical origin of aurora borealis in 1852, invented several improvements in telegraph and telephone instruments, was engaged with Edison in the invention of the duplex and the quadruplex telegraph which he successfully launched on the market, and introduced in this country the European system of despatching messages through pneumatic tubes. He published in the 'Boston Journal' and in the 'Atlantic Monthly' accounts



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of his discoveries concerning the aurora borealis and also wrote: 'History, Theory, and Practice of the Electric Telegraph' (1860); 'The Speaking Telephone' (1878); 'Bell's Electric Speaking Telephone' (1884); 'The Electric Telephone' (1890); etc.

**Prescott, Oliver**, American soldier: b. Groton, Mass., 27 April 1731; d. there 17 Nov. 1804. He was graduated from Harvard in 1750 and engaged in the practice of medicine. He was an officer in the State militia with rank as major, lieutenant-colonel, and in 1776 became a member of the board of war. In 1777 he was elected to the supreme executive council of his State, and in 1778 received rank as third major-general of militia. He resigned soon after his promotion to second major-general in 1781 and was empowered by the government to cause the arrest of any person whom he should consider dangerous to the commonwealth. In 1779 he was made judge of the probate court of Middlesex County, Mass., and played an important part in the suppression of Shays' rebellion in 1786-7.

**Prescott, William**, American soldier, brother of O. Prescott (q.v.): b. Groton, Mass., 20 Feb. 1726; d. Pepperell, Mass., 13 Oct. 1795. He served with the rank of lieutenant in the expedition against Nova Scotia under Wilson in 1755, and was offered a commission in the British army. He declined the honor and lived in retirement until the battle of Lexington in 1775 when he organized a regiment of which he became colonel, and joined the Continental camp at Cambridge. At the battle of Bunker Hill he was very conspicuous, really commanding the patriot forces and displaying the greatest courage and ability. He served in the Continental army two years and then retired from active duty with the exception of a short service as a volunteer at Saratoga in 1777. He was a member of the Massachusetts legislature for several years. Consult Parker, 'Colonel William Prescott, the Commander in the Battle of Bunker's Hill' (1875).

**Prescott, William Hickling**, American historian: b. Salem, Mass., 4 May 1796; d. Boston 28 Jan. 1859. In 1811 he entered Harvard College, and graduated in 1814. He long had trouble with his eyesight, which eventually became so weak that during the latter half of his life he could read only for a few moments at a time, and could scarcely see to write at all. He had early resolved to devote himself to a literary life, and soon after leaving college went to Europe, and spent two years in traveling through England, France, and Italy. The subject for which his inclination and abilities more especially fitted him was history, and he published his 'History of the Reign of Ferdinand and Isabella the Catholic' in 1838. The success which this achieved was most decisive. It was received with the utmost enthusiasm both in America and Europe; was soon translated into French, Spanish, and German; and its author was elected a member of the Royal Academy of Madrid. Prescott's next work was the 'History of the Conquest of Mexico, with a Preliminary View of the Ancient Mexican Civilization, and the Life of the Conqueror Hernando Cortez' (1843), which was received with equal favor, and in 1847 appeared the 'History of the

Conquest of Peru, with a Preliminary View of the Civilization of the Incas.' Prescott now began the 'History of the Reign of Philip II.,' and no pains nor expense were spared by him to render the result commensurate with the undertaking. He received the most liberal co-operation from all quarters, public and private, and everywhere both public and private collections were thrown open to his inspection. In 1855 the first two volumes of the work appeared entitled, 'The History of the Reign of Philip II., King of Spain,' and in 1858 the third volume. In 1856 Prescott published an edition of Robertson's 'History of the Reign of Charles V.,' with notes and supplement, containing an account of the emperor's life after his abdication.

The labors of Prescott afford a remarkable instance of the success of indomitable industry and perseverance carried out in the face of what might otherwise appear almost insurmountable obstacles. Partial blindness preventing him from consulting personally the authorities from which he drew his materials, he had them read aloud to him. His first reader knew, however, no language but English. The historian "taught him," as he says, "to pronounce the Castilian, suited, I suspect, much more to my ear than to that of a Spaniard." He afterward obtained the services of a reader acquainted with several of the continental languages. Prescott's contemporaries laid strong emphasis, and not unjustly, on the thoroughness of his research. But unfortunately modern discovery has done much to correct his pictures of early American civilization, for his information on which he had no recourse save the Spanish chroniclers. Hence 'The Conquest of Mexico' and 'The Conquest of Peru' are now to be valued less for their historical accuracy than for the sweep of the narrative and unfailing interest of the style. Indeed, this "easy flow of language" and "faultless lucidity," praised by Bancroft, is everywhere apparent in Prescott's work. He has not escaped the charge of too highly coloring his scenes for the sake of dramatic effect. He was not an analytical investigator, but rested content with a splendid synthetic arrangement of the concrete facts which he sincerely labored to obtain. This artistic sense and breadth of scope gave to his work an interest and a popularity not known in the case of many historians. A collection of eminent opinions on Prescott may be seen in the familiar 'Dictionary of Authors,' by Allibone. His contributions to periodicals were collected under the title of 'Biographical and Critical Essays' (New York, 1845; London, 1861). A complete edition of his work has been published in 15 volumes (new ed. 1890). Consult the 'Life' by Ticknor (1864); Ogden, 'William Hickling Prescott' (1904).

**Prescott, Ariz.**, city, county-seat of Yavapai County; on the Santa Fé, P. & P. railroad; about 135 miles north of Phoenix, the capital of the Territory. The plateau upon which the city is situated has here an altitude of about 5,000 feet. Prescott was formerly the capital of the Territory. It is in the midst of a rich mining region; the chief minerals mined in the vicinity are copper, silver, and gold. Considerable attention is given to stock raising and there is some lumbering. There is here Saint Mary's Hospital and home for children, and Saint Mary's Sanitarium. The educational institu-





WILLIAM HICKLING PRESCOTT.







## PRESCRIPTION—PRESIDENTIAL BEE

tions are Saint Joseph's Academy, Saint Xavier's Indian School, public and parish schools, and a public library. Pop. (1890) 1,759; (1900) 3,559.

**Prescrip'tion**, in medicine, a statement or formula, usually in writing and made by a physician, containing directions for the preparation and use of medicines or remedies for a patient. Formerly prescriptions were written altogether in Latin, but in this country and in Scotland English is now chiefly used for the directions, Latin being reserved for the names of ingredients. In England both prescriptions and directions are still usually written in Latin. In prescribing the physician may, from the nature of the case, use an officinal or extemporaneous preparation. Prescriptions are now much more simple than formerly. The parts of a regular prescription are four, as follows: (1) The superscription, with the date, name of patient, and the sign *R*, an abbreviation of *recipe* (take); (2) the inscription, that is, the body of the formula, containing names and names of ingredients; (3) the subscription—directions for the apothecary; (4) the signature, comprising directions to the patient regarding the use of the medicines or remedies prescribed, and followed by the signature (sometimes initials) of the physician. The prescription is composed of ingredients each designed for a particular purpose. The most active of these is called the *base*; the *adjuvant* is meant to promote the action of the first; the *corrigent* or corrective is intended to modify that action; and to these is added the *excipient*, also called the *vehicle*, etc., for the purpose of imparting to the whole a form or consistency convenient and agreeable for use.

**Presenta'tion**, in ecclesiastics, means the nomination of one or several candidates to a vacant office in the church. In ecclesiastical benefices the usual rule is that if the patron fails to present within six months after a vacancy has been intimated to him, the *jus devolutum* takes place; in other words, the patron loses his right, which in consequence devolves on the party before whom the presentation should have been laid, as the bishop under Episcopacy, and the presbytery under Presbyterianism.

**Presentation at Court.** See COURT, PRESENTATION AT.

**Present'ment**, in law, is properly speaking the notice taken by a grand jury of any offence, from their own knowledge or observation, without any bill of indictment being laid before them at the suit of the crown; as the presentment of a nuisance, a libel, or the like, upon which the officer of the court must afterward frame an indictment before the party presented can be put to answer it. The term is also used to include inquisitions of office, and indictments by a grand jury; or to express the formal notice taken in copyhold courts of the deaths of tenants, surrenders and admittances taken out of court, and similar circumstances.

**Preservation of Food.** See FOOD PRESERVATION.

**Preservation, Fort.** See OSWEGATCHIE.

**Preser'vatives.** See ANTISEPTIC.

**Presidency.** See UNITED STATES, *Presidency*.

**President**, signifying he who presides. It is used for: (1) the principal member of a society or association, who takes the chair when present at meetings; (2) the chief official of a company or board; (3) the head of a university or college, or of a learned faculty; (4) the elected chief of a republic. In the United States the president is the chief executive of the government. He is commander-in-chief of the army and navy of the country, and has the nomination of most of the executive officers of the government, besides a large number of judicial and administrative functionaries. He is elected for a term of four years, and is eligible for any number of re-elections, though, in conformity with the precedent set by George Washington, no President has yet been elected more than twice. The President has a veto power and unlimited pardoning prerogative as to offenders against National laws. His salary is \$50,000 a year, and his residence, during his presidency, is the White House in Washington. He is elected by an electoral college, which in some contingencies makes the choice by States, and he may receive a minority of the popular vote and yet be legally chosen to the office. In case of his death or total disability the functions of the office devolve on the Vice-President, who is elected coincidentally with the President, and is the presiding officer of the Senate. The following is the list of Presidents up to the present: George Washington, 1789 and 1793; John Adams, 1797; Thomas Jefferson, 1801 and 1805; James Madison, 1809 and 1813; James Monroe, 1817 and 1821; John Quincy Adams, 1825; Andrew Jackson, 1829 and 1833; Martin Van Buren, 1837; William Henry Harrison (died 4 April 1841), 1841; John Tyler (elected as Vice-President), 1841; James Knox Polk, 1845; Zachary Taylor (died 9 July 1850), 1849; Millard Fillmore (elected as Vice-President), 1850; Franklin Pierce, 1853; James Buchanan, 1857; Abraham Lincoln (assassinated 14 April 1865), 1861 and 1865; Andrew Johnson (elected as Vice-President), 1865; Ulysses S. Grant, 1869 and 1873; Rutherford B. Hayes, 1877; James A. Garfield (died by assassination 19 Sept. 1881), 1881; Chester A. Arthur (elected as Vice-President), 1881; Grover Cleveland, 1885; Benjamin H. Harrison, 1889; Grover Cleveland, 1893; William McKinley, 1897 and 1900 (assassinated 6 Sept. 1901); Theodore Roosevelt (elected as Vice-President) 1901; 1905.

**President, The**, the name of an American frigate, the flagship of Capt. John Rodgers in the early part of the War of 1812 (q.v.). It was a sister ship of the Constitution and the United States. It defeated the British ship Endymion on 15 Jan. 1815, but was obliged to surrender to her consorts.

**President's March**, the title of a popular American national air composed in 1789 by Pfyles, leader of the orchestra at the John Street Theatre, New York. It was played for the first time on Trenton Bridge as Washington rode over on his way to be inaugurated. Later Hopkinson set the words of 'Hail Columbia' to the air, and it became immensely popular under that name.

**Presidential Bee**, in American politics, an expression referring to a man who has aspirations to the presidential chair and uses his influ-



## PRESIDENTIAL ELECTORS—PRESS ASSOCIATIONS

ence accordingly. Such a one is said to have the "presidential bee in his bonnet."

**Presidential Electors.** See ELECTORS, UNITED STATES PRESIDENTIAL.

**Presidential Succession,** the order in which a vacancy in the office of the President of the United States can be filled pending a new election. The 49th Congress passed a measure entitled "An Act to provide for the performance of the duties of the office of President in the case of removal, death, resignation, or inability both of the President and Vice-President." The measure was approved by the President 19 Jan. 1886. The text is as follows:

§ 1. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in case of removal, death, resignation, or inability of both the President and Vice-President of the United States the Secretary of State, or if there be none, or in case of his removal, death, resignation, or inability, then the Secretary of the Treasury, or if there be none, or in case of his removal, death, resignation, or inability, then the Secretary of War, or if there be none, or in case of his removal, death, resignation, or inability, then the Attorney-General, or if there be none, or in case of his removal, death, resignation, or inability, then the Postmaster-General, or if there be none, or in case of his removal, death, resignation, or inability, then the Secretary of the Navy, or if there be none, or in case of his removal, death, resignation, or inability, then the Secretary of the Interior, shall act as President till the disability of the President or Vice-President is removed or a President shall be elected: Provided, That whenever the powers and duties of the office of President of the United States shall devolve on any of the persons named herein, if Congress be not then in session, or if it would not meet in accordance with law within 20 days thereafter, it shall be the duty of the person on whom said powers and duties shall devolve to issue a proclamation convening Congress in extraordinary session, giving 20 days' notice of the time of meeting.

§ 2. That the preceding section shall only be held to describe and apply to such officers as shall have been appointed by the advice and consent of the Senate to the offices therein named, and such as are eligible to the office of President under the Constitution, and not under impeachment by the House of Representatives of the United States at the time the powers and duties of the office shall devolve upon them respectively.

**Presidio,** pre-síd'ī-ō, a Spanish word which means "a fort." It is applied especially to four fortified Spanish forts on the coast of Morocco: Alhucemas, Ceuta, Melilla, and Peñon de Velez. The military settlements made by the Spaniards in California have usually retained the name "Presidio" for the military posts. The chief Presidios of Spanish California were massive forts at Los Angeles, Monterey, San Diego, and Santa Barbara.

**Presidio of San Francisco, Cal.,** a United States military post in the suburbs of the city of San Francisco. It contains 1,480 acres. It was established as a military post by Spain, and Mexico continued it until it was ceded to the United States in 1848. It was established as a United States military post in 1850.

**Press,** in mechanics, see METAL-WORKING MACHINERY; in printing, see PRINTING PRESS.

**Press, Freedom of the,** the right of every citizen to print whatever he chooses, which at the same time does not prevent his being amenable to justice for the abuse of this liberty. The right of printing rests on the same abstract grounds as the right of speech, and it might seem strange to a man unacquainted with history that printing should be subjected to a previous censorship, as it is in some States, and has been in all, any more than speaking, and that the liberty of the press should be expressly

provided for in the constitutions of most free States. But when we look to history we find the origin of this, as of many other legislative anomalies, in periods when politics, religion, and individual rights were confusedly intermingled. It is only since men's views of the just limits of government have become clearer that the liberty of the press has been recognized as a right; and to England we are particularly indebted for the establishment of this principle. The existence of a censorship of the press was for centuries, however, deemed an essential to the safety of all European governments. Liberty of printing, as we understand it, is a comparatively modern notion; Milton's plea for a free press met with no response from his own party, nor for very many years later was it the cue of any party in the English commonwealth to refrain from suppressing the writings of their political opponents. In England the liberty of the press, soon after printing was introduced, was regulated by the king's proclamations, prohibitions, charter of license, etc., and finally by the court of star-chamber. The Long Parliament, after their rupture with Charles I., assumed the same power. The government of Charles II. imitated their ordinances, and the press did not really become free till the expiration of the statutes restricting it in 1693, after which it was found impossible to pass new laws in restraint of it, and it has remained free ever since, the last restriction being done away with on the abolition of the newspaper stamp duty, in 1856. Such legal checks as remain are merely intended to prevent outrages on religion or decency, to protect subjects from detamation, and to conserve the copyright of authors. The constitutions of many of the United States declare, as we should expect, for the liberty of the press. The same may be said of all the South American republics.

**Press Associations,** in journalism, (1) a co-operative organization for gathering and distributing information and reports of current events for daily newspapers; (2) an association of editors and newspaper writers for social intercourse and for the discussion of subjects patent to journalism. Of the latter class there are in the United States a national organization, two tri-State, and numerous State organizations which meet annually. The press association for the dissemination of news is a product of 19th century journalism and was unknown prior to 1848. In that year Baron Julius Reuter of Prussia organized a continental press association for the purpose of serving the leading newspapers of European capitals with a report of the important current happenings of continental Europe. The plan met with immediate success and in the following year, Baron Reuter visited London and secured the co-operation of the more prominent daily newspapers of the British capital, and from this beginning has grown the great news-gathering enterprises of the present day. "Reuter's" has become a familiar word throughout the English-speaking world, the organization maintaining resident correspondents in every country and in every large city on both hemispheres. In 1868 there was formed a subsidiary concern called the Press Association of London, which serves the provincial newspapers of the United Kingdom with daily news re-



## PRESS CENSORSHIP — PRESSBURG

ports. As the telegraph was perfected and extended, other associations, the Central News Agency of London, Havas' Continental Agency, the Exchange Company, Dalzel's Cable News, and the National Press Agency, came into existence abroad, and during the Franco-Prussian war, the South African war, and other similar events, great rivalry arose between these organizations.

In the United States the Associated Press of New York was organized prior to 1860, and the Western Associated Press was formed during the Civil War period. The latter was a strong co-operative organization, and for many years it was an important factor in the business of news gathering in this country. For 20 years the New York Associated Press and the Western Associated Press worked together in harmony. The wires of the Western Union Telegraph were utilized for transmitting reports, and thousands of miles of leased wires were constantly in use. In 1882 the United Press was formed, using the Postal Telegraph wires for the transmission of news, and in 1883 a third and smaller rival, the Press News Association, entered the field. Meanwhile dissensions arose over contracts between the New York and the Western Associations, and the disputes were carried into the courts. The evidence showed that the Western Associated Press had made contracts for franchises between January 1883 and January 1893 with newspapers in the far West, calling for payments under the contracts of \$118,410. Of this amount the books showed that \$85,294 had actually been paid in. One half of this amount was claimed by the New York Associated Press as its share of the money collected from such sales of franchises. Suits and counter suits were commenced and the Western Associated Press was finally dissolved. A new Associated Press was organized under the laws of Illinois and for several years a close rivalry existed between this company and the United Press. Then dissensions arose and in 1900 the Associated Press was reorganized and reincorporated under the laws of New York State. In the meantime the Press News had died from financial mismanagement and soon afterward the United Press was wrecked. The Associated Press now began a prosperous career with no rival worthy of the name. The New York City Press Association, a local concern, was incorporated as a part of the Associated Press, which also began an exchange arrangement with Reuter's Agency in Europe. All the New York newspapers with the exception of the *Sun* receive their foreign and domestic reports from the Associated Press. The *Sun* organized an independent news-gathering service, called the Laffan Bureau, and from the ruins of the United Press, co-operated with a number of newspapers between New York and San Francisco, thus building up a creditable organization independent of the Associated Press. A third organization, the Scripps-McRae Press (Western service) and the Publishers' Press (Eastern service) in 1903, was serving news to several hundred newspapers. These two companies are practically one, dividing the eastern and western fields between them. The three press associations were strenuous rivals during the Spanish-American War, and special correspondents were sent with the American fleets and the armies in the field. Reporters were also stationed at every

port on the southern coasts. An Associated Press correspondent was with Dewey at the battle of Manila Bay. All three associations maintain resident correspondents in the larger American cities, and in London, Paris, Rome and the foreign capitals.

Closely allied with the press associations is the newspaper syndicate, which instead of furnishing current daily news, supplies special articles, correspondence, fiction and miscellaneous literary material to thousands of daily and weekly newspapers throughout the country. S. S. McClure was the pioneer in this field, followed by the American Press Association, the Bachelier and Johnson syndicate, the A. N. Kellogg Newspaper Union, the Leslie Syndicate, the Bulletin Press Association, and numerous others. The syndicate is enabled, by its sales of the same article to many customers, to purchase matter quite out of the reach of the individual newspaper, and to sell it on terms that each can afford. The scheme is found to be so advantageous that practically all the leading newspapers use syndicate matter to a considerable extent. Besides the firms engaged primarily in the syndicate business, several leading metropolitan daily newspapers, notably the *New York Herald* and the *American*, dispose of their own matter to papers published in other cities.

WILL M. CLEMENS,

*Editorial Staff, 'Encyclopedia Americana.'*

**Press Censorship.** See CENSORSHIP OF THE PRESS.

**Press-gang**, the name given in England to a detachment of seamen who (under the command of a naval officer) were empowered, in time of war, to take any seafaring men and oblige them to serve on board the king's ships. See IMPRESSMENT.

**Pressburg**, přes'boorg, or Presburg (Magyar, *Pozsony*; Slavonic, *Presburek*), Austro-Hungary, (1) town in the west of Hungary, capital of the county of Pressburg; on the Danube, 35 miles east of Vienna. The site of the town is remarkably fine, being in the form of a semicircle, bounded on the south by the Danube, from the banks of which it gradually ascends to the west and north toward ramifications of the Carpathians; and an extensive plain, covered with gardens, vineyards, meadows, and corn-fields, forms its boundary on the east. The houses are built of brick and stone, and of two or three stories. The edifices most deserving of notice are the Landhaus, or Hall of the Diet, in which the chambers of the kingdom used to meet; the cathedral, a huge Gothic pile with a lofty steeple, less remarkable as a church than as the place where the kings of Hungary were formerly crowned; the monasteries, the Jesuit church, a synagogue, the town-house, theatre, bishop's palace, orphan hospital, and barracks. The manufactures consist of woolens, silks, leather, and tobacco. The trade, chiefly in corn, is extensive. Outside the town there used to be an artificial mound called the Coronation Hill, to which the newly crowned kings of Hungary rode in grand procession and brandished the sword of Saint Stephen toward the north, south, east, and west, signifying thereby that they undertook to defend the kingdom from danger, come from which quarter it might. Pressburg is a place of very great an-



tiquity. In 1541, when the Turks captured Buda, it became the capital of Hungary, till the Emperor Joseph II. restored it to Buda. The peace by which Austria ceded Venice to France and the Tyrol to Bavaria was concluded here in 1805. Pop. (1900) 65,867. (2) The county of Pressburg, area about 1,250 square miles, is traversed by part of the Carpathian chain in the north, in the south it is flat and fertile. It is watered by the Danube. March, Waag, and Dudwaag, and yields corn and grapes. The large forests furnish abundance of timber. Pop 331,370.

**Pressensé, Edmond Dehault de**, *éd-môn-dè-ôlt dé prâ-sôn-sâ*, French Protestant theologian: b. Paris 3 June 1824; d. there 8 April 1891. He studied theology under Vinet, Tholuck, and Neander, and in 1847 was appointed pastor of the independent Chapelle Taitbout in Paris. Throughout his whole career he was an eloquent opponent of the connection of church and state, and an able supporter of evangelical Christianity. He also took part in politics, in 1871 was elected to the National Assembly by the department of the Seine, and thenceforward constantly sought to consolidate the republic on a thoroughly liberal basis. He was elected a life senator in 1883. He founded the '*Revue Chrétienne*' in 1854 and conducted it till his death. His published works which have appeared in an English version include: '*Histoire des Trois Premiers Siècles de L'Eglise Chrétienne*' (1888); '*L'Eglise et la Révolution Française*' (1869); '*Jesus-Christ, son Temps, sa Vie, son Œuvre*' (1866; 7th ed., 1884), a reply to Renan's '*Vie de Jesus*'; '*Etudes Contemporaines*' (1880), translated into English as '*Contemporary Portraits*'; '*Les Origines*' (1883-7), translated as '*The Study of Origins*'; '*Variétés Morales et Politiques*' (1885); '*Alexandre Vinet*' (1890); '*Etudes Evangeliques*.' Among other works may be cited '*La Liberté Religieuse en Europe depuis 1870*' (1874). Consult biographies by Loyson (1891), Roussel (1894).

**Pressure.** See FORCE; POWER.

**Pressure Figures**, in mineralogy, are certain radiating lines developed by the pressure of a point on a crystal or cleavage surface. They are diagonal to the percussion figures (q.v.).

**Pres'ter John** (Priest or Presbyter John), a semi-legendary character of the Middle Ages. It was reported by travelers that there was a Christian prince who reigned in the interior of Asia under his name, and the same story was also known to the Crusaders. Albert of Aix and Otho of Freisingen speak of him in the 12th century; Rubruquis, in the 13th, attributes the name of Prester John to a Nestorian prince, Ung Khan, who had reigned in Karakoram over two Mongol tribes, and perished in a war against Genghis Khan, above half a century before the time of his journey. Other travelers of the 13th century also mention this personage. Who this Prester John was cannot be determined. The supposition that he was one of the chief priests of the Lamaites does not agree with the position assigned to his residence by the travelers, nor do any etymological explanations seem satisfactory. The Portuguese in the 15th century, hearing a story of a Christian prince in the interior of Africa, whose name was Ogan, and who was in fact the negus

(king) of Abyssinia, and being misled by the resemblance of the names Ogan and Ung Khan, made the mistake of transferring the throne of Prester John from Asia to Africa and giving the name to the Abyssinian prince. Consult: Oppert, '*Der Presbyter Johannes in Sage und Geschichte*' (2d ed., 1870); and '*The Book of Sir Marco Polo*' (Hakluyt Society, 1874).

**Pres'ton, Harriet Waters**, American translator and novelist: b. Danvers, Mass., 1843. At an early age she became noted as a linguist, and has since achieved a brilliant reputation as a translator from the Latin and Provençal languages, and as an essayist. In addition to translations of Mistral's '*Miréio*' (1873), Virgil's '*Georgics*' (1881), and several other works, she has published of her own original work: '*Aspendale*' (1881); '*Troubadours and Trouvères*' (1876); '*A Year in Eden*,' with Louise Dodge (1886); '*Private Life of the Romans*' (1893); '*Love in the 19th Century*' (1873).

**Preston, John Smith**, American politician and soldier: b. near Abington, Va., 20 April 1809; d. Columbia, S. C., 1 May 1881. He was graduated from the Hampden-Sidney College in 1824, studied at the University of Virginia and at Harvard, and after an extended tour of Europe settled in Columbia. He was a member of the South Carolina legislature in 1848-56 and gained a high reputation as an orator. He openly and ardently upheld the secession movement, headed his State's delegation to the Charleston convention in 1860, and in the following year became one of the commissioners to Virginia, where he made a brilliant speech urging secession upon that State. He was engaged at the first battle of Bull Run and afterward was assigned chief of the conscript department with the rank of brigadier-general. After the war he lived in Europe for a time, and after his return to the United States remained a bitter opponent of the government until his death.

**Preston, Margaret Junkin**, American author: b. Philadelphia, Pa., 1825; d. Baltimore, Md., 28 March 1897. She was married to John T. L. Preston of the Virginia Military Institute in 1857 and from that time until her husband's death lived in Lexington, Va. In 1855 she translated the Latin hymn '*Dies Iræ*' and in 1856 published her first book, a novel entitled '*Silverwood*.' Her subsequent work is almost entirely in verse and is characterized by deep religious feeling and an ardent espousal of the Confederate cause. She published: '*Beechenbrook*' (1866); '*Old Songs and New*' (1870); '*For Love's Sake*' (1886); '*Aunt Dorothy*' (1890); etc. Her diary, giving an interesting and valuable history of her life in the South, is published in part in Elizabeth Preston Allan's '*Life and Letters of Margaret Junkin Preston*' (1903).

**Preston, Thomas Scott**, American Roman Catholic clergyman: b. Hartford, Conn., 23 July 1824; d. New York 4 Nov. 1891. He was graduated from Washington (now Trinity) College in 1843, from the General Theological Seminary of the Protestant Episcopal Church in 1846, and held assistant rectorates in New York. Subsequently he entered the Roman Catholic Church, and after study at St. Joseph's Seminary, Fordham, N. Y., was ordained priest in 1850. He became chancellor of the diocese of New



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York, and in 1861 rector of St. Ann's, New York. In 1881 he was made monsignor, and in 1888 prothonotary apostolic. He vigorously opposed the land and labor movement of Henry George (q.v.), and was active in urging the excommunication of Dr. McGlynn (q.v.). Among his many controversial and devotional works are: 'Life of St. Vincent de Paul' (1866); 'Lectures on Christian Unity' (1867); 'Lectures on Reason and Revelation' (1868); 'Protestantism and the Bible' (1880); and 'God and Reason' (1884).

**Preston, William Campbell**, American legislator and educator: b. Philadelphia, Pa., 27 Dec. 1794; d. Columbia, S. C., 22 May 1860. He was graduated from the South Carolina College in 1812, studied law and was admitted to the bar in 1820. He established a law practice in Columbia, S. C., the next year, and speedily became prominent in his profession, excelling as a jury lawyer. He sat in the State legislature in 1828 and in 1830-2, where he boldly advocated nullification and won a high reputation as an orator. In 1836 he was elected to the United States Senate, but refused to act with his colleague, Calhoun, in the latter's support of Van Buren, and resigned his office in 1842. In 1845-51 he was president of the South Carolina College and proved an able and successful administrator. He established the Columbia Lyceum, which he endowed with his own library of 3,000 volumes. Consult O'Neill, 'Bench and Bar of South Carolina.'

**Preston**, England, an important manufacturing town of Lancashire, 28 miles northeast of Liverpool; on a height above the north bank of the Ribble, near the head of its estuary, and on the London & Northwestern and other railways. The river is spanned by five bridges. The handsome central railway station cost about \$1,000,000. Other important buildings are the Gothic town hall; court-house, in the Doric style; a new infirmary, the house of correction, the custom-house, corn-exchange, new gas-offices, large and handsome market-shed, extensive barracks, workhouse, theatre, and assembly-rooms; the Literary and Philosophical Institution, provided with a library and museum; the Harris Institute of Literature, Art, Science, and Technical Instruction (formerly the Mechanics' Institute, and now greatly enlarged); the Free Public Library and Museum, in the Grecian style, with many valuable paintings, etc. The ecclesiastical edifices include a number of established churches, besides Roman Catholic and other chapels. Among the former Christ Church is admired for the purity of its Norman architecture; and the parish church, which has been rebuilt in the decorated style of the 14th century, with a spire 196 feet high, is also a fine building. St. Walburge's Roman Catholic chapel, which has a beautiful spire 306 feet high, ranks as the most splendid place of worship in Preston. The town is supplied with water from reservoirs situated near Longridge, 18 miles northeast of Preston, with a capacity of 405 millions of gallons. On the south side of the town are two beautiful public parks, and on the north side of the town is the Moor Park.

The original staple manufacture of the town was linen, which is still woven, but has been completely eclipsed by the cotton manufacture, first introduced in 1777. There are steam saw-

mills, electrical engineering works, machine-shops, iron and brass foundries, railway-carriage works, breweries, malt-houses, roperies, tanneries, etc. A considerable shipping trade is carried on, though it was long obstructed by the condition of the Ribble. Since 1884 the river has been canalized and a dock of 40 acres built, besides two graving-docks and a timber-pond of 25 acres, with the necessary approaches, basins, gates, etc., and a very considerable increase in the trade has now taken place.

Preston is said to have risen on the decay of Ribchester, the Roman Rigodunum, situated about 11 miles farther up the river. Its name, originally Priest's town, it owed to the number of religious houses which it contained. About 600 it was a Saxon settlement; in 1323 it was taken and burned down by Robert Bruce; in 930 its first parish church was built; in the great civil war it espoused the Royalist cause, and suffered severely during the contest, having been twice captured by the Parliamentarians, who on the latter occasion were headed by Cromwell in person; in the rebellion of 1715 it was occupied by the Jacobite forces, who erected barricades and made a brave resistance, but were ultimately obliged to surrender at discretion. Pop. (1901) 118,220.

**Prestonburg, Engagements at and near.** In September 1861 Col. John S. Williams began to organize a Confederate force at Prestonburg, in eastern Kentucky, to operate in the interior of the State. On 8 November Gen. William Nelson, who had advanced against him with three Ohio regiments, detachments of Kentucky infantry and cavalry, and two sections of artillery, with a part of this force encountered a detachment thrown forward by Williams to cover his withdrawal. After a well-contested engagement at Ivy Mountain, Williams was forced from his position and retreated through Pound Gap into Virginia, with a loss of 10 killed, 15 wounded, and 40 missing. Nelson was recalled to Louisville, and Williams returned to Prestonburg. Gen. Humphrey Marshall had been ordered, 1 November, to the command of the Confederate forces in eastern Kentucky, including those of Williams and soon had in addition two Virginia regiments and a battery of four guns, making a total force of about 2,400 men, who were badly clothed, many of them barefooted, and generally badly armed, many of the men having only shotguns and squirrel-rifles. In the beginning of January 1862 Marshall had the greater part of his command intrenched near Paintsville, on the main branch of the Big Sandy River, a few miles north of Prestonburg. On 17 December Gen. Buell assigned Col. James A. Garfield to the command of a brigade of about 3,000 men, partly cavalry, and sent him against Marshall and to clear the valley of the Big Sandy. On the 23d, when Garfield began his march up the course of the river, the greater part of the brigade was concentrated at Louisa, on the Big Sandy. On 6 Jan. 1862, after driving in several scouting parties, Garfield arrived within seven miles of Paintsville. Marshall, well informed of his approach, fell back from Paintsville on the night of the 5th to the forks of Middle Creek, about three miles above Prestonburg. Garfield advanced through Paintsville, defeated Marshall's cavalry at the mouth of Jennis' Creek on the 7th, and on the morning



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of the 10th attacked Marshall on Middle Creek with cavalry and was repulsed by artillery alone. Garfield now attacked with infantry and the fight continued from noon to near dark with varying success, several Union advances being repulsed; but Marshall finally abandoned his position, though not retiring from the field until next morning, when, being out of food for his men, he marched to Martin's Mill. Garfield did not pursue. He crossed the river on the 11th and occupied Prestonburg, and on the 12th and 13th withdrew to Paintsville. Both sides claimed the victory. Garfield had 1,700 men on the field, and his loss was two killed and 25 wounded. Marshall had 1,500 engaged, and lost 11 killed and 15 wounded. Consult: 'Official Records,' Vol. VII.; The Century Company's 'Battles and Leaders of the Civil War,' Vol. I.

E. A. CARMAN.

**Prestonpans**, prēs-tōn-pānz', Scotland, a small town in the county of Haddington, on the Firth of Forth, nine miles east of Edinburgh, celebrated for the battle fought in the vicinity, 21 Sept. 1745, when the Highlanders, headed by Prince Charles, defeated the royal troops commanded by Sir John Cope. Pop. (1901) 1,721.

**Prest'wich**, SIR JOSEPH, English geologist: b. London 12 March 1812; d. Shoreham, Sussex, 23 June 1896. He was educated at University College, London, and continued his geological studies though engaged in business as a wine merchant. The Geological Society conferred a medal upon him in 1849, and he received like honors from the Royal Society in 1865 and the Institute of Civil Engineers in recognition of his contributions to science. In 1870 he became president of the Geological Society and in that year he retired from business. He became professor of geology at Oxford in 1874 and though advanced in years for the adoption of a new profession his vast learning and the vigor with which he approached his new task enabled him to fill the position with great success. His most important researches relate to the Tertiary deposits, which he rearranged and reclassified, and evidences concerning the existence of the prehistoric man. He also applied his knowledge to the practical question of obtaining from underground waters a better supply for cities. He retained his professorship at Oxford until 1888, was connected with various important scientific societies and in 1896 was knighted. His writings include about 140 papers of which the most notable are published in his 'Geology' (1886-8) and 'Collected Papers on Some Controverted Questions in Geology' (1895). Consult Lady Prestwich, 'Life and Letters of Sir Joseph Prestwich' (1899).

**Presump'tion**, in law, is a supposition held as good or real before it is shown or certainly known to be so. Presumptions are either *juris*, or *juris et de jure*. A legal presumption in law is one established in law till the contrary be proved. Thus, a person who has the possession of goods is presumed to be the owner, or a man is assumed to be innocent unless the contrary be proved. Presumptions are adopted from the necessity of arriving at some conclusion or other in most cases where the evidence is general or inconclusive. Thus, where a person has disappeared and has not been heard of,

the law will in general presume that he is still alive, unless after a lapse of time considerably exceeding the ordinary duration of human life; but if there be evidence of his continuous unexplained absence from home, and of the non-receipt of intelligence concerning him for a period of seven years, the presumption of life ceases.

**Pretender, The.** See STUART, JAMES FRANCIS EDWARD.

**Pretender, The Young.** See CHARLES EDWARD STUART.

**Preti**, prā'tē, **Mattia.** See CALABRESE.

**Pretoria**, prē-tō'rī-ā, South Africa, capital of the Transvaal Colony (q.v.); situated a short distance north of the small river Aapies, a tributary of the Crocodile, 4,500 feet above sea-level, 32 miles northeast of Johannesburg, 349 miles by rail west of Delagoa Bay, and 1,040 miles by rail northeast of Cape Town. The town is regularly laid out and many of the streets are planted with splendid willow-trees. The most important public buildings are: the government buildings, in Church Square, surmounted by a statue of Liberty; the post-office; the Dutch Reformed Church, in the centre of Church Square; the Anglican cathedral of St. Alban; a Roman Catholic church, with school and convent buildings; the Jewish Synagogue, a handsome building; the new market buildings; a palace of justice, in course of erection for the reception of the law courts; a public library, containing English and Dutch books; a museum; a gymnasium and training institute. The town is lighted by electricity, and public waterworks were opened in 1891. Just outside the town are the barracks formerly occupied by the Transvaal State Artillery, and near them the prison is situated. In 1896 the Boer authorities began the construction of a circle of six forts round the town, which since the war have been dismantled. Pretoria was founded in 1855, and was named in honor of Andries Pretorius, the first president of the South African Republic. In 1863 it replaced Potchefstroom as the seat of the central administration. In December 1880 the British garrison in Pretoria was besieged by a force of Boers, and on the retrocession of the country in the following year the town was evacuated by the British troops. The gold-rush which began about 1886, and the working of the natural wealth of the neighboring Witwatersrand, had a great influence upon the condition of Pretoria, which was rapidly improved in respect of architecture and sanitation. On 5 June 1900 the town was occupied, practically without opposition, by a British force under Lord Roberts, and then became the headquarters of the British operations in the South African war (q.v.). The population before the war was about 12,000.

**Pretorius** (Dutch, prā-tō'rī-ūs), **Marthinas Wessels**, Boer soldier and politician: b. Natal 1827; d. Potchefstroom, South Africa, 19 May 1901. He took part in the "Great Trek" of 1836, and in 1852 became commandant-general of the Boers. In 1860 he was elected president of the Orange Free State, in 1864 of the South African Republic. Re-elected in 1869, he soon afterward resigned. After Kruger's election in 1883, Pretorius took small part in the affairs of the republic, being persistently opposed to the war policy against Great Britain as destined event-



## PREVENTIVE MEDICINE

ually to subvert the independence it sought to secure. Pretoria, the capital of the Transvaal, was named in his honor.

**Preventive Medicine.** Generally the term "preventive medicine" has been regarded as almost synonymous with public hygiene, and its application has been confined to the operations of the sanitary authorities in the prevention of the infectious and communicable diseases. These operations have not in the past included even all of the more important communicable diseases, although the list in recent years has been considerably extended. Formerly cholera, plague, yellow fever, typhus fever, epidemic dysentery, smallpox, scarlet fever, diphtheria, and typhoid fever practically comprised all of the diseases which came specifically under the supervision of the public health authorities. Recently this list has been considerably increased by some sanitary boards. Many of the diseases referred to—for example, cholera, plague, yellow fever, epidemic dysentery—have practically passed from the supervision of the authorities, at least in the temperate zones, because either they no longer occur at all in these regions, or only occasionally a case or a group of cases appears and calls for specific action and supervision. The eradication of these epidemic diseases may be regarded as the greatest triumph of preventive medicine. It will of course be noted that public hygiene, or preventive medicine, in this restricted sense, has taken little or no cognizance as yet of many exceedingly important communicable diseases, such as syphilis, gonorrhœa, puerperal fever and, generally speaking, even of tuberculosis.

Preventive medicine in the proper sense has a very much broader scope than that indicated, and may be defined as the sum of all medical knowledge applicable to the prevention of disease—of all disease in the broadest sense, and not simply of the communicable diseases. It presupposes the widest knowledge of medicine, and has its essential foundation in our knowledge of the anatomy and causation of disease. Preventive medicine comprises therefore the prophylaxis of disease; it is general, comprising those measures which are applicable to the prevention of disease in the community (including especially the communicable diseases); and it is individual, as applied to the prevention of disease of all kinds in the individual members of the community. General prophylaxis refers to what are spoken of as preventable diseases, and these in the broad sense may be regarded as all of the infectious diseases which are communicable. Individual prophylaxis has a still wider scope and includes the whole sum of medical knowledge as applied to the prevention of disease (of all varieties) and the prolongation of life. General prophylaxis and individual prophylaxis do not always run along wholly parallel lines; for what is best for the individual is not necessarily best for the community. Preventive medicine is an applied science, and includes all purely medical knowledge applicable to the attainment of its aim. In securing its aim preventive medicine necessarily improves the general physical well-being of the individual, and thus life is rendered not only longer, but happier.

General prophylaxis attains its purpose in different ways. Through the establishment of sea quarantine it attempts to exclude infectious diseases which are endemic. These are spoken of

as "quarantinable diseases," and they of course must differ with locality, depending upon what communicable diseases are endemic in a locality. In the United States, plague, cholera, typhus fever, yellow fever, and leprosy are the diseases which the authorities especially attempt to exclude from the country. Scarlet fever, measles, diphtheria, and smallpox, being endemic, are not held at quarantine, but are referred to isolation hospitals for supervision until their termination. During recent years the quarantinable diseases have been almost completely excluded from this country. Occasionally a case has been admitted at some point, and a group of cases, or a localized epidemic, has followed; but in almost all instances the outbreaks have been of a restricted and local character. It does not seem probable that in North America there will ever again be any serious danger of the prevalence of cholera, plague, typhus fever, or leprosy. In dealing with the other communicable diseases specific methods have been devised, depending upon the nature of the disease and the method of its transmission. In some instances the attempt is made to destroy the cause, or prevent its entrance into the body; in other instances, to render the individual insusceptible to the cause and at the same time protect him from exposure to infection. For example, the cause of smallpox not being known, it is vain to attempt to destroy it in the individual; but as vaccination renders a person insusceptible to smallpox, it proves an absolutely efficient means for preventing the prevalence of this disease. In cities and countries where vaccination and revaccination are enforced smallpox rapidly disappears; and even when cases are introduced from without, the disease does not extend. Thus in Prussia, where there is compulsory vaccination in infancy and revaccination at different intervals later in life, smallpox practically does not exist. In different portions of the United States the prevalence of smallpox in epidemic form is determined in each instance by the thoroughness with which different communities have been vaccinated.

In typhoid fever the methods followed in prevention are of a different character. The typhoid bacilli which cause typhoid fever are practically always taken into the body through the mouth, usually in drinking-water or food. The commonest sources of infection are contaminated water, milk, and oysters, and also the direct infection of those in immediate contact with typhoid fever cases, by the transfer of the typhoid bacilli to the mouth on soiled hands, or from eating or drinking utensils. Aerial infection plays a small part in the causation of this disease. The prevalence of typhoid fever has been very greatly restricted by the protection of the sources of water-supply, by the application of sanitary measures to the collection of milk, and by proper disposal of sewage. Sewage is the medium through which the typhoid infection reaches the water-supply. Milk is infected, not when derived from the animal, but subsequently, from the washing of utensils with contaminated water, or in some similar way. As yet no active measures have been adopted by the sanitary authorities to prevent the contamination of shell-fish through the sewage-pollution of the water in which the shell-fish beds are situated. This is probably a much more common source of infection than has been generally supposed.



## PREVENTIVE MEDICINE

In the case of scarlet fever, measles, diphtheria, chickenpox, whooping-cough, and mumps, prophylactic measures comprise the removal of the sick, if possible, to special isolation hospitals designed for this purpose, and the adequate disinfection of clothing, rooms, furniture, bedding, etc., which may have become infected by contact with the sick. At present no other means are available, except in diphtheria, largely because of the lack of knowledge as to the exact causes of these diseases. In diphtheria, besides these measures, there is now a method for rendering the individual insusceptible to the disease for short periods by administering immunizing injections of diphtheria antitoxin. By these injections the individual may be rendered insusceptible to the disease (as in smallpox by vaccination), but the immunity is of short duration.

Many sanitary authorities are now adopting measures for the prevention of tuberculosis, which causes more deaths throughout the civilized world than any other single disease. Here again the problem of prophylaxis differs from that applicable to any of the other diseases mentioned. In tuberculosis the tubercle bacilli, which are the cause of the disease, are solely contained in the discharges from the diseased tissues, but the only form of tuberculosis (the disease may affect any organ or tissue of the body) in which the discharges containing the tubercle bacilli are likely to be a source of danger to others, is tuberculosis of the lungs, or pulmonary consumption. In this form, tubercle bacilli are frequently present in the expectoration in almost incredible numbers. The prophylaxis of tuberculosis is therefore practically comprised in the destruction of the expectoration of persons suffering from pulmonary tuberculosis at the time of its exit from the body. If this could be absolutely accomplished the transmission of tuberculosis from one person to another would be almost completely avoided. A common source of infection is probably present in the minute drops of atomized expectoration which are forcibly discharged into the air in coughing and sneezing, unless the mouth and nose are covered during these acts. The prevention of tuberculosis only requires the exercise of scrupulous care with regard to the expectoration, the removal to isolation hospitals of those who are unwilling, too ignorant, or unable because of weakness, to adopt proper precautions, and the disinfection of rooms, with their contents, which have been occupied by tubercular patients. There remain to be considered, aside from this prophylaxis as applicable to the human being, the measures necessary because of the possible transmission of the disease from animals, especially through the meat and milk of tubercular cows. But while this is a real danger, its importance has probably been greatly overestimated. It is now well known that tuberculosis very rarely exists at birth. It is never inherited, in the strict sense, and only in very exceptional instances does intra-uterine infection occur.

General prophylaxis has as yet scarcely touched upon many of the other infectious and probably, to some extent at least, preventable diseases. The venereal diseases have been ignored because the problem is so largely a social one. No preventive measures even promising in their character have been suggested for dealing with them. The prevalence of the puerperal

diseases has been very largely reduced through individual prophylaxis at the time of childbirth.

The diarrhoeal diseases of infancy are not as a rule properly to be regarded as communicable, but their prevalence has been greatly restricted through the work of health authorities in the sanitary control of milk and, to a less extent, of the water-supply. The reduction during recent years in the death-rate from diarrhoeal diseases of children under two, which has taken place almost everywhere in this country, is almost phenomenal; and indirectly the reduced prevalence of these diseases has materially decreased others brought on by them—diseases of malnutrition, such as rickets, etc. The results which have thus been accomplished have been due almost entirely to increased medical knowledge and its intelligent application to preventive medicine.

Preventive medicine, however, in the truest, broadest, and best sense, includes not only this work in the general application of medical knowledge to restricting the prevalence of the infectious diseases in the community, but also the application of medical knowledge to the protection of the individual from disease of all kinds at every stage in life from birth to old age; and it is this individual prophylaxis which has received the least attention either from the medical profession or from the people. Here is a very large field for intelligent work. A moment's consideration shows at once the impossibility of formulating general rules, or of applying the same rules to all individuals, for it is a matter of common observation that individuals differ widely in their physical and mental characteristics, susceptibilities, and tendencies. The occurrence in different families of certain similar types of disease in successive generations is a matter of general observation; and the influences which are injurious at one period in life may be not only not harmful but beneficial at another. It is most unfortunate, from this point of view at least, that the family physician of former times is so generally disappearing. The ideal family physician knew thoroughly the family histories of his patients, their tendencies, susceptibilities, weaknesses; he watched every stage in the life of the child from birth; he knew where to restrain, where to encourage, and what to prohibit, where dangers to their physical well-being lay, and how to advise them for self-protection. In earlier days when the knowledge of disease was less extensive than at present, it was not within the power of the physician to advise as wisely as at present. It is well known now that disease as such is never inherited. It is too much the custom to think of disease as a definite entity, whereas it is really only an abnormal process. It is not possible to see or examine disease, as it has no existence as such, but in some instances the causes of disease may be studied, as is the case in the infectious diseases due to known micro-organisms. In these may be investigated the micro-organisms causing the disease and the changes in the organisms produced by the germs; so also may be studied the abnormal manifestations of life which these changes produce, those manifestations which are called the symptoms of disease. The so-called inherited diseases which are of an infectious nature are simply instances of infection during intra-uterine life, as tuberculosis and syphilis. The diseases of metabolism, such as gout, diabetes, adiposity, etc., are not in-



stances of inherited disease, when they occur in different generations in the same family, as is frequently the case, but are the result of the transmission from parent to children of functionally inefficient organs, which break down under the demands laid upon them.

An absolutely efficient prophylaxis applied to the individual would permit the conduct of a physiological life from birth to its termination in a physiological death, occurring when the vital resistance with which the individual was endowed at birth was exhausted. With advancing medical knowledge and a higher civilization there should be a closer approximation to this condition in a larger and larger percentage of the population and a material prolongation of the mean life-time.

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**Prevost**, prě-vō', **Augustine**, English soldier: b. Geneva, Switzerland, about 1725; d. England 5 May 1786. He entered the army, served under Wolfe at Quebec as captain of the 60th regiment, and in 1778 captured the fort at Sunbury, Ga., for which service he was brevetted major-general. He commanded the forces which defeated Gen. John Ashe at Briar Creek in 1779, but failed in an attempt to capture Charlestown in that year. He distinguished himself by his successful defense of Savannah against the Americans in October 1779, and received full rank as major-general in recognition of his services.

**Prévost**, prā-vō, **Eugene Marcel**, French novelist: b. Paris, France, 1 May 1862. He was educated at the Polytechnic School in Paris and until 1891 was employed in a tobacco-factory at Lille. His conceptions are clever and well worked out, his style easy and usually graceful, but his later work, though brilliant, shows a tendency to the delineation of morbid emotional types. His first book, 'Le Scorpion' (1887), attracted great attention from its attack on the Jesuit system of education. His later works include: 'Chouchette' (1888); 'La Cousine Laure' (1890); 'Lettres des Femmes' (1892); 'Nouvelles Lettres des Femmes' (1893); 'Demi-vierges' (1894); 'Le Moulin de Nazareth' (1894); 'Notre Compagne' (1895); 'Le Jardin secret' (1897); 'L'heureux Ménage' (1901).

**Prevost**, prě-vō', **Sir George**, English soldier, son of Augustine Prevost (q.v.): b. New York 19 May 1767; d. London, England, 5 Jan. 1816. He entered the army in early youth, distinguished himself in the West Indies, was promoted major-general in 1805, and created a baronet later in the same year. In 1808 he was appointed lieutenant-governor of Nova Scotia and in the autumn of that year he conducted a division of troops to the West Indies where he participated in the capture of Martinique as second in command. He was made lieutenant-general in 1811, and appointed governor-in-chief of British North America. In the War of 1812 he rendered important service to his government, but his defeat at Plattsburg in 1814 forced him to abandon his attempt to invade New York and brought him under censure.

**Prévost d'Exiles**, prā-vō dĕg-zĕl, **Antoine François**, French author: b. Hesdin (Artois)

1 April 1697; d. near Chantilly 23 Nov. 1763. He was at first a Jesuit, then enlisted in the army, after a brief return to the order again turned soldier, and still later joined the Benedictines of St. Maur. Subsequently he lived in Holland and England, and in 1735 became almoner and secretary of the Prince de Conti. He founded 'Le Pour et le Contre,' a journal patterned after the 'Spectator,' which ran through 20 volumes (1733-40); translated Richardson and Hume's 'History of England'; and wrote a 'Histoire des Voyages' (1747-80), and several works of fiction, including 'Le Doyen de Killérine' (1732-5). 'Mémoires et Aventures d'un Homme de Qualité qui s'est Retiré du Monde' (1728-56), which includes 'Manon Lascaut,' a story of some celebrity in French literature, frequently reprinted, and the basis of a drama (1851) by Barrière and Fournier, and 'Contes, Aventures et Faits Singuliers' (1764). A selection from his works appeared at Paris in 1810-16. Consult Harisse, 'L'Abbé Prévost' (1896); and the study by Schroeder.

**Prévost-Paradol**, prā-vō pä-rä-döl, **Lucien Anatole**, French writer: b. Paris, France, 8 Aug. 1829; d. Washington, D. C., 11 Aug. 1870. He was educated at the Collège Bourbon and the Ecole Normal, was editor of 'La Revue d'Histoire Universelle' in 1854, and in 1855 accepted the chair of literature at the University of Aix, but resigned in 1856 to become editor of the Paris 'Journal des Débats.' As a journalist, his keen irony, his brilliant, forcible style, rendered him a formidable adversary. A believer in constitutional government he was opposed to Napoleon III. His articles were instrumental in recalling the French army from Mexico, but his contributions to the 'Courrier du Dimanche' caused the suppression of that journal in 1866. After the formation of the Ollivier ministry in 1870 he became reconciled to the empire and accepted the post of ambassador to the United States. His reception at Washington was very different from his expectations, public opinion being in sympathy with the Germans rather than the French in the Franco-Prussian troubles. The formal attitude of the Administration, and the trying conditions generally, preyed upon his mind and he committed suicide shortly after his arrival. His editorials are still considered models of journalistic style and his books include: 'Du Rôle de la Famille dans l'Education' (1857); 'Quelques Pages d'Histoire Contemporaine' (4 vols., 1862-6); 'La France Nouvelle' (1868).

**Preyer**, pri'ēr, **Wilhelm Thierry**, German physiologist: b. Manchester, England, 4 July 1841; d. Wiesbaden, Germany, 15 July 1897. He was educated in the universities of Bonn, Berlin, Heidelberg, Vienna, and Paris, took degrees in both philosophy and medicine, and in 1869 was appointed professor of physiology at Jena. In 1888 he became privat-docent at Berlin. He has made valuable investigations in the fields of quantitative spectral analysis, the perception of sound and the precise qualities of the senses. Of his books the most famous is 'Die Seele des Kindes' (1881), and especially deserving of mention are: 'Ueber Empfindungen' (1867); 'Ueber die Grenzen der Tonwahrnehmung' (1876); 'Elemente der allgemeinen Physiologie' (1883); 'Der Hypnotismus' (1890).



## PRIAM — PRICE

**Priam**, *prī'am*, the last king of ancient Troy, was the son of Laomedon and Strymo or Placia. He was the 6th of the Trojan kings and reigned 40 years. His territory included Lesbos, Mysia, and the Hellespont. When a youth he marched with the Phrygians against the Amazons, and went as ambassador to the Thracians. After the death of his father he reigned in Troy. By his first wife, Arisbe, daughter of Merops, he had Æsacus. He afterward gave Arisbe to Hyrtacus, and married Hecuba, by whom he had, according to Homer, 19 children, among whom Hector, Alexander or Paris, Creusa, Laodice, Polyxena, Cassandra, Deiphobus, Helenus, Pammon, Polites, Antiphus, Hipponous, Polydorus, and Troilus were the most distinguished. By four concubines he also had 30 sons and four daughters. When he was extremely old the Greeks demanded of him the restoration of Helen, who had been carried away by Paris, and on his refusal to give her up they made war against Troy, took and destroyed the city, after a siege of 10 years, his son Hector having already fallen. According to later legends, when the Greeks entered the city he armed himself, to seek death in the midst of the enemy; but Hecuba prevailed upon him to take shelter at the altar of Zeus. Here he saw his son Polites fall by the hand of Pyrrhus; and, unable to contain himself, hurled his javelin at the youth, who dragged the old man by the hair from the altar and plunged a sword into his breast.

**Priapus**, *prī-ā'pūs*, in Greek mythology, a field and garden god especially honored in Lampsacus, a town of Mysia, situated in a rich wine country. Aphrodite bore him to Dionysus when the latter was returning from India, though his father unwillingly acknowledged him on account of his ugliness. The first fruits of the crops were offered to him as the god of the fields, the protector of gardens, bees, goats, and sheep. Homer and Hesiod do not mention him and it was only in later times that he was honored with divine worship. He was represented with horns and goat's ears, and large phallus, having in his lap all kinds of fruits; in his hand he held a sickle, and usually a horn of plenty. His worship spread from Lampsacus to Greece and thence to Rome. He represents the productive power of nature and is the god of sensual pleasure.

**Priber**, *prē-bār*, **Christian**, French Jesuit in America. He came among the Cherokee Indians in 1736 and took up his residence with them in Great Tellico Town in what is now East Tennessee. Intending to make a dictionary and grammar of the Cherokee language he adopted the dress of the Indians to lessen their feeling of his being a stranger, meanwhile striving to civilize and convert them. His influence among the Cherokees grew to such an extent that they adopted a code of laws he prepared for them thereby exciting the distrust of the English government of South Carolina. Fearing French influence the English demanded Priber from the Indians, who refused to surrender him, and the safety of the English envoy was secured only by Priber's interference. But while traveling in Alabama in 1741 he was seized by the English authorities and cast into prison in Frederica, Georgia, where he soon died.

**Pribilof**, *prē'bē-lōf* (sometimes called **Pribylov**, or **SEAL**). a group of islands in Bering Sea, belonging to Alaska; about 200 miles north of the Aleutian Islands and 320 miles west of Bristol Bay. The largest islands of the group are Saint George and Saint Paul. The total area is about 180 square miles. This group is of great importance as here is the breeding place of the fur-seal. The winter home of the fur seal has not (1904) been discovered; about May they come to Pribilof Islands, where the fog hangs over the land almost continuously. The islands were discovered the last of the 18th century by Gerassim Pribylof (or Pribyloff), a Russian, and first mate on the boat Saint George. He had been drifting about in the Bering Sea, looking for the breeding place of the fur-bearing seal, and at last he found the place. He took possession of the island (saw only one at first) for Russia, his country, and he named the island Saint George after his boat. Later the second island was discovered and called Saint Paul and the whole group was named after its discoverer. There are on the islands about 400 permanent residents.

**Price**, **Julius Mendes**, English traveler: b. London, England. He was educated in Brussels and at the Ecole des Beaux Arts, Paris; entered journalism and was a special artist-correspondent of the 'Illustrated London News.' In 1884-5 he served in the army with the Bechuanaland campaign in South Africa and has since engaged in various exploring expeditions in Siberia, Mongolia, China, western Australia, etc. He was with the Greek army in the Græco-Turkish war in 1897, was engaged in an expedition in the Northwest Territory, Canada, and the Klondike in 1898, and was in China in 1900-1. He has published: 'From the Arctic Ocean to the Yellow Sea' (1892); 'The Land of Gold' (1896); 'From Euston to Klondike' (1898); etc.

**Price**, **Langford Lovell**, English political economist: b. England 20 July 1862. He was educated at Trinity College, Oxford, was lecturer to the Toynbee Trust in 1886-7 and in 1895-6 was lecturer in statistics at University College in London. He was examiner at Victoria University in 1898 and in 1903 was called to that position at the University of Wales. He has published: 'Industrial Peace' (1887); 'Money and its Relation to Prices' (1896); 'A Short History of English Commerce and Industry' (1900); etc.

**Price**, **Richard**, British Unitarian clergyman and political economist: b. Tynton, Glamorganshire, Wales, 22 Feb. 1723; d. London 19 April 1791. In 1758 he became pastor of a Unitarian congregation at Hackney, where he continued as long as he lived. He published in 1758 'Review of the Principal Difficulties in Morals,' which was followed by 'Four Dissertations on the Importance of Christianity, the Nature of Historical Evidence, and Miracles, etc.' (1767). In 1771 appeared his 'Observations on Reversionary Payments and Annuities,' succeeded by the celebrated 'Northampton Mortality Tables,' and other valuable works relating to life assurance and annuities. He also published 'Appeal to the Public on the Subject of the National Debt'; and during the contest with the North American colonies, 'Observa-



## PRICE — PRICKLY PEAR

tions on the Nature of Civil Liberty' and the 'Justice and the Policy of the War with America' (1776). This work was widely circulated in this country, and Congress, through Franklin, expressed its desire to receive his assistance in regulating the national finances. When Pitt became prime-minister he consulted Price in his schemes for the reduction of the national debt, and the establishment of the sinking fund was by his recommendation. Consult Morgan, 'Memoirs of the Life of Richard Price' (1815).

**Price, Sterling G.** American soldier: b. Prince Edward County, Va., 11 Sept. 1809; d. Saint Louis, Mo., 29 Sept. 1869. He was educated at Hampden-Sidney College, studied law, removed to Chariton County, Mo., in 1831, and in 1840 was elected to the Missouri house of representatives, of which he was speaker until 1844 when he was elected to Congress. He resigned on the outbreak of the Mexican War and organized a cavalry regiment of which he was commissioned colonel. Under General Kearney he marched with his men from Fort Leavenworth to Santa Fé where he was left in charge, and upon being attacked by the Mexicans he repulsed them severely and completed the conquest of California. In 1847 he was promoted brigadier-general of volunteers, became military governor of Chihuahua, and in 1848 won a decisive victory over the Mexicans at Santa Cruz de Rosales. In 1853-7 he was governor of Missouri, and in 1861 presided over the convention called to decide the secession question. He was a "Conditional Union" man but later joined the Confederacy, and in 1861 was appointed major-general of State forces, participating under Gen. Ben McCulloch in the defeat of the Union forces at Wilson's Creek in August of that year. He then captured Lexington on the Missouri, but was forced to retreat before Frémont. He served under Van Dorn at Pea Ridge in 1862 and was promoted major-general in the Confederate army. He commanded one wing of Van Dorn's army at Corinth. He was defeated by Rosecrans at Iuka, Miss.; accompanied Beauregard in his retreat to Tupelo, and afterward serving in the Trans-Mississippi department, was there engaged in the unsuccessful attempt to capture Helena in 1863. In 1864 he succeeded in preventing General Steele's advance toward Red River, and later made a raid into Missouri. He was driven into southwestern Arkansas toward the close of the war and after the surrender he lived in Mexico until 1866. Consult Snead, 'The Fight for Missouri' (1886).

**Price, Thomas Randolph,** American educator: b. Richmond, Va., 18 March 1839; d. New York 7 May 1903. He was graduated from the University of Virginia in 1855, studied in Berlin and Kiel, and in 1861 returned home to enlist in the Confederate army in which he served through the war as a private and on the staff of Gen. Stuart. In 1867 he became professor of Latin and Greek at Randolph-Macon College, later being transferred to the Greek and English chair, and in 1876 was appointed to the chair of Greek and Hebrew in the University of Virginia. In 1882 he was called to Columbia University as professor of English language and literature and remained at the head of the department until his death. He

published: 'The Teaching of the Mother-Tongue' (1877); 'Shakespeare's Verse Construction' (1889); edited 'Othello' in the Bank-side Shakespeare (1890); etc.

**Prich'ard, James Cowles,** English ethnologist and physician: b. Ross, Herefordshire, 11 Feb. 1786; d. London 22 Dec. 1848. He studied medicine at Edinburgh, began practice at Bristol in 1810, and in 1814 became physician to the Bristol infirmary. In 1813 he published 'Researches into the Physical History of Mankind,' in one volume, but in the 3d edition (1849) extended to five; 'The Eastern Origin of the Celtic Nations' (1831); 'Natural History of Man,' which has been translated into both French and German (1843); 'Insanity and Other Disorders Affecting the Mind,' long a standard authority (1835); 'Different Forms of Insanity in relation to Jurisprudence.' In 1845 he was appointed one of the London commissioners of lunacy.

**Prickly Ash,** any of several prickly shrubs of the United States of the rue family (*Rutaceæ*) and genus *Xanthoxylum*, especially *X. clava-herculis*, whose aromatic and pungent bark is used in the southern States as a rustic remedy for toothache. In the south this bush is therefore known as toothache-tree and pepper-wood.

**Prickly Heat.** See MILIARIA.

**Prickly Pear,** a genus (*Opuntia*) of American cactus. About 130 species have been recognized in the region they occupy from British Columbia through the western States, Central America and West Indies to southern South America. They are very variable in their specific characters, and the lines between species are very indistinctly marked. Some are very dwarf prostrate plants; others are tree-like in height and spread of top. They have club-shaped, cylindrical or flat spiny or hairy, fleshy stems, and except upon the youngest joints bear no leaves. These leaves drop off very soon. The flowers, which are borne near the upper parts of the joints or stems and on the most bristly parts, are solitary or in corymb-like panicles and are usually yellow and very showy. The fruit is a modified stem, the ovary being sunken in its apex. It varies with different species from dry to fleshy and succulent, in many species being edible. Prickly pears were in cultivation among the natives when America was discovered, and were introduced by the Spaniards to the Mediterranean region, and finally to Asia, South Africa, Australia, etc. In all these places they are now regarded as troublesome weeds, though in many they are valued for their fruit. In Sicily they are one of the chief crops, the peasants living mainly upon the fruit from July to November. Since some of the varieties will produce about nine tons of fruit to the acre upon land too rocky, thin or poor for other crops; since this production can be counted upon for a long series of years without any cultivation after the plants become established (in three years or less, usually); and since they are highly nutritious, their value is not over-estimated in climates adapted to their culture; namely, dry and frostless. They contain about 14 per cent of sugar and nearly 2 per cent of fat. A crop of nine tons per acre would, therefore, be equivalent to about 2,500 pounds of sugar.



## PRIDE — PRIENE

In view of these statements it seems strange that attention has not been directed to improvement of varieties, etc. They have not been ranked with horticultural fruits, though they are of far more economic importance than many that are. In many sections they are used for stock feeding, especially in seasons of drought. The spines are generally rubbed or burned off, but cattle often eat them without this treatment, and frequently suffer death because the spines pierce their intestines. The plants are most used for fodder in the western States, Africa and Australia. In Tunis, dairymen are rarely without a plantation of prickly pear for their herd. The plants are also planted for ornamental purposes in gardens and greenhouses in many parts of the world not adapted to their cultivation; and in places adapted to them they are favorite hedge plants. The most esteemed species are probably the Indian fig (*O. ficus-indica*), the tuna (*O. tuna*), *O. engelmanni*, and *O. fulgida*, the first two being especially valued for the fruit, the last two for their fodder. *O. vulgaris* is a common species in the eastern States and is hardy as far north as Massachusetts.

**Pride, Thomas**, English Parliamentary officer: d. Nonsuch 23 Oct. 1658. Having been a drayman and a brewer, he began service in the civil war as ensign under the Earl of Essex, and was finally promoted colonel. As a soldier he won considerable distinction, being conspicuous at Preston (17-19 Aug. 1648), and commanding a brigade in the Scottish campaign. An extreme anti-Royalist, he was selected by the army to exclude the Royalist members from the House of Commons. (See PRIDE'S PURGE.) He was one of the judges of Charles I., whose death-warrant he signed. During the lord-protectorship of Cromwell, he was knighted and made a member of the newly organized House of Lords. On the Restoration, it was voted his body be exhumed and hanged with that of Cromwell on Tyburn gallows. Noble, author of 'The Lives of the Regicides,' says, however, that in Pride's case the sentence was not carried out.

**Pride and Prejudice**, a novel by Jane Austen, written in 1796, when the author was but 21, but not published till 1813. The theme is extremely simple: merely a history of the gradual union of two people, one restrained by unconquerable pride and the other blinded by prejudice; but in spite of little plot, the interest is sustained through the book.

**Pride of India, Price of China**, a tree (*Melia azedrach*), of the mahogany family, a native of Syria, Persia, and the north of India, and cultivated in different parts of the world as an ornamental tree. It grows to the height of 30 or 40 feet with a trunk of 20 inches diameter; but in open spaces it is spreading and not so high. Its leaves consist of smooth, pointed, dark green leaflets, arranged in pairs with an odd one at the end. The flowers, hanging in clusters at the ends of the branches, are of lilac color and agreeable perfume. They give place to bunches of berries about as large as cherries, and yellow when ripe. The fruit is sweetish, and edible, though generally supposed to be poisonous. In the cities of the Southern States where the tree was introduced by the elder Michaux, early in the 19th century and

upon many of the plantations rows of Pride of India trees are very common, and in autumn the branches and the ground beneath are covered with their berries. A decoction of the bark of the root is administered as a cathartic and vermifuge. In large doses it is said to produce narcotic effects, and such appears to be the action of the ripe berries upon the robin red-breasts, which are very fond of them, and eat them until they become stupefied and fall to the ground. From this state, however, they soon recover.

**Prideaux, prid'ō, Humphrey**, English scholar and divine: b. Padstow, Cornwall, 2 May 1648; d. Norwich 1 Nov. 1724. He was graduated from Christ Church, Oxford, in 1672 and was appointed rector of Saint Clement's, Oxford, in 1679, prebend at Norwich in 1681, archdeacon of Suffolk in 1688, and in 1702 became dean of Norwich. He was a man of studious habits, a deep thinker, acquired a vast store of knowledge, and a wide reputation for judgment, integrity, and wisdom. His greatest work was entitled 'The Connection of the History of the Old and New Testaments' (4 vols., 1715-18). Among his other works are 'Marmora Oxoniensia' (1676); 'Life of Mahomet' (1697).

**Prideaux, John**, English soldier: b. Devonshire 1718; d. near Fort Niagara, N. Y., 19 July 1759. He entered the army in early youth, and attained the rank of brigadier-general in 1759. In that year he was given command of one of the four divisions which were sent to conquer Canada, and while Amherst, Wolfe, and Stanwix co-operated in the north, Prideaux attempted the reduction of Fort Niagara, one of the strongest fortresses in possession of the French. He landed before the fort on 7 July and opened an attack, repelled a sortie on 11 July and on the 19th prevented the landing of the French reinforcements sent by Frontenac, but was killed in the trenches on the same day by the premature bursting of a shell. His work was not without results, however, as the fort surrendered on the 24th.

**Pride's Purge**, the familiar name for the forcible exclusion of Royalist members from the House of Commons in 1648 by Colonel Thomas Pride (q.v.). Both houses of Parliament voted by large majorities to accept the terms offered by Charles I. The Council of Officers thereupon determined to expel members of the majority from the House of Commons, and on 6 Dec. 1648 Colonel Pride, acting under instructions from Fairfax, took his stand with a guard at the entrances to the Commons, forcibly prevented the entrance of about 90 members, and arrested above 40 others. The Independents were thus free to act in co-operation with the army. The few peers left in the Upper House made vain opposition to the measures of the decimated Commons, by which they were quite ignored, the Lower House passing a resolution that the Commons of England "have supreme power in this nation." See ENGLAND, History.

**Priene, pri-ē'nē**, in ancient history, a city of Ionia at the mouth of the Gæson in early times, but because of the alluvial deposits of the Mæander finally lay several miles from the coast. One of the 12 cities in the Ionian League, Priene was conquered by Lydia, and on Cræsus' overthrow became the property of Persia. The



great temple of Athene Polias, the scene of the festival called the Panonia, was here; a dedication upon it by Alexander the Great is now in the British Museum. The plan of the ancient city has been made plain by explorations made in 1895-9 under the management of the Royal Museum in Berlin. Consult Lenschau, 'De Rebus Prienensium' (1890).

**Priessnitz**, prēs'nīts, **Vincenz**, German peasant, founder of the Kaltwasserkur, or system of hydropathy (q.v.): b. Gräfenberg, Austrian Silesia, 4 Oct. 1799; d. there 28 Nov. 1851. Having effected by the application of cold water a cure of a severe injury he had received, he subsequently employed it in local cases as a healing agent. Two English physicians, Sir John Floyer and Dr. Currie of Liverpool, had anticipated him in advocacy of the method, and a Silesian, Hahn, had published a book on it derived largely from a work by Floyer. But Priessnitz was the first to develop hydropathic practice. He established an institution at Gräfenberg which was much frequented, among the guests being many physicians who came to study his claims. He wrote nothing himself, but many records of experiences of his cure, most of them favorable and many enthusiastic, were written by others. Consult the study by Selinger (1852); and Philo von Walde, 'Priessnitz als Begründer des Wasser- und Naturheilhahrens' (1897).

**Priest**, **Josiah**, American author: b. New York, about 1790; d. western New York, about 1850. He was an unschooled man, a harness-maker by trade; but published several books, some of which became very popular. Among them were: 'Wonders of Nature' (1826); 'View of the Millennium' (1828); 'Stories of the Revolution' (1836); 'American Antiquities' (1838); and 'Slavery in the Light of History and Scripture' (1843).

**Priest**, one who performs the sacred rites of any religion, especially the sacrificial rites, and who is thus a mediator between the Deity and men.

In primitive times the function of priesthood was inherent in the head of a family, the *pater familias*; but as states were organized priesthood on behalf of the people was assumed by the chief or king, or was exercised, under him, by a special order of men; but still the rites of domestic religion would continue to be performed by the head of the household. In early Greece and Rome when kings were banished and the power of the state came into the hands of elected magistrates the priestly office of the king, or his headship in religious affairs, was vested in the *archon basileus* as at Athens, or the *rex sacrorum* as at Rome; the term King (*basileus rex*) being retained after kingship had been done away, doubtless because of some religious scruple, lest the gods should resent the lowering of the appellation of the head of the state religion. The priests of the state religion were now appointed by the public authority, whether their functions were general or were restricted to the service of special gods in special temples.

In Rome there never was in pagan times anything like a priestly order or priestly caste or class, as the order of knights (*equites*) or patricians (*patricii nobiles*), nor was priesthood

hereditary. In Greek states the priestly service in certain temples and places was restricted to certain families; for the rest, the priesthood was a function of the state. In Egypt the priesthood was a very close corporation, the members of which, with the king at their head, were the supreme arbiters of civil and even military as well as of religious affairs: the priesthood alone possessed whatever science existed of the mysteries of religion or of the secrets of statecraft, or the laws of nature.

In primitive Israel, as in other primitive societies, priesthood was the attribute of the father of the family: the priest by vocation, as a man set apart to minister on behalf of the people in their relations to the Deity, does not come into view till the Mosaic epoch; and the fully developed priestly system of Israel did not come into existence till the time of Solomon or even, perhaps, till after the return of the people from Babylon and the building of the second temple at Jerusalem by Zerubbabel in 520 B.C., nearly 500 years after Solomon's reign. Before the building of Solomon's Temple there were in Israel several temples or sanctuaries with oracles that were consulted to ascertain the will and pleasure of Jehovah, and with priests as their interpreters; and the priests and the Levites constituted a distinct order of society; but after the secession of northern Israel every devout king of Judah earnestly sought to suppress religious worship or sacrifice everywhere save in the central national Temple: this end was not achieved till after the return of the captives from Babylon. Henceforth the worship even of the true God elsewhere than in the Temple at Jerusalem was denounced as impious and little different from worship of false gods. The entire priestly order was massed in Jerusalem and its neighborhood; the priests were distributed into 24 classes each presided over by a chief priest, and each class of priests ministering in the Temple one week in rotation: over the whole priesthood presided the High Priest, believed to be always a lineal descendant of Aaron, the brother of Moses.

The ministers of the several religions mentioned, as well as those of Phœnicia, Babylon and other countries, are styled in English "priests": in Hebrew, Greek and Latin respectively the priest is *Kohen*, *hiereus* and *sacerdos*. But the English word priest, derived from the Greek *presbyteros*, an elder person, has not in itself any denotation of sacrifice or of priestly function but only of maturity of age.

In the Greek New Testament the priest of the Jewish law is always called *hiereus* and in the Latin Vulgate version *sacerdos*, never *presbyteros*, or *senior* (elder). On the other hand, neither in the Greek original nor in the Vulgate Latin version of it is *hiereus* or *sacerdos* ever said of the minister of the religion of Jesus Christ, but always *presbyteros* and *presbyter*; and in the authorized English version *presbyteros* is invariably rendered elder, never priest. Nevertheless, in the Book of Common Prayer of the Anglican Church and in that Church's Articles of Religion the word priest is everywhere employed instead of elder; but this "priest" of the Prayer Book is not *hiereus*, *sacerdos*, a sacrificing priest; for in the Articles the sacrificial function of the priest of the Catho-



lic Church is classed with "blasphemous fables and dangerous deceits." Hence for the Anglican Church, as for all the other Protestant Churches, the priest, presbyter or elder is not the minister of a sacrifice. It is different in the Catholic Church and in the numerous heretic and schismatic churches of the East. Those churches teach, with the Church of Rome, that in the Christian dispensation it is the chief office of the priest to offer sacrifice, namely, the eucharistic oblation, which is a perpetual representation of the offering made on Calvary. In the belief of those churches the mass is the self-same sacrifice which Christ offered—the victim the same, the priest the same: for the victim is Jesus Christ, his body and blood; and the priest is the incarnate Son of God in heaven, the High Priest, who is represented in the mystic offering by the priest who ministers at the altar.

It is worthy of mention that till the middle of the 3d century no extant writing of any of the fathers employs the Greek or the Latin word for priest (*hiereus*, *sacerdos*) to designate the *presbyteros*. In the Roman pontifical the order of the priesthood is called both *presbyteratus* and *sacerdotium*.

**Priestley**, prĕst'li, **Joseph**, English physicist and Unitarian divine: b. Fieldhead, Yorkshire, 13 March 1733; d. Northumberland, Pa., 6 Feb. 1804. After a secondary education he accepted an invitation to become Presbyterian minister of Needham Market, Suffolk, on an average salary of £30 a year. After three years he took charge of a congregation at Nantwich, Cheshire, to which he joined a school. Here his reputation increased, and in 1761 he was invited by the trustees of the Dissenting academy at Warrington to occupy the post of tutor of languages and belles-lettres under Dr. Aiken. A visit to London having introduced him to Drs. Franklin, Watson, and Price, he was encouraged to compose a 'History of Electricity,' which appeared in 1767. In the same year he became minister, at a salary of £100 a year, of the Mill Hill chapel at Leeds, where his religious opinions grew decidedly Unitarian. At Leeds his attention was first drawn to the properties of "fixed air" (carbonic acid gas); and about this time he completed his 'History and Present State of Discoveries relating to Vision, Light, and Colors.' In 1771 he agreed to accompany Captain Cook on his second voyage in the capacity of astronomer, but his appointment was cancelled, as the Board of Longitude objected to his theology.

After six years at Leeds he accepted an invitation from the Earl of Shelburne, afterward Marquis of Lansdowne, to reside with him as a companion in the nominal capacity of librarian. While forming a part of the establishment of this nobleman, he occupied himself in scientific pursuits, and in 1773 gave to the 'Philosophical Transactions' a paper on the different kinds of air, which obtained the prize of Copley's gold medal. On 1 Aug. 1774 he discovered oxygen or "dephlogisticated air," as he called it, a result quickly followed by other important discoveries, such as nitrous gas, nitrous oxide gas, sulphurous oxide gas, fluoric acid gas, muriatic gas, and ammoniacal gas, etc. By these exploits he may be said to have been almost the first to render chemistry a precise science. In 1775 he

published 'Examination of the Doctrine of Common Sense, as held by Drs. Reid, Beattie, and Oswald,' and soon after the treatise of Hartley. He had already declared himself a believer in the doctrine of philosophical necessity, and in a dissertation annexed to his edition of Hartley expressed some doubts of the immateriality of the sentient principle in man. This doctrine he still more forcibly supported in his 'Disquisitions on Matter and Spirit' (1777). Probably because of his "materialistic" views, the connection with Shelburne was dissolved in 1780, Priestley retaining an annuity by original agreement. He next removed to Birmingham, where he became once more minister of a non-conformist congregation, and occupied himself on his 'History of the Corruptions of Christianity' (1782), and 'History of the Early Opinions concerning Jesus Christ' (1786). With Erasmus Darwin, Watt, Boulton, Wedgwood, and other famous men he founded the now celebrated Lunar Society, which rendered Birmingham for the time of its existence almost the intellectual centre of England. His 'Familiar Letter to the Inhabitants of Birmingham' was written in support of the claims of Dissenters for a repeal of the test acts. The era of the French Revolution, whose principles Priestley vindicated, added to the usual animosity of theological dispute. The anniversary of the capture of the Bastille being celebrated at Birmingham, a mob assembled, and although Priestley was not present, burned his house, and nearly all his library, manuscripts, and apparatus. The outrage was countenanced by too many exercising both lay and clerical influence, and the legal compensation which he obtained fell short of his real losses by about £2,000. On 1 Aug. 1874, Birmingham made some amends for the wrong done to her greatest citizen, by the erection of a marble statue of him in front of the town-hall. On quitting Birmingham (1791) he succeeded his friend Price as preacher in the Gravel Pit Chapel, Hackney, where he remained some time in the cultivation of his scientific pursuits, until finally goaded by party enmity to seek an asylum in the United States, which he reached in 1794, and took up his residence at Northumberland, Pa. In America he dedicated his whole time to his accustomed pursuits. Some discourses of his led to the formation in Philadelphia of a Unitarian congregation, and he held private meetings in his own house. He was never naturalized; and, curiously enough, never learned to make change in United States coinage. Priestley was an ardent controversialist, chiefly in consequence of extreme simplicity and openness of character; but no man felt less animosity toward his opponents than he did, and many who entertained the strongest antipathy to his opinions were converted into friends by his gentleness and urbanity in personal intercourse. As a man of science he stands high in the field of invention and discovery, and to few has pneumatic chemistry been so much indebted. On his own admission his researches in his favorite science were superficial, and his great discoveries to a considerable extent accidental. But this should detract nothing from the honor due to the earnest pioneer. As a metaphysician his elucidation of Hartley's theory of association, his works upon philosophical necessity and upon



## PRIESTS OF THE MISSION—PRIMATES

materialism, will always insure attention. As a theologian Priestley, who followed his convictions wherever they led him, passed through all changes, from Calvinism to a Unitarian system in some measure his own; but to the last remained a zealous opposer of infidelity. Of his theological and controversial productions, those most generally esteemed are his 'Institutes of Natural and Revealed Religion' (1772-4), and 'Letters to a Philosophical Unbeliever' (1780-2). He also wrote many works of practical divinity. There is an edition of his 'Theological and Miscellaneous Works, with Memoirs and Correspondence' (1817-32).

**Priests of the Mission.** See LAZARISTS.

**Priests of Saint John the Evangelist.** See ORDERS, RELIGIOUS.

**Prigg Case, The,** in American history, a famous slave case tried in 1837. Edward Prigg caused a fugitive Maryland slave-woman to be returned to her mistress, in violation of a Pennsylvania statute forbidding the carrying of any negro out of the State in order to enslave him. The case was finally brought before the Supreme Court of the United States, where it was contended that the statute was unconstitutional since it conflicted with the National Fugitive Slave Act of 1793. The opinion was handed down that the national law must be carried out by national authorities alone.

**Prim, Juan,** hoo-än' prēm, COUNT DE REUSS, MARQUIS DE LOS CASTILLEJOS, Spanish general and statesman: b. Reuss, Catalonia, 6 Dec. 1814; d. Madrid 30 Dec. 1870. Destined for the law, he entered the ranks of the volunteers in the cause of the infant queen Isabella on the outbreak of the civil war, which in 1833, followed the death of Ferdinand VII. At its close in 1839, Prim threw himself into politics, and when Queen Maria Christina quitted Spain, worked in behalf of the Progresista party against Espartero, who, 8 May 1841, had assumed the regency. In May 1843 he led the insurrectionist forces against Espartero, and upon the downfall of the Espartero ministry was rewarded by the queen by being created successively brigadier-general, Count de Reuss, and in 1843 governor of Madrid. Suspected later of conspiracy against the government in 1844, he was sentenced to six years' imprisonment but was released after six months, and made governor of Porto Rico. Distinguishing himself in the war against Morocco at the battle of Los Castillejos, 1 Jan. 1860, he was given the title of Marquis de los Castillejos. He commanded the Spanish expedition, which acting jointly with the French and English landed in Mexico early in 1862 to enforce claims of indemnity against that country, but withdrew his troops almost immediately. Again accused of conspiracy, he was banished in 1864, but headed an uprising in January 1866 against the government and was compelled to flee to England in 1867. From there he gave support to a revolution started in Spain that summer and in September suddenly appeared in Cadiz and fought against the government in the military revolution headed by Topete and Serrano. Upon the defeat of the government Serrano appointed Prim minister of war in his provisional government. He became head of the cabinet and procured the election of Amadeo, duke of Aosta,

second son of the king of Italy, as king of Spain. He was shot by unknown assassins while driving through Madrid. Consult: F. Jimenez, 'Historia Militar y Politica de D. Juan Prim' (1860); Leonardson, 'Prim' (1901).

**Primary Batteries.** See BATTERY.

**Primary Election.** See ELECTIONS.

**Primary Rocks,** formerly applied by geologists to the earliest rocks, including particularly those owing their present state to igneous agency. Gneiss, various schists and granite were so regarded. At the present time Primary is used as equivalent to Palæozoic (q.v.).

**Pri'mate,** since the 4th century of the Christian Church, the title assumed by the bishop of the capital of a province, and hence equivalent to metropolitan or exarch. The Council of Chalcedon decreed that the primacy, or "first place before all," was to be accorded to the "archbishop of Old Rome." In Africa the title belonged to the bishop of Carthage. In other parts of Christendom an attempt was made to distinguish between primates and metropolitans as early as the 9th or 10th century, for one of the capitularies of the early French kings ordains that no metropolitan shall assume the title of primate unless he has a just claim to that honor; and in the 11th century the popes expressly reserved the title only for the leading metropolitans in different countries, and endeavored to subordinate the other metropolitans to them. The resistance to this arrangement was, however, so general and emphatic that the dignity of primate remained little more than a nominal one, entitling the holder of it merely to precedence on public occasions. In France the archbishop of Lyons was appointed primate of the Gauls by Gregory VII. in 1079, and the archbishop of Rouen is also primate of Normandy. In the German empire the archbishop of Salzburg was primate. In Hungary the archbishop of Gran is primate; in Bohemia that of Prague; in Spain that of Toledo. In Poland the primacy belonged to the see of Gnesen. None of these bishoprics any longer retain primatial rights of jurisdiction excepting that of Gran. The office belonged of right to the Papal legate, who was president of the senate and censor of the king. He governed the state during an interregnum, had a court, guards, and a marshal of the palace, and in general enjoyed the highest privileges. In the Church of England both the archbishops still retain the title of primate, the archbishop of Canterbury being distinguished as the primate of all England and the archbishop of York as the primate of England. In the Protestant Episcopal Church of Ireland the archbishop of Armagh is primate as formerly when the church was established.

**Primates,** the name given by Linnæus to his highest order or group of the *Mammalia*, which included the bats (*Cheiroptera*), the apes, monkeys, and lemurs (*Quadrumanæ*), and man (*Bimana*). By common consent of zoologists the bats have been removed, leaving the monkeys, lemurs and man as a fairly homogeneous group. Formerly the definition of this order was comparatively easy, but owing to numerous recent palæontological discoveries an almost unbroken series of forms between the lemurs and the *Insectivora* is now known, and the interrelation-



## PRIMATICCIO — PRIME MINISTER

ships between the former and the higher apes, and of the latter with one another and with man, have been shown to be more complex than was anticipated. Leaving out of account the prelemurine fossils, the order may be characterized as follows: There are always complete milk and permanent dentitions, the latter having the various kinds of teeth well differentiated and usually the following formula: incisors,  $\frac{2}{2}$ ; canines,  $\frac{1}{1}$ ; premolars,  $\frac{2}{2}$  or  $\frac{3}{3}$ , and molars  $\frac{3}{3}$  or  $\frac{2}{2}$  (rarely). Occasionally there is the loss of an incisor, premolar or canine. The molars are of the simple quadritubercular grinding type, and the premolars are still simpler. In all cases the orbit is surrounded by a bony ring and frequently separated from the temporal fossa by a plate of bone. The clavicles are well developed, the radius and ulna and the tibia and fibula (except in one case) are never coalesced, the scaphoid and lunar bones of the wrist are distinct, and the pollex and hallux (except the latter in man) form opposable thumbs. With a few exceptions among the lemurs and marmosets, the digits are all terminated by flat nails. Except in isolated cases the stomach is always simple, there are two pectoral mammæ and the testes are contained in a scrotum. Concerning the subdivision of the order in suborders and families there are several opinions; but the customary recognition of the sub-order *Prosimia* or *Lemuroidea* for the lemurs and their allies, of *Quadrumania* for the monkeys, baboons and marmosets, and of *Anthropomorpha* for the apes and man will serve present purposes. Consult: Hartman, 'Anthropoid Apes' (1886); Forbes, 'Handbook of Primates' (1896-7).

**Primaticcio, Francesco**, frän-chës'kō prēmā-tēt'chō, Italian painter: b. Bologna 1504; d. France 1570. He was a pupil of Innocenzo da Immola and Bagnacavallo, and began in 1525 to study under Giulio Romano. In connection with several of the pupils of the latter he painted the Palazzo del Tè, in Mantua, from Giulio's designs. Through the recommendation of Frederick, duke of Mantua, Primaticcio was engaged by Francis I. of France in 1531 to decorate the palace of Fontainebleau. To his influence were owing not only numerous paintings in fresco and works in stucco which the king caused to be executed, but several branches of painting, as, for instance, enamel painting, and designs for tapestry, were carried to greater perfection through his exertions. Francis sent him to Italy to purchase antique statues, and casts of famous works of art. On the death of Rosso, the royal painter, Primaticcio succeeded to his post, and Francis II. appointed him in 1559 superintendent of the royal buildings. He furnished the designs of several architectural works, among them of the tombs of Francis I. and Henry II. His works at Fontainebleau, however, gained him more reputation. His was a clever facile pencil, but he was the slave of mannerism and meretriciousness, and that fluent but artificial elegance which remained so long the characteristic of French art. His frescoes and stucco work have been almost all destroyed, we can only judge of their quality from engravings, and there are no oil-paintings which can with certainty be ascribed to him, even the authenticity of 'The Contenance of Scipio' now in the Louvre is sometimes doubted.

**Prime, Edward Dorr Griffin**, American Presbyterian clergyman and religious journalist: b. Cambridge, N. Y., 2 Nov. 1814; d. New York 7 April 1891. He was graduated in 1832 from Union College, and from Princeton Theological Seminary at Princeton in 1838. He filled several pastorates, including that of the Eighty-sixth Street Presbyterian Church, New York, and contributed articles to the 'New York Observer' under the signature "Eusebius." With his brother, S. I. Prime (q.v.), he edited the paper 1854-85, and continued to edit it a year longer after his brother's death. He published: 'Around the World' (1872); 'Forty Years in the Turkish Empire' (1875); 'Notes, Genealogical, Biographical, and Bibliographical of the Prime Family' (1888); etc.

**Prime, Samuel Irenæus**, American Presbyterian clergyman and editor: b. Ballston, N. Y., 4 Nov. 1812; d. Manchester, Vt., 18 July 1885. He was graduated from Williams College in 1829, entered the Princeton Theological Seminary and in 1833 was ordained in the ministry. He was in charge of pastorates at Ballston Springs, N. Y., 1833-5; at Matteawan, N. Y., 1835-40. In 1840 he became editor of the New York 'Observer' and continued as such until his death, with the exception of a period in 1849 when he was secretary to the American Bible Society, and another in 1850 when he edited the 'Presbyterian.' He was one of the founders of the Evangelical Alliance of America in 1866 and its corresponding secretary until 1884, was vice-president of the American Tract Society and was prominently connected with various religious and educational institutions. From 1854 he was a regular contributor to 'Harper's Magazine,' where his "Editor's Drawer" became famous, and in 1858 his literary earnings enabled him to purchase the 'Observer,' which he made the leading organ of his denomination. His 'Power of Prayer' (1858) reached a sale of 175,000 copies in United States and England and was translated into French, Dutch, and Tamil. Among his other books are: 'The Old White Meeting-House' (1845); 'Travels in Europe and the East' (1855); 'Letters from Switzerland' (1860); 'Kirwan' (1870); 'Irenæus Letters' (1st series, 1880; 2d series, 1885); etc.

**Prime, William Cowper**, American journalist: b. Cambridge, N. Y., 31 Oct. 1825; d. New York, 13 Feb. 1905. He was graduated from Princeton in 1843, studied law, was admitted to the bar in 1846 and engaged in law practice in New York in 1846-61. In 1861-9 he was editor-in-chief of the New York 'Journal of Commerce,' was 1st vice-president of the Metropolitan Museum of Art after 1874 and professor of the history of art at Princeton after 1884. He devoted much time to literature and was an authority on numismatics and Egyptian antiquities. Among his publications are: 'The Owl Letters'; 'The Old House by the River' (1853); 'Boat Life in Egypt and Nubia' (1857); 'Coins, Medals, and Seals' (1860); 'I Go A-Fishing' (1873); 'Holy Cross' (1877); 'Along New England Roads' (1892); 'Among the Northern Hills' (1895); etc.

**Prime.** See CANONICAL HOURS.

**Prime Minister**, in most European governments, is a premier, secretary of state, or other officer of state, who at the summons of the sov-



## PRIME NUMBER—PRIMROSE

ereign has succeeded in forming an administration, of which he is the head, and which may be named after him. It may be assumed that those who accept office under him agree with his policy in the main. Though each member of the ministry administers his own department independently of his colleagues, all important departmental matters are submitted to him, the most important being brought before the whole ministry, and no appointment of moment is made or recommended to the crown without his knowledge and concurrence. His own patronage is very extensive. In forming an administration, he selects all those who are to fill the various offices, though the appointments are subject to the sovereign's approval. In England it is on his advice that as vacancies occur the archbishops, bishops and deans and the highest judges are appointed, and over one hundred crown livings are filled; and on his recommendation that the most envied temporal titles and honorable distinctions—peerages, baronetcies, and the Garter, for example—are conferred, and such high appointments as the lord-lieutenancy of Ireland, the viceroyalty of India, the principal ambassadorships and colonial governorships, and lord-lieutenancies of countries, are made by the crown. He is the leader of the House of Parliament, of which he is a member. Yet as prime minister he enjoys no legal precedence over his colleagues, his official existence being indeed not recognized by statute. In European governments the prime minister, or premier, is usually charged with the management of diplomatic affairs, and in this respect resembles the Secretary of State of the United States.

**Prime Number**, an integer indivisible by any number save itself and unity, that is, one which can not be factored; such numbers are 1, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, etc. They occur very frequently among the lower numbers, and begin to be scarce among the higher thousands. The determination of the prime numbers has remained a mere matter of rejecting factorable numbers; this is done in a quasi-mechanical way by the table called Eratosthenes' sieve, upon which all the numbers to be tested are written at equal intervals and covered in succession by gridiron-like slips of paper, covering first all multiples of 2 (the even numbers may better be omitted at the start), then all multiples of 3, and so on. But even with the modern theory of numbers no rule has been laid down for the periodicity of the occurrence of the prime numbers. Gauss discovered in 1810 that the frequency of the prime numbers approximated to the value of the logarithm integral; Tchebycheff gave a formula based on the same integral for the determination of the number of prime numbers less than any given number; in a monograph dated 1859 Riemann gave an even more exact formula, and a very complicated one, also dependent on the integral  $\text{li}(x)$ . The Theory of numbers has also shown that "every prime number is (in general in more than one way) a sum of four squares," but this is equally true of other numbers, inasmuch as (1) every factorable number is the product of two prime numbers, and (2) the sum of four squares into the sum of four squares is always a sum of four squares. The theorem of Goldbach that "every even number is the sum of two prime numbers" seems at first glimpse a mere restatement of the definition of

an even number. Factor tables have been made for all numbers between 1 and 10,000,000 in the attempt to codify the prime numbers; by reference to them it may be instantly discovered whether a given number is prime or not.

**Primero**, *prī-mē'rō*, or **Prime**, a card game very popular in England in the 16th century, but now obsolete. The same or a very similar game was played in Italy under the name *primiera*, and in France under the names *prime*, *ambigu*, etc. Primero belonged to the family of games of which the old post and pair and the more modern brag and poker are members.

**Primitive Baptists**. See BAPTISTS IN AMERICA.

**Primitive Methodist Connections**. See METHODISM.

**Primogeniture**, *prī-mō-jěn'ī-tūr*, seniority of birth, and the right by law of the eldest son of a family (and of those who derive through him) to succeed, in cases of intestacy, to the father's real estate, to the absolute exclusion of the younger sons and the daughters. This rule, system, or right prevails in Great Britain: but, following the example of revolutionary France, most of the countries of continental Europe have abolished it. Several exceptions to the rule are allowed in the United Kingdom, but, these apart, whenever a man dies intestate leaving real estate, his eldest son is entitled to the whole of it, and the rest of the children not otherwise provided for out of the personalty are left without anything. If there is no male heir, the daughters succeed, not singly and in the order of seniority, but jointly. In the United States no distinction is made in the descent of estates to lineal descendants.

**Primrose**, a popular name for many garden and wild plants, among which the following are probably the best known: Evening primrose (*Oenothera biennis*, etc.); Arabian primrose (*Arnebia cornuta*); Cape primrose (*Streptocarpus* spp.); and various species of the genus *Primula*. This last consists of about 150 species of mostly perennial herbs with rosettes of leaves of various forms (especially under cultivation), and salver-shaped, generally showy, white, yellow, pink, lilac and purple flowers borne in clusters upon scapes. They are natives of the North Temperate zone, one species South American, one Javanese, and generally common in mountainous countries. About 40 are Himalayan; a dozen North American. They may be divided into five groups according to their uses as ornamental plants for which purpose they have long been popular. The auricula (q.v.) and the alpine primroses, neither of which are widely popular in America, the former because the climate is believed to be against them, the latter because alpine gardens have not become popular. Third, the yellow or purple-flowered out-door species, such as *P. imperialis* and *P. japonica*, which with winter mulching are grown in the Northern States; the polyanthus group, which contains the oxlip (*P. elatior*) and the cowslip (*P. officinalis*), very popular, fully hardy favorites blooming in early spring; and the greenhouse primroses, such as the Chinese (*P. sinensis*), *P. obconica* and *P. forbesi* (baby primrose), all of which are widely popular houseplants. Propagation is usually by seed, though varieties that do not come true to type may often be propagated by division or cuttings.



## PRIMROSE DAY—PRINCE EDWARD ISLAND

Seed should be sown soon after its collection, since it quickly deteriorates if allowed to become dry. In general, primroses succeed best in deep, well-drained, loose, rich loam not exposed to the glare of the sun. The polyanthus kinds may be grown in cold frames during the winter, set in beds in early spring, removed after flowering to shady moist situations for the summer, divided in the autumn and planted in cold frames again. The yellow-blossomed kinds are favorites with florists. The greenhouse kinds are sown under glass in early spring and kept growing steadily in flower pots of increasing sizes until the 6-inch size is reached in autumn when they should commence to blossom. The soil for them should be light, loose and rich both in plant food and humus. At the primrose shows there are often 200 to 300 distinct varieties on exhibition, mostly of *P. sinensis*, which has developed many remarkably beautiful forms attractive in foliage as well as flower.

**Primrose Day**, in England the anniversary of the death of Lord Beaconsfield (q.v.), 19 April 1881. Every member of the Primrose League (q.v.) wears a bunch of primroses on that day in token of sympathy with, and support of, the objects of the league.

**Primrose League**, an English political organization founded in 1883 by members of the so-called Fourth party (consisting of Lord Randolph Churchill and a few others) in memory of the Earl of Beaconsfield. The name was chosen in accordance with a mistaken notion that the primrose was Lord Beaconsfield's favorite flower. The league is one of the strongest bulwarks of the Unionist party. The members include knights, dames, and associates, and are divided into groups called habitations. In their propaganda they rely less on discussion, lectures, etc., than on the appeal to the social elements in human nature; and the rapid increase of membership is due mainly to the efforts of female members. In 1900 the league had 1,710,040 members on its roll, the number of habitations being 2,401.

**Primula.** See PRIMROSE.

**Primum Mobile**, *prīmūm mōb'ī-lē*, in astronomy, the ninth or highest sphere of the heavens, whose centre is that of the world, and in comparison with which the world is but a point. This the ancients supposed to contain all other spheres within it, and to give motion to them, turning itself, and all of them, quite round in 24 hours. See ASTRONOMY.

**Prince, Helen Choate Pratt**, American novelist, grand-daughter of Rufus Choate (q.v.): b. Dorchester, Mass., 26 Nov. 1857. She was married in 1881 to C. A. Prince and is now (1904) residing in France. Her works are: 'The Story of Christine Rochefort' (1895); 'A Transatlantic Chatelaine' (1897); 'At the Sign of the Silver Crescent' (1898); 'The Strongest Master' (1903).

**Prince, Le Baron Bradford**, American lawyer and politician: b. Flushing, L. I., N. Y., 3 July 1840. He was graduated from Columbia College Law School in 1866; was member of the New York Assembly 1871-5, introducing the Constitutional amendments of 1874, and from 1876 to 1877 member of the State Senate. After this he became prominently identified with the development of New Mexico, politically and in-

dustrially. From 1878 to 1882 he was chief justice of that territory and its governor 1889-93. His writings include: 'E Pluribus Unum' (1868); 'Historical Sketches of New Mexico' (1881); 'A Nation, or a League' (1884); 'The Money Problem' (1896); etc.

**Prince, Thomas**, American clergyman and historian: b. Sandwich, Mass., 15 May 1687; d. Boston, 22 Oct. 1758. He graduated from Harvard in 1709, studied in England and was pastor of a church at Combs, Suffolk, England, 1711-16, then returned to Massachusetts accompanied by several of his congregation. On 1 Oct. 1718 he was ordained pastor of the Old South Church, as colleague of the Rev. Joseph Sewall. In 1727 appeared the first volume of his 'Annals of New England,' materials for which he had collected with great care while in England. It was approved by the legislature, but owing to the indifference of the public was never completed. He published also sermons, several works on phases of the early history of New England, and 'The New England Psalm-book Revised and Improved' (1758). He made a valuable collection of books by New England authors and MSS. connected with New England records; this was partially destroyed by the British in 1766, but the remainder was presented to the Boston Public Library in 1860. Prince was highly regarded for his erudition.

**Prince**, a title which means literally one who holds the first place. In ancient Rome the title of *princeps senatus* was given to the leading senator, being the one whose name came first in the list and who had the right to record his vote first. In modern times the title of *prince* (or *princess*) is given to all sovereigns generally, as well as to their sons and daughters and their nearest relations. In England the title is also applied, in strict heraldic language, as a mode of address to dukes, marquises, and earls, but it is not generally so used. In Germany there is a class of sovereigns, ranking next below the dukes, who bear the title of prince as a specific designation. The members of royal families are there called *Prinzen* instead of *Fürsten*, to distinguish them from the class to whom the latter title more peculiarly belongs. On the Continent there are ancient families not immediately connected with any reigning house who bear the title of prince. Formerly, in France, *duke* was a title superior to *prince*. In England the only case in which the title is a territorial one is that of the Prince of Wales. See NOBILITY.

**Prince Albert Land**, Canada, an Arctic island of the Franklin District, separated from the Mackenzie District by Coronation Gulf, Victoria, Dease, and the Dolphin and Union straits, along the Northwest Passage. Its southern and southeastern peninsulas are known respectively as Wollaston Land, and Victoria Land; Prince Albert Sound is a deep inlet on its eastern coast, and Collinson Inlet another on the north coast. It has not been fully explored.

**Prince Edward Island**, Canada, an insular province of the Dominion, in the southern part of the Gulf of Saint Lawrence, separated east to west from Cape Breton Island, Nova Scotia, and New Brunswick, by the curving Northumberland Strait, from 10 to 30 miles wide. The greatest length of Prince Edward Island on a curve is about 150 miles, breadth varying from



## PRINCE OF INDIA—PRINCE RUPERT'S DROPS

4 to 34 miles, area 2,133 square miles; it is the smallest province of the Dominion. The capital is Charlottetown (q.v.) which is connected by rail with all the principal points of the island. Other towns are Summerside, Georgetown, and Souris.

*Topography, Physical Features, and Natural Resources.*—The coast-line presents a remarkable succession of large bays and projecting headlands. Of the latter the most prominent are North Cape on the northwest, West Cape on the southwest, and East Cape on the northeast; the largest bays are those of Richmond on the northwest, Egmont and Bedeque on the southwest, Hillsborough on the south, and Cardigan on the east. The surface undulates gently, nowhere rising so high as to become mountainous, or sinking so low as to form a monotonous flat. The soil consists generally of a light reddish loam, sometimes approaching to a strong clay, but more frequently of a light and sandy texture. The prevailing rock is a Triassic reddish sandstone. The island is well watered by numerous streams and springs. At one time the whole island was densely covered with beech, maple, fir, and other trees, and it is still well wooded, only about two thirds of the area having been cleared. There are no minerals of any importance. The fisheries are valuable, in 1900 giving employment to 2,330 boats and 29 vessels of 750 tons manned by 4,895 men. The total value of the catch was \$1,059,194; the most valuable item is the lobster, followed by the mackerel, cod, herring, and hake.

*Climate.*—The climate is much milder than that of the adjoining continent, and the air, generally free from the fogs which spread along the shores of Cape Breton and Nova Scotia, is remarkably salubrious. During the greater part of July, August, and September the thermometer during the hotter hours of the day seldom varies more than from 75° to 80° F.

*Agriculture.*—The island is eminently agricultural and pastoral. Of its total of 1,365,760 acres in 1900, 1,214,248 were occupied; 496,156 acres were in woodland and forest; 718,092 were improved; 536,175 were under crop; 178,072 were in pasture, and 3,845 in gardens and orchards. The principal products are wheat, barley, oats, beans, pease, potatoes, turnips, apples, etc. Good breeds of horses, cattle, sheep, and swine are reared, and dairy farming has become a thriving industry; large quantities of cream, butter, and cheese being manufactured.

*Manufactures and Commerce.*—The manufactures are chiefly confined to linen and flannels for domestic use; there are also several tanneries, boot and shoe factories, manufactures of tobacco, condensed milk, pork-packing establishments, and some ship-building. The exports of an annual average value of over \$1,000,000, consist chiefly of agricultural produce, live stock and fish, the imports of about the same value are chiefly dry goods, iron, hardware, coal, etc.

*Shipping and Communications.*—In 1900 the shipping of the province was 155 sailing and 21 steamships, aggregating 14,251 tons, the tonnage of the steamers being 3,966. The Prince Edward Island Railroad, built by the Dominion government, connects the principal points of the island and has a length of 209 miles. Telephonic communication extends throughout the island, which is also traversed in all directions by good coach-roads.

*Government.*—The province is administered by a lieutenant-governor nominated by the crown, who appoints an executive council of 8 members, with a legislative assembly of 30 members, half elected on a property qualification, and half on a popular franchise. The province was admitted into the Dominion of Canada in 1873, and is represented in the Dominion House of Commons by five members.

*Education and Religion.*—Adopted in 1851 the free school system is administered by a government superintendent and council. In 1901, 20,779 pupils were enrolled in 475 schools conducted by 589 teachers, and \$164,935 were expended for education. The membership of the principal religious denominations in 1901 was, Roman Catholics 45,796, Presbyterians 30,750, Methodists 13,402, Anglicans 5,976, Baptists 5,905.

*History.*—Sebastian Cabot is supposed to have sighted Prince Edward Island after discovering Newfoundland in 1497. Champlain gave it the name of Saint John and it was later included by the French in their vast and undefined territory of New France, and in 1663 was granted on a feudal tenure to a Sieur Doublet, a French naval officer. Little progress was made in settling the island till after the Peace of Utrecht in 1715, when its fertility attracted numbers of settlers from Cape Breton. It was taken by the British in 1745, restored by the Peace of Aix-la-Chapelle, retaken, and finally annexed to Britain in 1758. In 1873 it was admitted into the Dominion of Canada. Pop. (1891) 109,078; (1901) 103,259, chiefly native born of British origin, with 13,867 of French origin, and 1,604 of other nationalities. Consult: Campbell, 'History of Prince Edward Island' (1875); Dawson and Harrington, 'Geological Structure and Mineral Resources of Prince Edward Island' (1882-4).

**Prince of India**, a romance by Lew Wallace, published in 1893. The 'Prince of India' is the Wandering Jew.

**Prince and the Pauper**, *The*, a historical tale by Mark Twain (Samuel Langhorne Clemens) published in 1881. The plot hinges on the remarkable resemblance of a poor street boy to the young English prince, afterward Edward VI.

**Prince Rupert's Drops**, pieces of glass which have been cooled very suddenly from the melted state by having been dropped into water. They are called *larmes bataviques* (Dutch tears) by the French. The outside of the drop of melted glass is instantaneously solidified by the water, while the inside cools gradually, so that the outside shell is acted upon by very great stresses due to contraction of the internal portions when cooling. In fact the drop is kept in a state of excessive strain by stresses in unstable equilibrium; and if this equilibrium is destroyed by scratching the surface with a diamond, or breaking off the tip of the tail, the strained particles are violently released, and the mass is instantly pulverized. Heat is produced during the pulverization of the drop. This explanation applies to the falling out of the bottom of the very thick flask of unannealed blown glass called the "Bologna flask," when its surface is scratched. Glass articles—articles of any brittle material—ought to be cooled very slowly from the melted state. The process of slow cooling to



## PRINCE OF WALES — PRINCETON

which such articles are subjected is called annealing. To anneal glass it is placed in a large furnace which has nearly a red-heat at one end and a lower temperature than 100° C. at the other; after the glass has been passed very slowly from the heated to the cool end it is able to withstand sudden changes of temperature, etc., without fracture.

**Prince of Wales, The**, in England, the title given to the eldest son of the sovereign and heir apparent to the throne. The title is created and is not hereditary. It dates from the reign of Edward III. A statute of the order of the Garter, dated 1805, declares that the Prince of Wales shall, as soon as he receives this title, become a knight of the Garter. The arms of the Prince of Wales are the royal arms, with the addition of a label of three points argent, and any other addition that may be adopted by the different holders of the title.

**Prince of Wales Island**, the official name of Penang, an island of the Straits Settlement. See PENANG.

**Princeites**, prīn'sīts. See AGAPOMONE; RELIGIOUS SECTS.

**Prince's Feather**, an annual plant (*Polygonum orientale*) of the buckwheat family, with erect spikes of dark-red flowers and leaves inclining to purple. It is a native of India, but has long been cultivated in gardens everywhere.

**Prince's Island**, or *Ilha do Príncipe*, ēl'yä dō prēn'sē-pě, a Portuguese island off the coast of West Africa; in the Bight of Biafra; nearly midway between Fernando Po and St. Thomas Islands. It is of volcanic character, rising in the south to 3,000 feet; fertile and well-watered, but of little importance since the extinction of the slave-trade ruined its sugar-plantations. Its fertility has gained it the name of the Garden of Africa. Cacao is the only important export. The population is concentrated mainly in São Antonio, a town with a fine harbor on the northeast coast. With the neighboring island of St. Thomé it constitutes a province under a governor.

**Prince's Islands** (ancient DEMONESI), a group of nine islets near the east end of the Sea of Marmora; about 10 miles southeast of Constantinople. Prinkipo is the largest of the group. They are a favorite summer resort of the Constantinople Greeks, and in old times were frequently a place of exile for those who were in disfavor at the Byzantine court. There are on the islands a Greek Church, seminary, monasteries, and a naval college. In 1894 an earthquake caused loss of life and destruction of property. Pop. (1902) estimated 10,500.

**Prince's Metal**, in metallurgy, a mixture of copper and zinc in imitation of gold.

**Prince's Pine**, or *Pipses'sewa*, a low North American evergreen health-plant (*Chimaphila umbellata*) of the wintergreen family. From its leaves are made a powder and a fluid extract, used in making a herb-medicine for scrofula, rheumatism, etc. Another species is the spotted wintergreen (*C. maculata*).

**Princess**. See NOBILITY; PRINCE.

**Princess, The**, a narrative blank verse poem by Alfred Tennyson, published in 1847, the theme being the position of woman. Besides the various exquisite lyrics intercalated between

the cantos, the poem contains many of the poet's finest lines.

**Prince'ton**, Ill., city, county-seat of Bureau County; on the Chicago, B. & Q. railroad; about 100 miles west by south of Chicago. It was settled in 1830, incorporated in 1838, and in 1884 was chartered as a city. It is in an agricultural and coal mining region. Its industries are connected chiefly with farm products and the mining and shipping of coal, and the shipping of live stock. It has a number of well-built business blocks, a township high school, the Matson Public Library, and the high school library. The city owns and operates the electric light plant and the waterworks. Pop. (1890) 3,396; (1900) 4,023.

**Princeton**, Ind., city, county-seat of Gibson County; on the Southern and the Evansville & T. H. R.R.'s; about 27 miles north of Evansville. It was settled in 1804, incorporated as a town in 1814, and chartered as a city in 1884. Princeton is in an agricultural and coal mining region. The chief industrial establishments are the Southern Railroad shops, in which are 600 employees; the coal mines, 300 employees; oil wells, 100; lumber mills, 170; flour mills, 50; clock works, 60; handle factory, 10; and several smaller establishments. There are large lumber and brick yards. The city has 13 churches; and the educational institutions are a high school, public and parish schools, business college, and a Carnegie Public Library. The two banks have a combined capital of \$200,000. The government is vested in a mayor, who holds office two years, and a council of six members. Pop. (1890) 3,076; (1900) 6,041.

FRED R. EWING,  
Editor 'Clarion News.'

**Princeton**, N. J., borough in Mercer County; on an elevation about three miles from the main line of the Pennsylvania railroad, with which it is connected by a branch line; 10 miles northeast of Trenton, and 50 miles southwest of New York city. It was settled in 1696, but remained a straggling hamlet for some years. The removal of the College of New Jersey from Newark to Princeton, in 1756, gave the place new life, and except when it was occupied by troops, and as a battle ground, it has ever since remained a staid college town. On 27 Aug. 1776, the first State Legislature of New Jersey met here. The 31st, the members elected William Livingston as governor of the State. Congress assembled here June 1783, and remained in session until November. The removal of Congress from Philadelphia was occasioned by the threatening attitude of discontented soldiers. While in session here, 31 Oct. 1783, the news arrived of the signing of the treaty of peace with England. Princeton has broad, well shaded streets, and its location on the ridge gives it a fine view over the surrounding country. The colonial architecture has been preserved to quite an extent. The place is noted as being the seat of Princeton University (q.v.). Other educational institutions are Princeton Theological Seminary (Presbyterian), the high school, and the libraries. Pop. (1890) 3,422; (1900) 3,899.

**Princeton** (W. Va.), **Engagement at**. In the spring of 1862 Gen. Frémont, commanding a military department that included West Virginia, proposed to move from Monterey on Staunton, thence to the New River near Chris-



## PRINCETON THEOLOGICAL SEMINARY — PRINCETON UNIVERSITY

tianburg, his ultimate destination being Knoxville, Tenn. Gen. J. D. Cox, commanding on the Kanawha, was to co-operate by advancing from Gauley Bridge, in two columns, one by Fayette and Raleigh Court House over Flat Top Mountain to Princeton and "the narrows" of New River, the other by the turnpike to Lewisburg. Cox had four brigades; one was left to hold the lower Kanawha Valley; Col. George Crooks' was sent forward to Lewisburg; and Cox, with the two brigades of Cols. A. Moor and E. P. Scammon, about 2,000 men each, moved on the Fayette and Princeton route. Giles Court House and "the narrows" of New River were reached 7 May, and on the 16th his two brigades, after leaving a detachment at Princeton, were on the East River, and Crook had reached Lewisburg, on the other side of New River, all prepared to joint Frémont's main column at Christianburg. But "Stonewall" Jackson's appearance in the Shenandoah Valley sadly deranged Frémont's plans, and Cox was told to look out for himself. Meanwhile the Confederate brigades of Gens. Humphrey Marshall, Harry Heth, and J. S. Williams, all under command of Marshall, had been concentrated to protect the Virginia and Tennessee Railroad, and on the 16th Marshall, leaving Heth to hold the passes of New River, marched with about 2 500 men and three guns by the Wytheville road on Princeton, driving out the small detachment Cox had left there, after a stubborn resistance of six hours, continued until 10 P.M., and capturing the camp, with several tents, horses, and other things, including the headquarters correspondence. During the night Cox, with Moor's brigade, marched back from East River, ordering Scammon to follow, and at daylight of the 17th found Marshall withdrawing from the town and back to a wooded range of hills south and west of it. Cox advanced and attacked, and Marshall again fell back a mile, to a strong position covering the Wytheville and Wyoming roads, and waited for Heth to come up. Cox made some demonstrations, but seeing that Marshall held a steep wooded ridge, not easily accessible, and had a large force and some artillery, he waited until Scammon should come up, before making a serious attack. Scammon came up in the evening, closely pursued part way by Heth, and brought information that the Confederates were in great force; and Cox, realizing that his position at Princeton could be turned and his line of communication seized, retreated before daylight next morning to Flat Top Mountain, 25 miles from Princeton, a very strong position, and ordered Crook to halt at Lewisburg. Heth attacked Crook at Lewisburg on the 23d and was badly repulsed. (See LEWISBURG, BATTLE OF.) The Union loss at and around Princeton was 23 killed, 69 wounded, and 21 missing; the Confederate loss was much less. Consult: 'Official Records,' Vol. XII.; The Century Company's 'Battles and Leaders of the Civil War,' Vol. II.

E. A. CARMAN.

**Princeton Theological Seminary**, a Presbyterian seminary at Princeton, N. J. It was organized in 1812, and for a time the classes were held in the buildings of Princeton College (now Princeton University); in 1815 a tract of land was purchased for the Seminary, and a building erected. "The biblical criticism is conservative,"

and "the theology taught is that type of Calvinism set forth in the Westminster Confession." The courses include instruction in Old and New Testament theology, literature and history, homiletics, church history, pastoral theology, systematic theology, and Hebrew. The regular course is three years, a fourth year of graduate study is also provided for, and arrangement is made for "extra-curriculum" courses at the University. Students who are college graduates are admitted without examination; others must take examination for admission in full standing; students, however, on filing a certificate from the presbytery or ecclesiastical body under whose care they are studying for the ministry may without examination enroll in the classes and receive the certificate for completion of the course, but are not technically considered graduates of the Seminary. The degree of bachelor of divinity is conferred on students who have received the degree of bachelor of arts. The buildings include two library buildings, Stuart Hall, and three dormitories; the library numbers 72,000 volumes besides pamphlets. The grounds and buildings in 1904 were valued at about \$527,000, and the productive funds amounted to \$1,423,333. The students numbered 169 and the faculty 12.

**Princeton University**, located at Princeton, N. J. The first movement toward the establishment of the university was made in 1739 by the Presbyterian synod of Philadelphia, which appointed a committee to look into the matter, but this committee met with little success, and the project was laid aside for the time. In 1742 the synod was divided on account of a conflict growing out of the opinions of two factions in regard to the learning needed for admission to the ministry; one of these factions was the presbytery of New Brunswick, for the most part graduates of the Log College (founded by William Tennent in 1726); the other faction was the Presbytery of Philadelphia. After this division the presbytery of New Brunswick united with the presbytery of New York and others to form a new synod. Certain members of this synod, especially Dickinson, Pierson, Pemberton and Burr, turned their attention to the establishment of an institution on a more liberal basis than Log College, without denominational assistance or supervision. In 1746 they obtained a charter for the College of New Jersey. In the same year the Log College was closed by the death of its founder, and its leading men joined with the trustees of the new college. A second charter for the College of New Jersey was obtained in 1748; the scope of the college and the power of the trustees as stated in the two charters was essentially the same; the second charter increased the number of trustees and reaffirmed the liberality of the first instrument, opening the doors of the college alike to every religious denomination.

The college was opened in 1747 at Newark, N. J., in 1752 its location was fixed at Princeton, and in 1756 the building (Nassau Hall) was completed and instruction was begun there. The college exercises were interrupted during the Revolution by the presence of both armies, but only one Commencement was omitted; Nassau Hall was badly damaged, the library scattered and destroyed and the philosophical apparatus ruined. In 1783 when mutinous soldiers threatened the State House in Philadelphia,



## PRINCIPE — PRINGLE

Congress removed to Nassau Hall, which was thus, for a time, the National capitol. A law department was established in 1846, but discontinued in 1852 on account of lack of funds; electives were introduced in 1870; the scientific school was established in 1873, and the graduate department in 1877. In October 1896, on the 150th anniversary, the name of Princeton University was adopted.

The organization of the University includes three departments: (1) the Academic Department; (2) the John C. Green School of Science; (3) the Graduate School. The Academic Department offers courses in the departments of philosophy, language and literature, mathematics and natural science. Most of the studies of the Freshman and Sophomore years are required; the elective system begins in the Junior year, and in the Senior year the range of electives is still wider. The degree of bachelor of arts is conferred in this department. The work of the John C. Green School of Science is in three main departments, the department of science, the department of civil engineering, and the department of electrical engineering, offering a graduate course of two years. The course in the department of science is again divided into two groups, the course in general science and the course in chemistry; the work of these two courses is the same in the first two years, the students making their election between the two at the close of the Sophomore year. Certain academic studies, including philosophy, history, English and political economy are included in the curriculum of this school. The degrees of bachelor of science, civil engineer and electrical engineer are conferred. The graduate school offers graduate courses in each of the departments of the academic course, and confers the degrees of master of arts and master of science for one year's graduate work, and doctor of philosophy and doctor of science for two years of graduate work under prescribed conditions. There are eight university fellowships, five college fellowships, and 113 scholarships of which the largest is the Mahlon Long scholarship of \$10,000 founded in 1903 by G. W. Ely, of Columbia, Pa.

The present University Library consists of the Chancellor Green Library, built in 1872-3, and the New Library, erected 1896-7, united by a delivery room, 50 by 20 feet. The library collection in 1760 when the first catalogue was printed consisted of 1,300 volumes; in 1904 it numbered 183,000 volumes beside pamphlets; this includes several special collections and seminary libraries. The Garrett collection of Oriental manuscripts is in the library building, also the Garrett collection of American coins, and the Hutton collection of death masks. In addition there are four departmental libraries, astronomy, biology, botany, and geology and palæontology, selected from the general library and kept in other buildings near the corresponding laboratories; in 1904 these departmental libraries numbered 21,000 volumes. The Princeton Theological Seminary library is also open to students of the University. The University campus contains about 225 acres; among buildings beside the Library are Nassau Hall, the original building considerably remodeled, 11 dormitories (1904), the Halsted Observatory, Dickinson Hall, for the class room work of the Academic Department, the infirmary, the Marquand Chapel, Al-

exander Hall, and the old and new gymnasiums. Princeton has a leading part in intercollegiate athletics; besides the gymnasiums there are two athletic fields, the University Field, where all contests and games are held, and the Brokaw Field, for the benefit of those who are not members of the University teams. Secret societies are not allowed at Princeton, but the students maintain two literary societies founded before the Revolution, and other student organizations. The productive funds of the year 1903-4 amounted to \$2,591,750 and the annual income was \$308,557. The students of the year 1903-4 numbered 1,431, and the faculty 109. Woodrow Wilson, LL.D., was inaugurated as president in 1902.

**Principe**, prĕn'thē-pā, Philippines, sub-province of Tayabas, situated on the eastern coast of central Luzon, bounded on the north by Isabela and on the south by Nueva Ecija; length along the coast 64 miles; area 1,216 square miles, with dependent islands 1,218 square miles. The district is almost entirely mountainous; there are two main ranges, one near the coast, following the coast line, the other parallel with it, with narrow valleys between. Near the towns rice, corn, coffee, cotton, sugar, and vegetables are raised, but for home consumption only; there are a few simple mechanical industries, also for domestic use. The chief industry along the coast is fishing, and the fish are exported to the provinces to the south. Game is abundant in the mountains, and many of the inhabitants are largely engaged in hunting. There are no roads, few trails, and there is very little trade. In 1902 Principe was annexed to the province of Tayabas. Pop. 10,470.

**Prindle**, prĭn'd'l, **Cyrus**, American Methodist clergyman: b. Canaan, Conn., 11 April 1800; d. Cleveland, Ohio, 1 Dec. 1885. He was licensed to preach in 1821 and until his retirement in 1877 occupied various Methodist pulpits in New York, Vermont, Massachusetts, and Ohio. Opposed to the attitude of the Methodist Episcopal Church with regard to slavery, he became in 1843 the chief leader in the movement that resulted in the founding of the Wesleyan Methodist Church in America. He was an abolitionist from principle and when he had seen the work to which he and his followers were devoted, accomplished in the emancipation of the slaves, he returned to the Methodist Episcopal Church.

**Pringle**, prĭn'g'l, **Thomas**, Scottish poet: b. Blaiklaw, Roxburghshire, 5 Jan. 1789; d. London 5 Dec. 1834. He was educated at Edinburgh University and in 1811 became a copyist in the Register Office, Edinburgh. He began writing clever satire, and attracted the notice of Sir Walter Scott, who in 1817 gave him his notes for an article on the gypsies, which Pringle contributed to the 'Edinburgh Magazine,' started by himself and Cleghorn, and known after a rupture with the publisher as 'Blackwood's.' In 1820 with 24 others, he emigrated to South Africa, settling finally at Cape Town. Pringle worked hard to secure financial support for the colony by pamphleteering and started 'The South African Journal' and 'The South African Commercial Advertiser.' These were suppressed by the governor of the colony because of their liberal tendencies. In 1826 he returned to London and in 1827 became secretary to the Anti-Slavery Society. After seeing the triumph of his humani-



PRINCETON UNIVERSITY.



1. Stafford Little Hall.

2. Nassau Hall.







tarian endeavors in the abolition of slavery by England, in 1834, he died on the eve of returning to South Africa. His earlier poems were collected by him as 'Ephemerides' (1828); and the best of these, dealing with South Africa, were reprinted in 'African Sketches,' which included also the 'Narrative' of a residence in South Africa. These productions were characterized by vivid description and tender feeling. He is best known by his poem, 'Afar in the Desert I Love to Ride.' Pringle's 'Poetical Works' with a life were edited by Leitch Ritchie in 1839.

**Prin'sep, Valentine Cameron**, English artist: b. Calcutta, India, 14 Feb. 1838. He was elected R.A. in 1894 and is now professor of painting to the Royal Academy. He went to India to paint 'The Declaration of the Queen as Empress' in 1876 and the picture was exhibited in 1880. His other pictures include: 'A Minuet'; 'A Bientôt'; 'The Linen Gatherers.' Of his two plays, 'Cousin Dick' appeared at the Court Theatre, and 'M. Le Duc' at Saint James'. He has also written 'Imperial India'; 'An Artist's Journal' and two novels.

**Printing**, the art of producing impressions from characters or figures on paper or any other substance. Printing is of comparatively modern origin, only 400 years having elapsed since the first book was issued from the press; yet the principles on which it was ultimately developed existed among the ancient Assyrian nations. Printing from movable types was probably practised in China as early as the 12th or 13th century, as there are Korean books printed from movable clay or wooden types in 1317. The great discovery was that of forming every letter or character of the alphabet separately, so as to be capable of rearrangement and forming in succession the pages of a work, thereby avoiding the labor of cutting new blocks of types for every page.

The city of Haarlem in Holland claims that Laurens Janszoon Coster there invented the art of printing in 1423, making use of movable types of wood and afterward of lead and tin; but no printed works of his can be identified. The claims of Johannes Gutenberg (q.v.) to this invention are more generally recognized. He without question was occupied in various experimental researches of a secret nature in Strasburg, and possessed in 1438 printing materials, a press, and as it appears movable types. No book, however, was brought out by their use until after Gutenberg had returned (which was about 1450) to his native city of Mainz. Here he associated himself with a wealthy citizen, Johann Faust, who, on learning the secrets of the art, entered into partnership with Gutenberg, and agreed to furnish funds for developing the process. They employed to assist them Peter Schöffer, a scribe whose previous occupation had been the copying of books, and who appears to have been a man of taste and genius, and well fitted to bring a new process of this sort favorably before the public. He has the credit of substituting metallic types cast in plaster molds in the place of those which Gutenberg had previously made by carving pieces of wood and metal, and of still further perfecting the art by the invention of punches in hard metal, by the use of which sharpness of outline could be given to the matrices in which the types were cast, and perfect uniformity be retained in the type by

continuing to use the same punches for producing as many matrices as might be required. These inventors succeeded in printing a considerable number of books, the first of which known to have been printed with movable types were three editions of Donatus. Printing presses were in operation at Subiaco near Rome in 1465, and the types employed were more like those now called Roman than like the Gothic forms of the Germans, which with the characters imitating handwriting had up to this time alone been used. In 1469 printing was introduced into Milan and Venice; and the productions of the presses of John de Spira and Christopher Valdarfar of the latter city attained great fame for their perfection and beauty. Printing was introduced into Paris in 1470, and into London in 1474. (See CAXTON, WILLIAM.) Before the year 1500, it is stated, printing presses had been set up in 220 places in Europe, and a multitude of editions of the classical writers in their appropriate Greek and Latin characters were given to the world. A Greek grammar wholly in Greek types was printed in Milan in 1476. A Hebrew Bible was printed at Soncino in the duchy of Milan in 1488. Italic type was invented about the year 1500 by Aldus Manutius of Venice. From the 17th to the 19th century a great variety of ornamental type came into use, the styles differing from each other in the shapes of the letters, in the heaviness or lightness of the lines, and in the shading. Great ingenuity has been exercised in multiplying these varieties in so limited a field. The largest size of type for books is called great primer, and is seen in the largest old Bibles; it is now seldom used. English, which is the next lower size, is seen in church Bibles, in folios, and some quartos. Pica, small pica, long primer, and bourgeois are the sizes most in use. The succeeding varieties are brevier, minion, nonpareil, agate or ruby, pearl, diamond, and brilliant, the last being very rare, and the smallest type used in books. In the following list the different sizes are exhibited, each with its own name:

**Great Primer, English, Pica,  
Small Pica, Long Primer, Bourgeois,  
Brevier, Minion, Nonpareil, Agate, Pearl, Diamond, Brilliant.**

Late in the 19th century the "point" system was adopted generally by printers. In this new arrangement the principal types are designated as follows:

Nonpareil .....	6	point
Minion .....	7	"
Brevier .....	8	"
Bourgeois .....	9	"
Long Primer .....	10	"
Small Pica .....	11	"
Pica .....	12	"

For handbills or posters special types are employed of extra large sizes. A complete assortment of one size is called a font or fount, and the "sorts" that make up an ordinary font of Roman type are as follows: 3 complete alphabets in capitals, small capitals, and small or "lower case" letters, making 78 characters; the double letters ff, fi, fl, ffi, ffl (each cast in a single piece on account of the kern or bend of the f not permitting it to stand separately against another f, an i, or an l), 5; the diphthongs Æ, Œ, æ, œ, 6; figures, 10; marks of punctuation, 6; the



## PRINTING IN AMERICA—PRINTING PRESSES

apostrophe, hyphen, parenthesis, and bracket, 4; 4 sizes of dashes, and braces in 5 pieces, 9; the characters &, &, \$, £, 5; and the references \*, †, ‡, §, ||, ¶, 6; total characters, 129. Beside these, there are required for filling the blanks between words, at the ends of lines, etc., 4 sizes of spaces and 4 of quadrats (the former and the smallest of the latter being subdivisions of the em [m] or square of the size of the type, one equal to it, and the other two multiples of it), making altogether 137 sorts.

In presses the original invention was the hand press of 1450. Toward the end of the 18th century inventors began to devise presses to be moved by power. The first invention in this department is that of William Nicholson, patented in England in 1790. The types were placed around a revolving horizontal cylinder, and were inked by rolling against another cylinder revolving in contact with the first. For further information as to the development of the printing press see PRINTING PRESS. For a complete history of printing in the United States see AMERICAN PRINTING TRADE. See also COMPOSING MACHINE; STEREOTYPE; ELECTROTYPE, etc.

**Printing in America.** See AMERICAN PRINTING TRADE.

**Printing Presses.** In the early years of the 15th century, before the invention of movable metal types, crude religious pictures were printed from engraved blocks. These were at first single prints, and then folios and were bound in books. The most notable of the 21 known block-books was the 'Biblia Pauperium' (1420). This consisted of 40 woodcuts, 10 inches by 7½, of Biblical subjects, each with its legend in engraved Gothic characters. The sheets were printed on one side only, two pictures to a side, facing each other when bound. The press used was a development of the cheese or cider press common in all large mediæval households, and needed little change to adapt it to the uses of typography.

Gutenberg's press, upon which he printed his 'Bible' of 36 lines (1450?), his 'Bible' of 42 lines (1455?), and the 'Letters of Indulgence' of 1454, 1455, 1461, consisted of two upright timbers with connecting crosspieces at top and bottom, and with two intermediate cross timbers. The lower one was the support of the form of type. Through the upper passed a large wooden screw, the lower point of which rested on the centre of a wooden platen. After the form of type was fastened to its bed it was inked by hand inking-balls made of wool covered with soft leather. The sheet of paper, previously dampened, was then laid carefully upon the type, and the bed then moved laboriously by hand to its place. A wooden lever was thrust into its socket and the platen screwed down, held for a moment and then raised. The bed was drawn out and the printed sheet removed and hung up to dry. For 150 years this simple but effective form of the printing press continued in use, and the books thus printed by Fust and Schaeffer at Mainz, Jenson and the Aldi at Venice, Caxton at Westminster, Plantin at Antwerp, the Elzevirs at Leyden and at Amsterdam, and Bade and the Estiennes at Paris have brought their makers the highest fame.

**First Improvements.**—The first recorded improvements were those of William Janson

Blaeuw, of Amsterdam, about 1620. He passed the spindle of the screw through a wooden block, which was guided in the wooden frame, and from it hung the platen. He also invented a device for rolling the bed in and out under the platen, and improved the hand lever for turning the screw. This press was widely used on the Continent, and in England and America, and on such a one Benjamin Franklin worked in London in 1725. One of these, that from the Watt printing house, is now preserved in the Patent Office in Washington. For nearly two centuries this sufficed for books of small editions and for the little-circulated small newspapers and gazettes of the 17th and 18th centuries. The Earl of Stanhope in 1798 had made a press with a cast iron frame and greater leverage, but it was so cumbersome and heavy that it came into no great use. Here and there others improved it. George Clymer, of Phila-



FIG. 1 — The Gutenberg Press.

delphia, in 1816 substituted a combination of levers for the screws, and called his invention the Columbian press. He carried it to England and there in 1822 Peter Smith devised a toggle-joint, simple and effective, that replaced the screw and levers.

The final development of the hand press came in 1827, when Samuel Rust, of New York, perfected the Washington press. The iron frame was lightened and strengthened, the toggle motion was improved, and a screw stop regulated the pressure. The bed was made to slide in and out on a track by turning a crank connected with two endless bands. A bent lever working in a toggle-joint forced the platen down and coiled springs raised it. To the end of the bed was attached the tympan, a wooden or steel frame over which a cloth was tightly stretched and carrying the blanket to modify the force of the impression. When the bed was run out this was raised to an obtuse angle. The paper was laid upon this and carefully fitted to adjust-



# PRINTING.



1. A page form ready for electrotyping.

2. A stereotype plate of a newspaper page.

3. A roll of news paper ready for printing.







## PRINTING PRESSES

ing pins; the frisket, a thin frame holding a sheet of paper cut to the size of the form, was folded over the paper to protect it, to steady it and to raise the paper from the type after the impression. This press has been improved in construction, but in principle and form substantially the same press is widely used to-day in

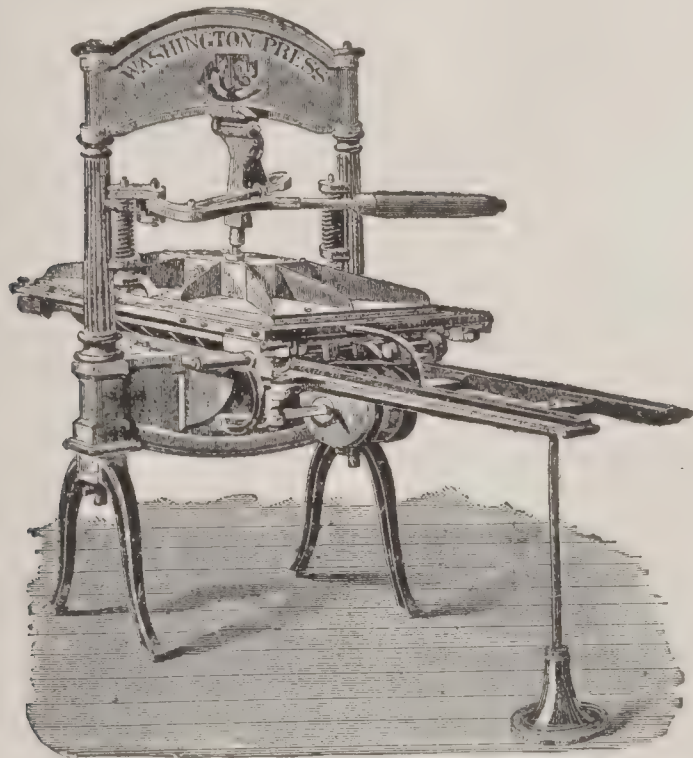


FIG. 2—Washington Hand Press.

the United States as a proof press and for the special work for which it is fitted. Its capacity is about 250 sheets an hour printed on one side. Alike in principle and construction, though differing in detail of depressing and raising the platen, is the Albion hand press as widely used in Great Britain.

The operation of the hand press when type, press, ink and paper had been prepared necessitated these eleven processes: The form was inked by hand; the paper was fitted to its place on the tympan; the frisket was folded over it to hold it; the tympan was folded down over the form; the bed was run under the platen by turning the crank; the platen was forced down by the workman's power applied to the lever; released, it was raised up by the springs; the bed was rolled out by a reverse motion of the crank; the tympan was raised; the frisket opened, and the printed sheet removed. Modern invention has sought to reduce all these to a single automatic process operated by mechanical power. Necessity divided the course of invention into three lines, the small job press and the large book and newspaper press soon widely diverging in type and construction to secure fine printing in one and the greatest speed in the other.

*Bed-and-Platen Presses.*—The development of the bed-and-platen power press for fine book work and illustrations reached its highest state in the Adams press, invented and patented by Isaac Adams, of Boston, in 1830 and 1836, and improved in many ways by R. Hoe & Co. since that firm acquired his business and patents in 1858. Over 1,000 have been manufactured, and it is still extensively used all over the world. Adams, after a few experiments with a timber frame, built his presses of iron and fixed the platen immovably in the frame. The form was placed on an iron bed beneath, as in a hand

press, and this bed was raised against the fixed platen and lowered by a system of cams straightening a toggle-joint. The ink fountain was placed at one end of the press, and the ink rollers in a movable frisket-frame passed over the face of the type and back while the bed was down. The sheets of paper were fed to grippers on the frisket which carried them over the form, and after the impression was taken the sheets passed forward on tapes to a sheet-flier, which delivered them to the fly-board. The speed of the larger sizes of the Adams press is 1,000 sheets an hour.

The most successful press designed for small job work substituted for the hand lever and crank a rotary power wheel which could be driven by a treadle by the foot of the operator, or by belt and shafting. The bed was set in a perpendicular frame, and the form was clamped to it. To the bed frame near the bottom was jointed the frame that held the platen. This opened to an angle of about 45 degrees. A crank rod fastened to the wheel brought the platen up to the type form and back at every revolution. On the platen by adjustable pins or quads the position of the paper was exactly fixed. Two thin steel frisket rods automatically folded over the margin of the paper as the platen rose. Above the bed of the press, and at an angle of from 225 to 270 degrees, was set a steel inking-disk, about the size of the bed, that slowly revolved, while at every revolution of the driving wheel a pair of ink rollers descended from the inking-disk over the form as the platen fell away, and back to the inking-disk as the platen rose to the form again. This automatic inking was even and uniform. This press prints over 1,000 impressions an hour, cards, letter-heads, hand-bills and the like. The labor needed is that of a boy or girl to feed

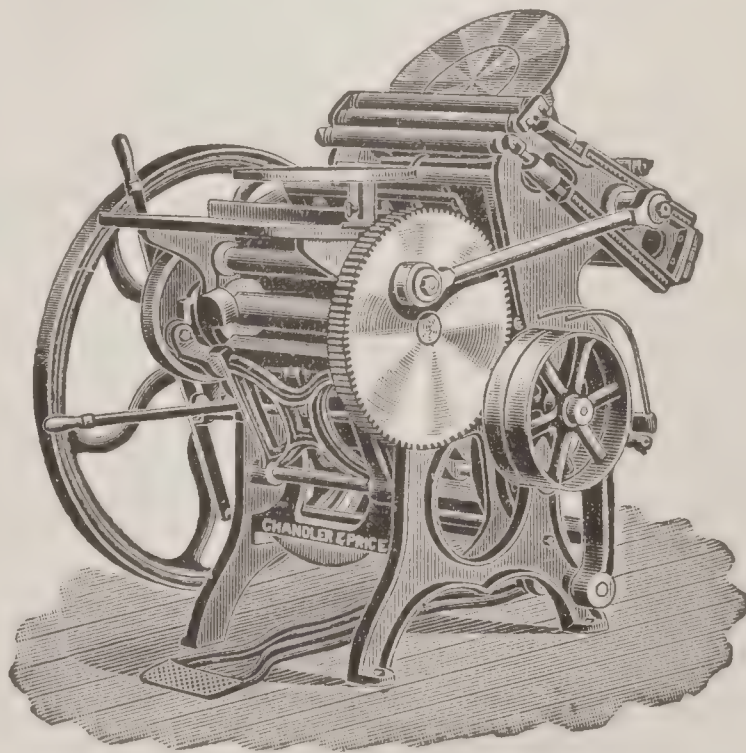


FIG. 3—Gordon Jobber.

and take off the sheets one by one. Many varieties are made, with varying excellence of detail. The Gordon press here illustrated is typical and widely used. The capacity is about 1,000 sheets an hour. The latest improvement is embodied in the Harris automatic press which has an automatic feeding device and a capacity for small work of 5,000 impressions an hour.



## PRINTING PRESSES

*Cylinder Presses.*—The basic principle of the cylinder press—a flat type form passed under an impression cylinder—is as old as Gutenberg's time, when from crude machines of this type copper-plate engravings were struck off; but no practical development of it was made until the beginning of the 19th century. So many patents have been issued since then for various devices to secure excellence or economy of operation that it is possible to note only the most striking and most successful. The first printer to work out a practical cylinder press was Frederick König, a Saxon by birth, who removed to England in 1806. He associated with him James Bensley, a London printer, and a machinist, a fellow countryman, Andrew Bauer. The product of their labors was a press which they put in operation in London in 1812. The form of type was placed on a flat bed, which was carried under an impression cylinder that had a three-fold motion. On the first third the sheet was fed at the top upon the tympan and gripped by the frisket, on the second part of the revolution the sheet received the impression and was removed by hand; and on the third the empty tympan came up to receive another sheet. The most efficient device which they invented to roll the bed holding the type form to and fro was this: A long shaft turned by gearing from the outside of the frame carried a pinion on its inner end; the shaft had in its length a universal joint that allowed for an up and down motion of the pinion as it revolved. Underneath and fastened to the bed was a rack, or row of teeth, with a crescent-shaped segment of metal and pins, or studs, at each end. To the outer end of the shaft was attached the wheel connecting with impression cylinder; this wheel, when set in motion, revolved the pinion and moved the bed by means of the teeth in the rack. When the bed reached the end of its appointed course, the pinion turned around over one of the pins or studs against the segment in the rack and immediately re-engaged the teeth on the opposite side and carried the bed back again to the other end, where the reciprocating motion was repeated. König followed this in 1814 by a continuously revolving cylinder, which was slightly reduced in diameter along that part of the periphery not used for the impression so as to allow the bed to return under it freely after the impression. He made also a two-cylinder press of this pattern, and two of these two-cylinder presses were set up in the London *Times* office in that year. Their capacity was 800 impressions an hour. This same year he devised a two-cylinder press—the first perfecting press,—by which a sheet was printed on both sides at one continuous operation. The forms were placed one at each end, and the sheet after being printed on one side under one cylinder was by tapes carried over a registering roller to the second cylinder for printing on the reverse side. This machine Applegarth and Cowper, by improvement, made very efficient. Every year showed patents on improvements, but the next of great value was that of Napier in 1828 and 1830. He discarded the tapes for the conveyance of the sheets and substituted "grippers" or "fingers" to clasp the sheets to the cylinder for the impression, and for delivering them after printing. He also made the impression cylinders of small size to make two or

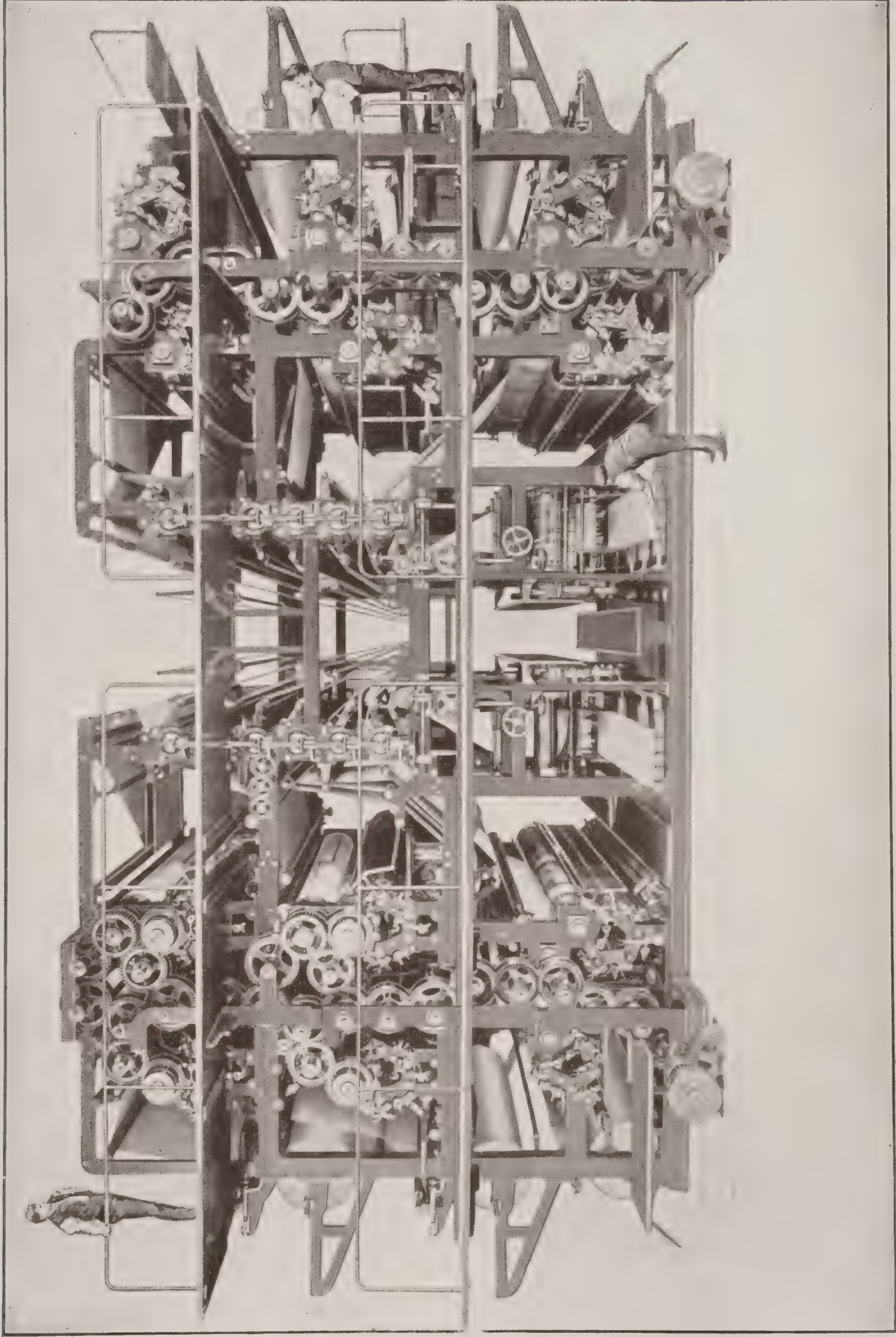
more revolutions to each sheet printed, and devised the toggle for raising the cylinder to allow the form to run back without touching.

The pioneers in introducing these new models into the United States were R. Hoe & Co., who had been for some time manufacturing bed-and-platen presses. Robert Hoe sent Sereno Newton (later to be a partner in the house) to England in 1832 to study the new inventions and devise improvements. The Hoe single small cylinder, double small cylinder and large cylinder perfecting press were designed and built, and with added improvements are being manufactured by them to-day. Hoe & Co. patented an entirely new mechanism to drive the bed in 1847. Two racks facing each other on different planes and separated by the diameter of the driving wheel were attached to a hanger fastened on the lower side of the bed. The driving wheel was on a horizontal shaft and movable sideways, so as to engage first one, then the other, of the racks. A roller at either end entering a recess in a disk on the driving shaft in a half revolution brought the bed to a stop and started it in the opposite direction. This was a new principle; a crank action operating directly upon the bed from a shaft having a fixed centre. It has been greatly developed, and now the type bed can be driven at great velocity and reversed without shock or vibration. A press with a bed measuring 48 x 65 inches can be run at a speed of 1,800 impressions an hour.

Still another invention came from abroad to be further developed here. A Frenchman named Dutarte in 1852 patented the stop-cylinder press which Hoe & Co. introduced in the country in the following year. Many improvements have been added to it by many inventors, until from it can be turned off the finest letter-press and cut work known to the printer's art. It is regarded the most perfect flat-bed printing press yet designed. A press with a bed 36 x 54 inches is capable of 1,000 to 1,500 impressions an hour, while the latest one built has a bed 45 x 62 inches and a speed of 1,700 impressions an hour. The press of to-day carries the form on a traveling iron bed moving on friction rollers of hardened steel and driven back and forward by a simple crank motion, stopping and starting without noise or shock. The cylinder is stopped by a cam motion, pending the backward travel of the bed, and during the wait the sheet is fed down against the guide; the grippers close on it before the cylinder starts, thus securing accuracy of register. The sheet, after the impression, is transferred to a skeleton cylinder, which receives it with grippers and delivers it over fine cords upon the sheet fliers, which deposit it on the table. From four to six inking rollers distribute the ink, partly from a vibrating polished steel inking cylinder and partly from a flat inking table at the end of the traveling bed.

Similar presses, with varying individual devices for securing special points of efficiency and of varying degrees of merit have also been made and widely distributed by such American press makers as A. B. Taylor, A. Campbell, C. B. Cottrell, C. Potter, Jr., Walter Scott, and the Goss, Huber, Miehle, Whitlock, Coy, and Duplex companies. Excellence, skill and accuracy in mechanical construction and ready resource of invention have maintained the supremacy of the American presses, over the foreign trade.





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THE LARGEST PRINTING PRESS IN THE WORLD.

THE DOUBLE SEXTUPLE FOR NEWSPAPER WORK.







## PRINTING PRESSES

*Newspaper Presses.*—The demand for faster presses of greater capacity grew enormously with the years of the 19th century, and invention kept pace. The greatest step forward was taken when Richard M. Hoe, of the firm of R. Hoe & Co., of New York, in 1845-6 took out patents for the Hoe Type-Revolving Machine, the first of which was put at work in the Philadelphia *Public Ledger* office in 1846. He had put into effect the basic idea of fastening the type to the main cylinder, while smaller cylinders carried the sheets of paper to receive the impression. Hoe designed an apparatus for fastening the columns of type in a form on a large central cylinder in a horizontal position, each page in its own cast iron bed. "V"-shaped column rules tapering to the base, with a special arrangement for locking up the forms, held the type firmly in place with the surface forming a true circle. The cylinder could be revolved at any speed without the type dropping out. An automatic inking apparatus carried the main ink-well beneath the cylinder, with distributing rollers between the impression cylinders. This first machine was built with four impression cylinders touching the type cylinder so that two were on each side and one as far above the other as possible. The framework of the machine bore four feed tables. At each a boy fed the sheets of paper to the automatic grippers, operated by cams, on the impression cylinders, which carried them around against the revolving forms of the central type cylinder. The printed sheet was conducted out by tapes under the feed board, and the patented sheet-flier, with its long wooden fingers fastened to the shaft and operated likewise by cam and springs, piled them upon the delivery tables. Upon this machine, with 2,000 revolutions an hour, 8,000 sheets were struck off printed on one side. The capacity of the machine was found to be greatly in excess of this, and the number of impression cylinders and accessories was increased to ten, giving the machine a product of 20,000 sheets an hour. The impetus given to the newspaper business was tremendous. Circulations that had been limited to the capacity of the old bed-and-cylinder press were rapidly increased twenty-fold. Many new papers were started. This press maintained its supremacy for 20 years, and 175 were built. In 1848 the first sent abroad was set up in the office of 'La Patrie' in Paris, but the stamp duty of the second empire soon effectively checked all French newspaper enterprise. Eight years later, however, Edward Lloyd, of 'Lloyd's Weekly' in London, saw this American press in the office of 'La Patrie' and ordered a six-cylinder press, which was erected in his office, Salisbury Square, Fleet Street, in 1859. John Walter, the proprietor of the London *Times*, having seen it in operation, ordered two ten-cylinder presses to replace their unique Applegarth vertical cylinder machines. Orders from almost all the leading newspapers of the United Kingdom followed. The next great step was taken in an allied trade when after various experiments was perfected the process of making curved stereotype plates by the use of flexible paper matrices. A simple adaptation of the bed of the type-revolving machine provided for the clamping of stereotype plates on the cylinder in place of the type forms. The forms could now be duplicated. The larger papers such as the

New York *Herald*, the London *Daily Telegraph* and the London *Standard* each kept five presses in constant operation as circulation increased.

*Web Presses.*—There remained yet another step before the increasing requirements of speed could be met. It was taken when William Bullock, an American, of Philadelphia, invented in 1865 the first printing press to print from a continuous web or roll of paper. Thirty years before, Sir Rowland Hill had suggested the possibilities of such a machine based on those that printed cotton cloth from engraved cylinders. But no practical working out of the problem in its details was offered. The Bullock press consisted of two plate cylinders and two impression cylinders, the second of which was made very large to lessen the offset from the first printed side of the paper. The stereotype plates were short of filling the whole circumference of the form cylinders, because the sheets were cut before printing by knives set in the cylinders. This was the radical fault of the press. The sheets were then carried through the press by tapes and fingers, and delivered by a series of automatic metal nippers on endless leather belts, placed at such a distance apart as to grasp each sheet successively as it came from the last printing cylinders. The Bullock press was perfected and came into considerable use. The New York *Sun* was the first newspaper to make use of them, and the New York *Herald* soon followed.

In 1868 the London *Times* had gone so far with its own experiments in constructing a rotary perfecting press that it set up the "Walter" press in its office. This had a capacity of 12,000 sheets an hour. It was similar in construction to the Bullock press, except that the cylinders were of uniform size and placed one above the other. The sheets, however, were severed after printing, brought up by tapes and carried to a sheet-flier, which moved back and forth and "flirted" the sheets alternately to boys on either side. This press was equipped with dampening cylinders containing sponges filled with water, and required a very strong and expensive paper. This press was also adopted by the London *Daily News* and the New York *Times*, but has now entirely gone out of use.

A recent invention in cylinder presses to satisfy the demands of small daily paper throughout the country for speed and economy is the Duplex press. It is a flat-bed web-perfecting press, and prints directly from the type form, with a capacity of from five to six thousand per hour of either 4-, 6-, 8-, 10-, or 12-page papers. Another adaptation for job work is the Coy rotary job press; this is simple in construction, and can handle a 30-inch web, printing on one side only, with an impression of  $7\frac{1}{4} \times 30$  inches, and cuts it into sheets, slits and perforates, with a capacity of 5,000 impressions an hour. It uses flat printing surfaces.

*The Rotary Perfecting Press.*—To fully perfect a press printing on a cylinder from a roll, or continuous web of paper, R. Hoe & Co., (in the words of Robert Hoe) in 1871 found these difficulties to be overcome:

First—The set-off of the first side. Devices were used to overcome this, and the ink-makers were induced to pay special attention to the manufacture of rapid-drying or non-setting-off inks.

Second—The difficulties of obtaining paper in the



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roll of uniform perfection and strength. The paper-makers were led to make a study of producing large rolls of paper meeting these requirements and became more and more experienced in its manufacture.

Third—The difficulty of the rapid severing of the sheets after printing.

Fourth—A reliable and accurate delivery of the printed papers.

These last two operations were not accomplished satisfactorily until the appearance of the Hoe machine. In this press the sheets were not entirely severed by the cutters, but simply perforated after the printing. They were then drawn by accelerating tapes, which completely separated them, onto a gathering cylinder so constructed that six perfect papers, or any other desired number, could be gathered, one over the other. These, by means of a switch, were at the proper moment turned off onto the sheet-flier, which deposited them on the receiving board. This gathering and delivery cylinder, patented by Stephen D. Tucker, a member of the firm of R. Hoe & Co., solved the problem of rapid flat delivery.

The first machine of this type that R. Hoe & Co. built went to London to 'Lloyd's Weekly,' and the first to be set up in the United States was used in the office of the *New York Tribune*. The limit of capacity depended on the ability of the web paper to stand the strain of passing through the press. The average speed was 12,000 perfect papers an hour, though in some offices a speed of 14,000 was reached, and on a test a speed of 18,000 was recorded.

The use of wood pulp in the manufacture of news papers (now universal) cheapened greatly the cost of paper, and a further stimulus was given to the manufacture of printing presses to increase speed and efficiency.

It was necessary that the newspaper sheets as delivered by the presses should be folded for delivery, and hand-fed folding machines were in use in every newspaper office. Into them the sheets were fed one by one. Each was carried by tapes under a striking blade that forced it between a pair of folding rollers. It was then similarly carried to another at right angles, and so on until the desired shape was reached. Such folders were made part of the fast presses, but as the limit of capacity of the folder was 8,000 sheets an hour, it was a drag until Stephen D. Tucker, in 1875, patented a rotating collecting cylinder, which doubled the capacity, and Walter Scott followed with an invention for making press and folder one machine.

This, however, was but the beginning. The pressure on the newspapers demanded larger than 8-page papers. It became necessary to revise some way to print 10-, 12-, 14-, and 16-page papers at one impression. About this time Anthony & Taylor, of England, patented devices by which the webs of paper could be turned over after printing on one side and the opposite, or reverse side, presented to the printing cylinder. Mr. Hoe bought the patent rights for England and the United States, and with them combined ideas patented by Luther C. Crowell, of Boston, who had made a machine for forming paper bags. After costly experiments these ideas were incorporated in a so-called "Double-Supplement" press, which was set up in the *New York Herald* office. Simplicity, speed, accuracy and efficiency had been combined. This press turned out either 4-, 6-, 8-, 10-, or 12-page papers at the rate of 24,000 an hour; the odd pages were accurately inserted and pasted in; the papers were cut and delivered folded. This press was really two presses built into one frame. In the secondary part the plate cylinders were half the length of those in the

main part, and at right angles to them. These were used for the supplements of two or four pages when it was desired to print more than eight pages. Each part was fed by its individual roll of paper. The plates being secured to the cylinders, the two rolls of paper were carried, each through its part of the machine, between two pairs of plate cylinders and impression cylinders and printed on both sides. Then the two webs of paper passed over turning bars, or "angle bars," with an edge at 45 degrees from its base, by which they were laid evenly and exactly one over the other as a brush from the paste fountain glided along the inner fold, pasting them together. The papers passed on down a triangular "former" that folded them along the centre margin. Thence the printed and folded web of paper passed over a cylinder, from within which a revolving blade projected and thrust the paper between folding rollers, while at the same moment a knife in the cylinder severed the sheet. A rapidly revolving mechanism, resembling in its motion the fingers of a hand, disposed of them accurately on traveling belts that hurried them on to the final delivery. Hundreds of this press have been built and operated in this country and abroad.

*Straight-Line Presses.*—The angle-bar press stood alone for a decade as having the only device, though somewhat cumbersome, for assembling the several sheets into one complete paper. Joseph L. Firm, foreman of the press-room at Frank Leslie's publishing house, however, solved the problem in a new way, and in 1889 patented the straight-line press. His first design was a simple tandem press. Three sets of cylinders were set in a straight line, and the printed product of the first passed over the second, and of the first and second over the third, thus assembling all three sheets over a triangular "former" for folding, cutting and delivering. It was but a step, to secure economy of construction and space, to build the press in tiers instead of tandem. Firm had the usual fortune of poor inventors. His first order, which was for a sextuple press, came from the *New York World*, and its building exhausted his resources. When set up, in 1891, it was so crudely and badly built that, failing to work properly, it was condemned. Poverty followed, but not for long. The Goss Printing Press Company of Chicago became interested in the straight-line press invention, which was being pirated, and bought it, taking Mr. Firm into the company. Litigation followed and established the patent and harmony among the printing press makers. Improvement was rapid. These presses mark the final development of the power printing press. Evolution and the requirements of the publishers of metropolitan newspapers have brought forward presses with various improvements of detail and in increasing sizes, until one press, so called, is a compound of two, four, six, eight, twelve presses built into one frame, one above the other, side by side or tandem, or all three for economy of space and power and efficiency, but the basic principle is the same,—a web of paper passes between two pairs of plate and impression cylinders and is printed on both sides; it is assembled (if on a double-supplement press or one of greater power), pasted, folded, cut or separated, folded again



## PRINTING PRESSES

and delivered ready for the carrier or mail-room, at a speed of 48,000 eight-page papers (the unit of manufacture) an hour; and with an accuracy that denotes exactness and skill of manufacture, excellence of material and utmost care and nicety in adjustment and operation.

The first improvement in the Hoe type of fast press was the quadruple (or four-fold) press built for the New York *World* in 1887. A further advance in 1891 produced the sextuple (a six-fold press), so constructed that the cylinders were all parallel. The first press of this pattern was set up in the New York *Herald* office. Eighteen months were needed to construct it; it weighed fifty-eight tons, and was composed of about 16,000 pieces. It was fed from three rolls of paper, each over five feet wide, and consumed an equivalent of 52 miles of paper, the ordinary width of the *Herald* page, every hour. Its delivery capacity was 72,000 eight-page *Heralds* in one hour, or 20 a second. The cylinders, when at top speed, made 200 revolutions a minute.

In 1896 an octuple (eight-fold) press was built for the New York *World*, with a corre-

machine, enabling the printing of three colors on the first and last pages of the newspaper. The largest Goss presses now in use are two in the office of the New York *Herald*,—called duodecuple, or twelve-fold. The *Herald* had two octuple presses and needed another. Its available floor space was entirely filled. The makers proposed to build in the air, as the press room was lofty, rising above the street level, and did on the same framework build another quadruple press on top of each of the octuples. Each press is now really made up of three quadruples, in tiers. Each can be operated individually; each delivers individually, the top press being fed and delivering its product on the mezzanine floor. In 1903 the New York *Herald* increased the size of its paper from a six-column page measuring  $13\frac{1}{4} \times 21$  inches to a seven-column page measuring  $15\frac{3}{8} \times 21\frac{1}{4}$  inches. It was able to make over its presses to accommodate the increased width of the web, though web and cylinders now barely clear the framework.

*Newspaper Color Presses.*—Ever searching for new features, New York newspaper pub-

THE GOSS THREE-DECK STRAIGHT-LINE PRESS.

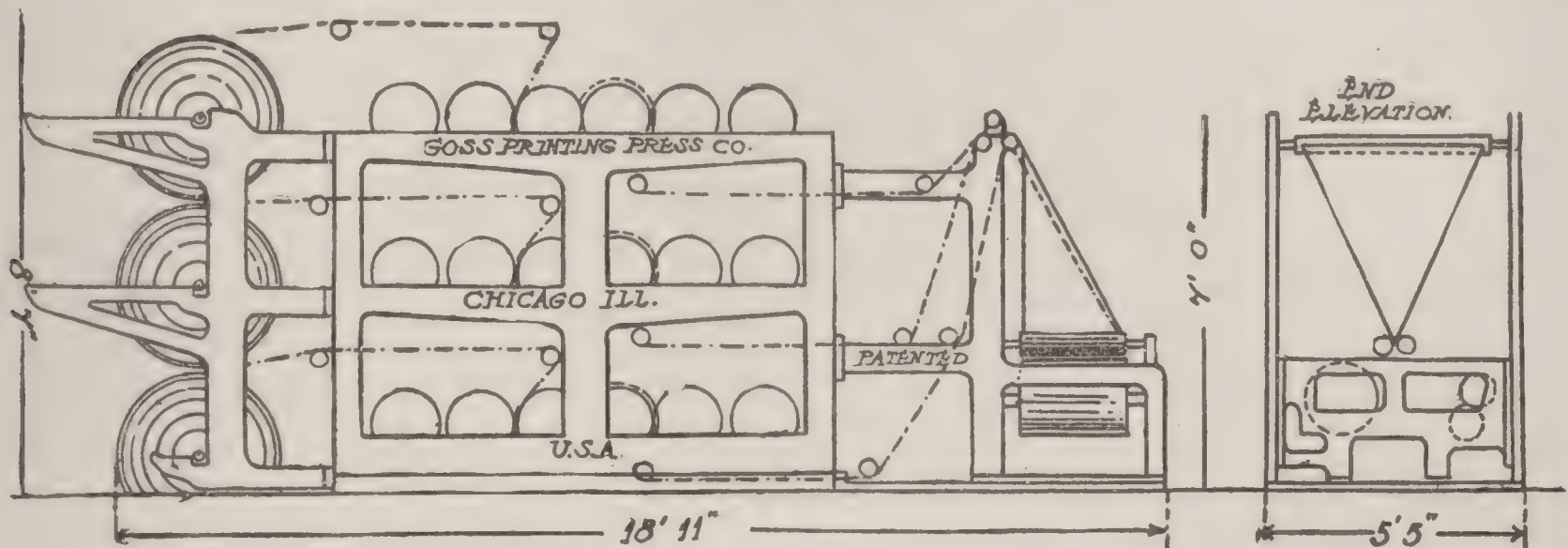


FIG. 4.—Diagram of the sextuple unit. Dotted line shows the course of the three webs of paper, which are assembled on the triangular "former" or folder. This press is two plates wide, has a capacity of 24,000 four-, six-, eight-, ten-, or twelve-page papers an hour; or 12,000 sixteen-, twenty-, or twenty-four-page papers. It weighs 42,000 pounds and requires forty horse-power.

sponding increase in output, and four double sextuples, with color-printing attachment, were constructed for the New York *Journal*. These are each 35 feet high, 17 feet long, 9 feet wide, weigh 110 tons and are composed of about 50,000 parts. It is possible, by associating the webs of paper, to collect and deliver twenty-four-page papers, and any combination between that and four-page papers, and in this, as in lesser presses of this type, each unit and any combination of units of the press may be run separately while the rest of the press is idle.

Even larger are the six giant double-octuple presses which R. Hoe & Co. designed for 'Lloyd's Weekly.' Two were set up and in operation in its office, Salisbury Square, London, by 1 Jan. 1904. Five months is required to build a press of this size. Each of these eight-roll presses can produce a 32-page paper, or, by collecting two of these before delivery, a 64-page paper, and, of course, any smaller combination of pages.

The 1902 patterns of the Goss press carry also "color decks," being an arrangement of two extra pairs of cylinders on the top of the

lishers in 1902-3 were planning and designing supplements and main sheets embellished with color printing. Their scientific pressmen and the press-builders were called on to produce the desired effects. Walter Scott, of Plainfield, N. J., designed and built a very efficient press that was set up in the office of the New York *World* in 1893. This had five two-page wide color cylinders for electroplates set tandem, with a pair of cylinders for printing the reverse side in a single color, usually black. Below was a complementary stereotype cylinder machine for printing four pages in a single color; so that this machine could produce either a four-page paper, one Christmas supplement showing no side pages in five colors and the inside in a single color. By skilfully dividing the ink fountains, and combining colors and overprinting, many shades are produced in the same paper, one Christmas supplement showing no less than 36 shades. This press was removed to the office of the *Post-Dispatch*, in St. Louis, in 1902, where it is still doing very efficient work. To meet increasing demand *The World* had R. Hoe & Co. build an angle-bar



double color-press in 1894, each side of which printed four (the two outside and the two inside) pages in four colors, and four pages in a single color; and another, a straight-line press, in 1898 with a capacity for four pages in five colors, and four pages in two colors; these two eights can be collected and delivered as a 16-page paper. The press will also produce a 24-page paper with four colors. The great problem to overcome was the offset from the color printing; this was done by bringing oil rollers into contact with the impression cylinders.

Color printing presses have been widely adopted by the American newspapers, and in the new models all the manufacturers offer "color decks."

The skill of the American printing press manufacturers has produced so many designs, adapted to meet every demand of newspaper publishers, large and small, that it is impossible to enumerate the patterns. The presses here illustrated are sufficient to show the types. See NEWSPAPER PRINTING.

R. H. LYMAN,

*Editorial Staff, 'The World,' New York.*

**Printz, Johan**, yō'hän prints, Swedish colonial governor in America: b. Bottneryd, Sweden, about 1600; d. 1663. He fought in Germany in the Thirty Years war with the rank of a lieutenant-colonel of artillery in the Swedish army, but having surrendered Chemnitz in Saxony to the enemy, was deprived of his rank. In 1641, however, he regained the good will of the crown, was raised to the nobility, and made the third governor of the colony established by the Swedes on the Delaware River in 1638. He landed at Fort Christina in 1643 and until his departure from the colony in 1658 maintained the prosperity of the settlement, upheld the Swedish claims, almost unaided, against the English under Sir Edmund Plowden and Lamberton, and against his near neighbors, the Dutch. He built forts on the island of Tinicum near the mouth of the Schuylkill below Philadelphia, at Wilmington, and at New Castle, exerting much influence over the Indians along the Delaware and protecting his trade with them. At Tinicum he built himself a rude mansion, known as "Printz Hall." The influx of settlers during his rule was made up of a good class of farmers who dealt fairly with the Indians and established a precedent of kindness and justice acted upon so successfully afterward by William Penn. The only record of Printz after he returned to Sweden is that he was made a general and in 1658 was appointed governor of Jonköping. Consult: Smith, 'The Thirteen Colonies' (1901); Winsor, 'Narrative and Critical History of America' (1889).

**Prion'idæ**, a family or subfamily of longicorn beetles distinguished from its allies by the margined and usually toothed thorax. They are mostly insects of large size and robust form. Their larvæ are large, soft grubs with small heads but powerful jaws, which bore in wood and are very destructive. They rest in a nearly straight position, not bent or doubled. A number of conspicuous species are found in the United States, several of the most common belonging to the genus *Prionus*, in which the thorax bears three marginal teeth on each side, the joints of the long antennæ fit into one an-

other in an imbricate fashion and number from 12 to 27. These insects are nocturnal, and the males are said to fight fiercely for possession of the females. One of the largest species is *P. brevicornis*, a common black beetle, which flies about in a heedless fashion at dusk. The huge larvæ, as large as a man's finger, live for three years; and are very injurious to the roots of poplar and other trees. A smaller and more slender beetle is *Orthosoma unicolor* which bores passages through the roots of grape vines. Other species are less destructive, confining their attacks chiefly to the dead wood of stumps and decaying tree trunks.

**Prior**, pri'or, **Matthew**, English poet and diplomatist: b. Wimborne Minster, Dorsetshire (possibly Winburn, Middlesex), 21 July 1664; d. Wimpole, Cambridgeshire, 18 Sept. 1721. He was educated at Cambridge, and in 1688 was chosen fellow of his College, Saint John's. With Charles Montague he wrote in 1687 'The Country Mouse and the City Mouse,' a parody of Dryden's 'Hind and Panther.' Through the Earl of Dorset he was appointed secretary to the English plenipotentiaries at The Hague in 1690; in 1697 he became secretary to the commissioners who concluded the Peace of Ryswick, and on his return from The Hague, secretary to the Lord-lieutenant of Ireland, and finally under-secretary of state. In 1699 he produced his 'Carmen Seculare for the Year 1700.' He succeeded John Locke as commissioner of trade and plantations, and sat for a short time in Parliament. At the beginning of the reign of Anne he left the Whigs to join the Tories. Made commissioner of customs in 1711 he took part soon after in the negotiations which preceded the peace of Utrecht, for a short time exercising the full powers of a plenipotentiary. On the accession of George I. he was impeached on the charge of high treason and kept in custody two years in his own house. Having been rendered nearly penniless, he published a folio edition of his poems by subscription. He was buried in Westminster Abbey. Prior made his way chiefly by his wit and social qualities. His poetical powers were at their best in short occasional pieces in the flowing ease and vivacity of narration. Consult: Aldine edition of 'Prior's Poetical Works' (1892).

**Prior**, the chief coadjutor of an abbot in the government of an abbey, or the actual ruler of a monastic establishment. Not till the 13th century was prior used as a term significant of authority or rule, but rather of superiority of any kind, as experience, wisdom, advanced age. Till that time the abbot's coadjutor was styled *præpositus* (provost), but now he was called prior and under him, in great abbeys was the sub-prior. Then, the head of a small monastery, of Benedictine monks, for example, was called prior. Finally, the chief officer of a convent of Augustinians, or Dominicans, or Premonstratensians, had the same title, while the corresponding officer of a Franciscan house was known as *custos* (guardian); but the heads of houses of the military orders of St. John of Jerusalem, of Malta and of the Temple were also Priors. Prioresses in religious houses of women, whether abbeys or simply conventual establishments, had much the same authority as priors in religious orders of men.



## PRIPET — PRITCHETT

**Pripet**, prēp'ēt (Russian, *Pripyat*), a river in the western part of Russia. It has its rise in the government of Volhynia, and is the outlet of several lakes; flows east and southeast and enters the Dnieper. It is about 500 miles long; navigable over 300 miles, and is connected with the Vistula and the Niemen by canals. Its upper course is through a vast uninhabited forest region, with large areas of marsh lands.

**Priscian**, prīsh'ī-an (Latin, PRISCIANUS CÆSARIENSIS, prīsh-ī-ā'nūs sē-zā-rī-ēn'sīs), Roman grammarian of the 6th century, A.D. From his surname "Cæsariensis" it is supposed that he may have been born at Cæsarea. Almost all that is known of the facts of his life is that he taught Latin at Constantinople. His 'Institutiones Grammaticæ,' in 18 books, a most thorough and comprehensive work, has chiefly preserved his fame. The first 16 books treat of the eight parts of speech recognized by the ancient grammarians. The last two are on syntax and are preserved separately in one manuscript, these bearing the title 'De Constructione.' The whole work, successively abridged, formed the basis of instruction in Latin up to the 15th century.

**Priscillian**, prī-sil'ī-an, Spanish religious sectary: b. about 350; d. Treves 385. He was charged with teaching heresy resembling Gnosticism or the doctrine of the Manichæans and was excommunicated by the Synod of Saragossa (380). However, he was able by his eloquence to cause the judgment to be withdrawn and put to flight his chief opponent, the bishop Ithacius. The bishop later gained the support of Maximus, the usurper at Treves, and secured the condemnation and execution of Priscillian. The followers of Priscillian were known as Priscillianists. Their beliefs included peculiar views of the influence of the heavenly bodies upon men. The literary remains of Priscillian have been gathered in the 18th volume of the 'Corpus Scriptorum Ecclesiasticorum Latinorum' (1889).

**Prism**, in geometry, a solid having similar and parallel bases, its sides forming similar parallelograms. The bases may be of any form, and this form (triangular, pentagonal, etc.) gives its name to the prism. In optics, any transparent medium comprised between plane faces, usually inclined to each other. The intersection of two inclined faces is called the edge of the prism, etc.; the inclination of the one to the other, the refracting angle. Every section perpendicular to the edge is called a principal section. The prism generally used for optical experiments is a right triangular one of glass, the principal section of which is a triangle. It is used to refract and disperse light, resolving it into the prismatic colors. See LIGHT.

**Prison Association of the United States, National**, an organization of reformers and philanthropists, founded in Cincinnati, Ohio, in 1870, under the presidency of Rutherford B. Hayes. There is a board of directors and an executive committee of seven. Meetings are held annually. There are standing committees on criminal law reform, prison discipline, juvenile delinquency, etc.

**Prison Reform.** See PENOLOGY.

**Prisoner of Chillon, The**, a narrative poem by Lord Byron based on the story of the im-

prisonment of François de Bonnavard (1496-1570) in Château de Chillon, situated between Clarens and Villeneuve on Lake Geneva. It was Sir Walter Scott's opinion that as a picture, this poem, however gloomy the coloring, might rival any which Lord Byron had drawn.

**Prisoners of War** are persons captured from the enemy in time of war. Among the ancients prisoners of war became the slaves of their captors. When a hostile army enters a country, noncombatants are usually left unmolested, so far at least as their personal liberty is concerned. The combatants who have laid down their arms become prisoners of war, and their persons are at the entire disposal of the conquerors. The practice is to keep them in confinement till the termination of the war, or until a mutual exchange of prisoners between the warring states gives them their liberty. They are commonly treated in a somewhat similar manner to ordinary prisoners.

**Prisons, Military, United States.** See MILITARY POSTS, UNITED STATES.

**Prisrend**, prēs-rënd', or **Perserim**, European Turkey, capital of the vilayet of Kosovo, on the right bank of the Rieka, four or five miles from its confluence with the Drin. It is the residence of a pasha, and the seat of a Greek metropolitan and a Catholic bishop. Among its buildings are 42 mosques, one Catholic and five Greek churches. It has considerable manufactures of fire-arms, and a large traffic with the adjacent country, and with many of the large towns in Albania, Rumelia, and Servia. Pop. about 39,000.

**Pritchard**, prīch'ard, **Jeter Connelly**, American legislator: b. Jonesboro, Tenn., 12 July 1857. He entered a printing-office in early life, removed to Bakersville, N. C., in 1873, and until 1887 was joint editor and owner of the 'Roan Mountain Republican.' He served in the State legislature in 1884, 1886, and 1890. In 1887 he was admitted to the bar and engaged in law practice in Marshall, N. C., was president of the State Protective Tariff League in 1894, served as United States Senator to fill a vacancy in 1894-7 and in the latter year was re-elected for the term of six years. In 1903 he became an associate justice of the Supreme Court of the District of Columbia.

**Pritchett**, prīch'ēt, **Henry Smith**, American astronomer and educator: b. Fayette, Mo., 16 April 1857. He was graduated from Pritchett College, Glasgow, Mo., in 1875 and later studied astronomy under Asaph Hall in the United States Naval Observatory where he became assistant astronomer in 1878. In 1880 he accepted the position of directing astronomer at Morrison Observatory, Glasgow, Mo., and in 1881 was appointed to the chair of astronomy and mathematics at Washington University, Saint Louis, Mo. He was permitted leave of absence in 1882 in order that he might observe the transit of Venus at Auckland, and he also made pendulum observations at Auckland, Sydney, Singapore, and Hong Kong. He was in Europe on scientific work in 1894-5, was appointed superintendent of the United States coast and geodetic survey in 1897, in 1900 president of the Massachusetts Institute of Technology, and in 1905 president of the Carnegie Foundation.



## PRIVAT DOCENT—PRIVY COUNCIL

**Privat Docent**, prē-vät' dō-tsěnt', in the German university system (and others modeled on it), an instructor whose lectures rank with those of the professors, but who unlike them has no standing in the faculty as a governing body of the university. He receives no fees except directly from his pupils. He must have received the doctoral degree and also be habilitated, that is, successfully defended a thesis, the result of his own research. The post is commonly a means of preparation for university professorships.

**Private Schools**, institutions under private control as distinct from public, and implying maintenance by private corporations or individuals. But the school may be private, or not public, in its origin and government, and if there are no limitations as to who may be admitted as pupils, it is usually classed as a public school. See RUGBY; SECONDARY SCHOOL.

**Privateer'**, the name applied in time of war to a ship owned by a private individual, which under government permission, expressed by a letter of marque, makes war on the shipping of a hostile power. To make war on an enemy without this commission, or on the shipping of a nation not specified in it, is piracy. Privateering was abolished by mutual agreement among European nations, except Spain, by the Declaration of Paris in 1856; but the United States of America refused to sign the treaty, except on condition that all private property at sea, not contraband, should be exempt from capture. This "Marcy," or "American," amendment, as it was called, was not accepted. This doctrine was again affirmed by the United States delegates to the Peace Conference at The Hague in 1898, but was again rejected by the European powers. It is doubtful, however, how far the abolition of privateering would stand in a general war, for it is the natural resource of a nation whose regular navy is too weak to make head against the maritime power of the enemy, especially when the latter offers the temptation of a wealthy commerce. It was usual for the country on whose behalf the privateers carried on war to take security for their duty respecting the rights of neutrals and allies, and their observing generally the law of nations. In the wars of 1793-1814 many English privateers were afloat. But in the same period no less than 10,871 English ships, with over \$5,000,000,000, were taken by French "corsairs"; the Breton privateer Surcouf took, in two months of 1807, prizes worth \$1,456,250. At the American Revolution the new republic fully realized the advantage of its position in preying on the mercantile marine of Great Britain; and in the War of 1812 British commerce suffered severely at the hands of American privateers, of which it was computed that some 250 were afloat. During the American Civil War the Confederate States offered letters of marque to persons of all countries, but no admittedly foreign vessels were so commissioned. During the same period the Congress of the United States empowered the President to grant commissions to privateers, but none such were granted. The Confederate cruisers were at first regarded in the North as mere pirates; and the "Alabama Claims" originated in the charge against Great Britain of allowing the departure of privateers from British ports, where they were fitted out illegally.

**Privet**, a genus (*Ligustrum*) of shrubs or trees of the order *Oleaceæ*. About 35 species are known, natives of eastern Asia, Australia, with one of the Mediterranean region. They are deciduous or evergreen and bear terminal panicles of small, whitish, generally fragrant flowers, followed by usually black berries which often remain on the plants during winter. They are justly popular plants in shrubberies and some are widely used as hedges since they are erect-growing and stand shearing well. They are readily propagated by means of cuttings, seeds, or layers, and will succeed in almost any soil, in full sun, on dry land, and under partial shade. The common privet (*L. vulgare*), *L. ibota*, and *L. ciliatum* are fully hardy in the Northern States, but the so-called California privet (*L. ovalifolium*), a Japanese species, is doubtfully hardy farther north than New York city. The berries of some species are eaten by birds, but are not of pleasant flavor. They supply a pink pigment used in map-making and in dyeing. The wood of some of the larger kinds is very hard and is used for making shoe-pegs and for turning. The only insect that is commonly troublesome upon the plants is the privet web-worm (*Diaphania quadrastigmatis*).

**Privilege** taken in its active sense is a particular law, or a particular disposition of a law, granting certain special prerogatives to some person contrary to the common right. Examples of privilege may be found in all systems of law, as in the case of members of Congress and of the several legislatures when in attendance at their legislative duties; parties as witnesses while attending court, and coming to and returning from the same, electors while going or returning to the election, are all privileged from arrest except for treason, felony, or breach of the peace. Privileges from arrest are either general and absolute, or limited as to time or place.

Embassadors and their servants are absolutely so privileged.

A privilege of arrest for a legislature member is limited to the period of the legislative session and a reasonable time in going and returning.

In the civil law a privilege is a right which the nature of a debt gives to a creditor, entitling him to be preferred before other creditors.

Privileged communications are those statements made by a client to his counsellor or attorney in confidence, relating to some cause or action then pending; such communications cannot be disclosed without the consent of the client. The courts sometimes exclude from evidence, as privileged communications, matters of a judicial, political, or professional nature on the grounds of public policy.

In many jurisdictions a writ of privilege or protection is issued by the courts, affording one, under proper circumstances, protection against arrest or from the service of civil process.

A witness is entitled to the privilege of refusing to answer incriminating questions.

HENRY M. EARLE.

**Privy Council**, in England, the body of advisers of the sovereign which formally sanctions those acts of government not properly the province of Parliament. Privy councillors are nominated, without patent or grant, at the pleasure of the crown, excepting certain persons appointed *ex-officio*. They hold office for life, or for the life of the sovereign, so that at the accession of a new sovereign the council must be reconstituted. The number of privy councillors is not limited by law. At the present time the body contains about 250 members.



## PRIVY-PURSE — PRIZE

*Jurisdiction.*—The duty of the Council, in general, is to advise the king on affairs of state. The Lord President of the Council is required by statute "to manage the debates in Council, to propose matters from the sovereign at the Council Table, and to report to the sovereign the resolution of the Council thereon." This function, however, is largely theoretical, as there are in fact no debates in council, this body merely giving formal sanction to orders in council, by which the king expresses his pleasure with respect to various administrative matters, as for instance, the bringing of treaties into effect, grants of charters, the government of colonies, and the regulating of departmental business. So, too, the Privy Council performs certain ceremonial functions. For instance, in council a bishop does homage for the temporalities of his see, a minister takes the oath of office, and the sheriffs for counties are chosen. The council has, besides, important duties of an administrative or judicial nature which it performs by committee or commission. Several of these committees have only a theoretical connection with the council, acting to all intents and purposes independently. The cabinet itself is such a committee, composed of ministers belonging to the Privy Council, but it has completely outgrown the parent body in political importance, having practically superseded it in the functions which this formerly performed. The board of trade, now under its own president and regarded as a distinct department of state, was from the first a committee of the Privy Council. The local government board of agriculture and the board of education are similar developments from the council, while the universities committee, the committee "for the consideration of charters of incorporation under the Municipal Corporations Act" of 1882 are still subordinate to the main body. The judicial functions of the Privy Council are carried on by its judicial committee, which includes the Lord Chief Justice and the four Lords of Appeal. It is concerned chiefly with appeals from colonial and Indian courts, has ecclesiastical jurisdiction and decides concerning petitions for extension of letters patent, copyright, etc. The Privy Council is summoned on a notice of 44 hours. Only on very extraordinary occasions is there a full attendance, the presence of six members being sufficient to constitute a council. Privy councillors have the title of "right honorable" and rank immediately after Knights of the Garter.

*History.*—The Privy Council developed out of the *curia regis* (king's council) of the Norman period, which exercised judicial, legislative, and administrative functions. Out of the *curia* grew the courts of law and equity and the houses of Parliament besides the Privy Council. After the time of Edward I. appeared the *concilium ordinarium*, or ordinary council of the king which in the 15th century gained the name Privy Council. The Select Council, ultimately the Cabinet, began to emerge from the larger body about the same time. In the time of Edward III. the Privy Council was occasionally merged in one assembly with the House of Lords, and in 1640 the Long Parliament reduced the powers of the council. In 1679 Sir William Temple made an unsuccessful attempt to reorganize it, but since then it has dwindled into

insignificance when compared with its early authoritative position, and its governmental duties have been assumed by the Cabinet. Ireland has a separate Privy Council. Bodies, somewhat similar and bearing the same name, formerly existed in several of the American colonies and States. Consult: Macqueen, 'Appellate Jurisdiction of the Privy Council' (1842); Finlason, 'The Judicial Committee of the Privy Council' (1878); Dicey, 'The Privy Council' (new ed. 1887); Gneist, 'History of the English Constitution' (1891); Anson, 'Law and Custom of the Constitution' (1892).

**Privy-purse, Keeper of the**, an officer of the royal household of Great Britain, in charge of the payment of the private expenses, including charities, of the sovereign. He has no control over any official or household expenses, and is independent of the great officers of the household.

**Privy-seal** (*privatum sigillum*), a British governmental seal appended by the sovereign to such grants or things as are afterward to pass the great seal; and sometimes used in matters of less consequence, which do not require to pass the great seal, as to discharge a recognizance, debt, etc.; no writ, however, which relates to the common law can pass the privy-seal. Since the time of Henry VIII. the privy-seal has been the warrant of the legality of grants from the crown, and the authority for the lord-chancellor to affix the great seal. Such grants are termed letters-patent. The officer who has the custody of the privy-seal was anciently called clerk of the privy-seal, afterward guardian *del* privy-seal; now he is called lord privy-seal, and is the fifth great officer of state, having also generally a seat in the cabinet. The lord privy-seal must not put the seal to any grant without good warrant; nor with warrant if it be against the law or inconvenient without first acquainting the sovereign therewith.

**Prix de Rome**, *prê de rôm* (French, "prize of Rome"), a prize offered by the French government to art students by which they are enabled to prosecute their studies in the capital of Italy. It was founded by Louis XIV. in 1666 and enlarged by Napoleon. Those eligible for the prize are painters, sculptors, architects, musicians, and engravers, and the privilege bestowed consists of an income of some 4,000 francs for four years with access to the Académie de France at Rome and exemption from military service. Candidates must be Frenchmen between the ages of 15 and 30, and must have done certain work at the Ecole des Beaux Arts or elsewhere. The competition is so arranged as to comprise only ten students from each department for the final comparison, and these are allowed three months in which to accomplish the work they put in for the prize. While studying at Rome the successful competitor is expected to send to the Salon, or if he be a musician to the Conservatoire, every year, specimens of the work he is engaged in, and thus report progress.

**Prize**, that which is taken from an enemy in war; that which is seized by fighting, especially a ship, with the goods contained in her; any description of goods or property seized by force as spoil or plunder. The law as to prizes



## PRIZE—PROBABILITY

taken at sea is regulated by international law. In order to vest the title of the prize in the captors it must be brought with due care into some convenient port for adjudication by a competent court.

**Prize-court**, in times of war, a court established to adjudicate on prizes captured at sea. In the United States, the United States District Courts have jurisdiction both as instance and prize courts, there being no distinction in this respect as in England, where the prize-court is a separate branch of the court of admiralty. See ADMIRALTY LAW.

**Prize-money**, in warfare, money paid to the captors of a ship or place where booty has been obtained, in certain proportions according to rank, the money being realized by the sale of the booty.

**Prjevalsky**, przhā-vāl'skē, or **Prejevalski**, prā-zhā-vāl'skē, **Nicholas**, Russian traveler: b. Otradny, government of Smolensk, 31 March 1839; d. Karakol, West Turkestan, 1 Nov. 1888. Having joined the army in 1855 he assisted in quelling the Polish insurrection of 1861. While stationed in Siberia in 1867 he explored the Usuri region, south of the Amur, and spent 1871-3 in traveling from Peking through southern Mongolia (region of the Ordus) to the Ala-shan, Koko-nor, and the upper waters of the Yang-tse-Kiang. In 1876-7 he explored Lob-nor on the borders of East Turkestan and China, and in 1879 reached a point some 160 miles north of Lhasa, when the Tibetan authorities turned him back. He reached Kiachta after a journey of nearly 15,000 miles. In 1883-4 he again crossed the Desert of Gobi, but returned without being able to reach Lhasa. He died just as he was starting on his fifth expedition. Prjevalsky brought back from these journeys valuable collections of animals and plants, all now preserved at St. Petersburg. His accounts of his journeys were published in the 'Proceedings' of the St. Petersburg Geographical Society in 'Petermanns Mitteilungen' and other journals.

**Pro'a.** See CATAMARAN.

**Prob'abilists**, those philosophers who maintain that certainty is impossible, and that we must be satisfied with what is probable. This was the doctrine of the New Academy, particularly of Arcesilaus and Carneades. The last-mentioned philosopher distinguished three principal degrees of probability, according as a representation might be probable when considered by itself alone; probable and unimpeached when compared with others; or thirdly, probable, unimpeached and in all respects confirmed. In morals probabilists are those who teach that in our actions we must follow what seems to us probably right, because in questions of morality demonstrative certainty is not to be attained. There are some Christian teachers (and among them Gury in his 'Compendium Theologiæ Moralis') who taught that a man may follow what is probably right, or what has been decided to be so by teachers of authority, although it may not be the most probably right, or may not seem probable to himself. It is this view that Pascal in his famous 'Provincial Letters' holds up to ridicule. Butler in his 'Analogy' bases his argument on probability, to which he applies the term "moral certainty."

**Probability, Theory of**, is that branch of mathematics which deals with the determination of the degree of belief which, in the absence of full information, should be given to certain classes of statements, or to the past or future occurrences of certain events.

In regard to the great majority of events there is in the mind of every one a state of uncertainty. Under differing circumstances one shows this uncertainty by saying that it is possible or that it is, or is not, probable that some event did or will happen. Ordinarily no attempt is made to establish an exact measure of the probability of an event, such attempt being clearly foredoomed to failure. Not infrequently, however, the first step toward such a measurement is taken by the making of a rough comparison of the probabilities of two events, the conclusion resulting that one of them is *more* probable than the other.

**Equally Probable Events.**—For certain sorts of events it is possible to proceed farther. Thus, as a next step, it is quite common to find that two events are regarded as *equally* probable. For instance, a coin being tossed, one says that head and tail are equally likely to appear; or, a properly made die being thrown, one estimates that any one of the six faces is as likely to appear as any other. Of course these estimates are made in spite of the belief that, starting from a given initial position, the body moves completely subject to the laws of dynamics, and that from certain influences but one result can follow. The fact is that the observer is so ignorant of the forces applied to the body that his judgment is formed independently of them. He perceives that from the nature of the body only a certain number of events are possible, and he finds no reason for concluding that one event rather than another will occur.

**Probability of an Event.**—Suppose now that five events are known to be equally probable, and that one of them will and only one can happen. Suppose also that if and only if one or another of the first three occurs, a further event *E* will occur. Then it is commonly said that the odds are 3 to 2 in favor of the event *E*; and since there are five equally probable events, of which exactly three are concurrent with *E*, it is said that the mathematical probability of *E* is  $\frac{3}{5}$ . In general, *when a specified event E is governed by n equally probable events, of which one will and only one can happen, and when, of m of these, each is decisively favorable to E, all others being decisively unfavorable, the mathematical probability of E is defined to be*  $\frac{m}{n}$ . In the extreme

cases in which none and all of the events, respectively, are favorable to *E*, the probabilities are said to be 0 and 1, though in each case there is certainty regarding the occurrence of *E*.

Assume now that, of *n* equally probable and mutually exclusive governing events,  $m_1, m_2, \dots, m_k$  are respectively favorable to the further events  $E_1, E_2, \dots, E_k$ , which are also mutually exclusive. Then the probabilities of  $E_1, E_2, \dots, E_k$  are respectively  $p_1 = \frac{m_1}{n}, p_2 = \frac{m_2}{n}, \dots, p_k = \frac{m_k}{n}$ .

If now  $m_1 + m_2 + \dots + m_k = n$ , one has  $\frac{m_1}{n} + \frac{m_2}{n} + \dots + \frac{m_k}{n} = 1$ ; or  $p_1 + p_2 + \dots + p_k = 1$ . This result may be stated formally as



## PROBABILITY

**Theorem 1.** *The sum of the mathematical probabilities of a number of events, of which one must and only one can happen, is unity.*

The application of the definition requires the selection of a set of governing events, finite in number, which must be either equally probable or capable of being replaced by a set of equally probable events; it then requires a correct enumeration of the favorable events and of the whole set. Each of these steps may present difficulties, but failure follows most frequently from a wrong selection of the set of governing events. Consider the following example:

*Ex. 1.* A coin being tossed twice, what is the probability that head appears twice?—One might say that the possibilities, or governing events, are three in number, viz., the appearances of two heads, of a head and a tail, and of two tails, respectively; that of these one is favorable, and that  $p = \frac{1}{3}$ . But the answer is incorrect because the appearance of two heads, or two tails, is not as probable as that of a head and a tail. The following are really equally probable events: the appearance of head, head; of head, tail; of tail, head; of tail, tail. They are four in number, one being favorable. Hence  $p = \frac{1}{4}$ .

The solutions of the following problems illustrate the direct application of the definition. Nearly all problems in this subject require the use of the theory of permutations and combinations. (See ALGEBRA, *Permutations and Combinations*.)

*Ex. 2.* Two dice being thrown, what is the probability that the throw will be seven?—The equally probable events are the appearances of the several numbers of the first die with those of the second die, and are 36 in number. The favorable cases are the following sets: 1, 6; 2, 5; 3, 4; 4, 3; 5, 2; 6, 1; they are six in number. Hence  $p = \frac{6}{36} = \frac{1}{6}$ .

*Ex. 3.* Two dice being thrown twice, what is the probability that at least one double appears?—In either throw any face of one die may be associated with any one of the other. Hence there are 36 equally probable cases for each throw. Each case for the first throw may be associated with each case for the second throw. Hence there are  $36^2 = 1296$  cases in all. Of the 36 cases in either throw 30 will fail to yield a double. The association of each of these cases for the first throw with each of these for the second throw will yield all of the unfavorable cases. Hence there are  $30^2 = 900$  unfavorable cases, and accordingly,  $1296 - 900 = 396$  favorable cases. Hence  $p = \frac{396}{1296}$ .

*Ex. 4.* (a) From a bag containing five balls some are to be drawn. Find the probability that an even number of balls will be drawn. (b) Find also the probability if the number of balls be  $n$ .—(a) The total number of cases is the sum of the numbers of ways of drawing 1, 2, 3, 4, and 5 balls, which is  $5 + 10 + 10 + 5 + 1 = 31$ . The numbers of ways of selecting 2 and 4 balls are 10 and 5. Hence the number of favorable cases is 15. Hence  $p = \frac{15}{31} = \frac{1}{2} - \frac{1}{62}$ .

(b) The total number of cases is

$${}_nC_1 + {}nC_2 + \dots + {}nC_n.$$

The number of favorable cases is  ${}_nC_2 + {}nC_4 + \dots$

Now  $(1 + 1)^n = 1 + {}nC_1 + {}nC_2 + \dots + {}nC_n$ ,

and  $(1 - 1)^n = 1 - {}nC_1 + {}nC_2 - \dots$

Hence  $2^n - 1 = \text{total number of cases.}$  Also

$$2^n - 2 = 2({}_nC_2 + {}nC_4 + \dots), \text{ and so } p = \frac{2^{n-1} - 1}{2^n - 1}.$$

Notice that an odd number of balls is more likely to be drawn than an even number.

Another problem remarkable alike for its apparent difficulty, the fine reasoning employed in its solution, and the simplicity of its results is the following one:

*Ex. 5.* At an election two candidates A and B received respectively  $a$  and  $b$  votes, A being elected. What is the probability that during the counting of the ballots A was always ahead?—The solution is obtained easily after it is shown that of the orders of counting which are unfavorable to the result mentioned exactly one-half begin with a vote for A. The answer is  $p = \frac{a-b}{a+b}$ , i.e., the majority divided by the total vote.

### TOTAL PROBABILITY. COMPOUND PROBABILITY.

It may happen that the  $m$  governing events favorable to  $E$  can be classified into sets of  $m_1, m_2, \dots, m_k$  events respectively, where  $m = m_1 + m_2 + \dots + m_k$ . The probability,  $p_1$ , that  $E$  will be concurrent with one of the set of  $m_1$  events is  $\frac{m_1}{n}$ . Then since  $\frac{m_1}{n} + \frac{m_2}{n} + \dots + \frac{m_k}{n} = \frac{m}{n}$ , one

has  $p_1 + p_2 + \dots + p_k = p$ . Stated formally one has

**Theorem 2.** *If an event can happen in several mutually exclusive ways, the probability of its happening at all is equal to the sum of the probabilities of its happening in the several ways.*—Here  $p$  is called the *total probability*,  $p_1, p_2$ , etc., the *partial probabilities*. On the other hand the event  $E$  whose probability is sought may consist in the concurrence of several independent events. Suppose that these events are  $e_1, e_2, \dots, e_k$ , and that for them the total numbers of cases are  $n_1, n_2, \dots, n_k$ , respectively, and that the numbers of favorable cases are  $m_1, m_2, \dots, m_k$ , respectively. Then for the event  $E$  the total number of cases is  $n_1 n_2 \dots n_k$ , and of these  $m_1 m_2 \dots m_k$  are favorable. Hence

$$p = \frac{m_1 m_2 \dots m_k}{n_1 n_2 \dots n_k} = \frac{m_1}{n_1} \frac{m_2}{n_2} \dots \frac{m_k}{n_k} = p_1 p_2 \dots p_k.$$

Hence one has

**Theorem 3.** *The probability of the concurrence of several independent events is the product of the probabilities of their several occurrences.*—This theorem can be extended to the cases in which events, not independent, have a specified order, and in such cases the probability of each is to be computed on the hypothesis that the preceding events have happened.

These three theorems form the basis of the whole of the elementary theory. Their application will be illustrated in the solution of the following example:

*Ex. 6.* A with three coins endeavors to throw more heads in one throw than B can throw with two coins. In case of a tie they throw again. What is the probability of A's winning?—The following ways in which A can win include all cases, and are



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mutually exclusive. He may (1) throw 3 heads, (2) throw 2 heads and win, (3) throw 1 head and win, (4) he may tie B on the first throw and win on a subsequent throw. Let  $p$  be the total probability of A's winning, and  $p_1, p_2, p_3, p_4$  the partial probabilities. The following table gives the chances of various throws by A and B:

Number of heads.....	3	2	1	0
A's chance.....	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$
B's chance.....	0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$

Then, by theorem 3,  $p_1 = \frac{1}{8}$ ,  $p_2 = \frac{3}{8}(1 - \frac{1}{4})$ ,  $p_3 = \frac{3}{8}(1 - \frac{1}{4} - \frac{1}{2})$ . Also  $p_4$  is the product of the probabilities that a tie will occur and that A will subsequently win. The probabilities that a tie will occur with 3, 2, 1, 0 heads are 0,  $\frac{3}{8} \times \frac{1}{4}$ ,  $\frac{3}{8} \times \frac{1}{2}$ ,  $\frac{1}{8} \times \frac{1}{4}$ . The sum is  $\frac{5}{16}$ . If a tie occurs, the initial condition is reproduced and A's chance of winning is  $p$ . Hence  $p_4 = \frac{5}{16}p$ . Then, by theorem 2,  $p = \frac{1}{8} + \frac{3}{8}p + \frac{3}{8}p + \frac{5}{16}p$ , whence  $p = \frac{8}{11}$ .

### PROBABILITIES OF REPEATED EVENTS.

An interesting part of the theory is that relating to repetitions of events. Consider an event whose probability is  $p$ , and let  $q = 1 - p$ . Suppose that  $n$  trials are made. The probability that the  $n$  trials will result in  $s$  occurrences and  $(n - s)$  failures of the event, in a specified order, is  $p^s q^{n-s}$ . But the number of different

orders is  $\frac{|n|}{|s| |n-s|}$ . Hence the probability that in  $n$  trials there will be exactly  $s$  occurrences is

$\frac{|n|}{|s| |n-s|} p^s q^{n-s}$ . By considering different values of  $s$  one may find the probability that the number of occurrences shall lie between specified limits. Thus if a coin be tossed ten times, one finds the probabilities of the appearances of exactly four, five, and six heads to be  $\frac{210}{1024}$ ,  $\frac{252}{1024}$ ,  $\frac{210}{1024}$ ; and the probability that the number of heads will not differ from five by more than one is  $\frac{672}{1024}$ , or  $\frac{21}{32}$ .

An easy problem is the determination of that number of occurrences which is most probable. It is necessary only to compare the results of giving to  $s$  consecutive values between zero and  $n$  to discover that for the most probable case  $s$  must be so chosen that the fraction  $\frac{s}{n}$

is as nearly as possible equal to  $p$ . Hence in ten throws, the most probable number of heads is 5 because  $\frac{5}{10} = \frac{1}{2} = p$ . Likewise in 73 throws with one die the most probable number of throws of aces is 12, since  $p = \frac{1}{6}$ , and  $\frac{12}{73}$  is the fraction having the denominator 73 and being most nearly equal to  $\frac{1}{6}$ .

Of particular interest is the case in which the number of trials is very large. In this case the evaluation of the probability may be made approximately by the use of Stirling's formula:

$n = n^{n+\frac{1}{2}} e^{-n} \sqrt{2\pi}$ , where  $e$  is the Napierian

base. By this means many interesting results may be derived. Thus if  $p_0$  denote the probability of that number of occurrences

which is most probable,  $p_0 = \frac{1}{\sqrt{2\pi n p q}}$ ; and if

$P_l$  denote the probability that the number of occurrences shall not deviate from the most probable number by more than  $l$ , which does not exceed a small multiple of  $\sqrt{n}$ , then

$$P_l = \frac{2}{\sqrt{\pi}} \int_0^r e^{-t^2} dt + \frac{e^{-r^2}}{\sqrt{2\pi n p q}},$$

where  $r = \frac{l}{\sqrt{2n p q}}$ . The results here obtained

are due to James Bernoulli, and are usually combined in a statement of what is called

*Bernoulli's Theorem.* If an event has a constant probability,  $p$ , and if  $q = (1 - p)$ , then,  $n$  trials being made, the most probable result is that in which the ratio of the number of occurrences to the number of trials is most nearly equal to  $p$ . The number of trials being very great, the probability that the deviation of the number of occurrences from the most probable number shall not exceed  $l$  is

$$P_l = \frac{2}{\sqrt{\pi}} \int_0^r e^{-t^2} dt + \frac{e^{-r^2}}{\sqrt{2\pi n p q}},$$

where  $r = \frac{l}{\sqrt{2n p q}}$ , and  $l$  does not exceed a small multiple of  $\sqrt{n}$ .

For very many purposes in the Theory of Probability the definite integral  $\int_0^r e^{-t^2} dt$  is of great importance, and so tables of its values for different values of  $r$  have been prepared. It may be shown, too, that a very good approximation to the value of  $P_l$  is given by the equation

$P_l = \frac{2}{\sqrt{\pi}} \int_0^{r'} e^{-t^2} dt$ , where  $r' = \frac{l + \frac{1}{2}}{\sqrt{2n p q}}$ .

From the tabulated values of the probability integral,  $\frac{2}{\sqrt{\pi}} \int_0^{r'} e^{-t^2} dt$ , the following facts regarding  $P_l$  become evident. First, the deviation  $l$  being specified, the values of  $r'$  and of  $P_l$  decrease rapidly as  $n$  increases. In fact if the number of trials be increased sufficiently, the probability that the specified deviation will not be exceeded can be made smaller than any fraction assigned in advance. Second, if  $r'$ , and hence  $P_l$ , be specified, the corresponding deviation  $l$  increases rapidly as  $n$  increases, but the relative deviation, or the ratio of the deviation to the number of trials, decreases rapidly.

To illustrate these statements let it be recalled that, a coin being tossed ten times, the most probable result is five heads and five tails, and the probability that the deviation of the number of heads (from five) should not exceed one was found to be  $\frac{21}{32}$ . Consider now the cases of 10,000 and 10,000,000 trials. A careless examination might suggest that for the same probability,  $\frac{21}{32}$ , the corresponding deviations would be 1000 and 1,000,000 respectively. As a matter of fact, simple computations show that they are not more than 50 and 1500 respectively.



## PROBABILITY

The very close relation which existed between the theory of probability and the study of games of chance makes it exceedingly interesting to see what conclusions can be drawn regarding the probable results of persistent gambling. Bernoulli's theorem applies directly. Since the conclusions for all cases are similar it will be most satisfactory to consider a simple one.

Suppose, then, that A, with a capital of \$1000, repeatedly bets \$10 evenly that the toss of a coin will yield head. The game seems fair, and it might appear that in the long run A would neither win nor lose. Notice, however, that A will be ruined whenever he shall have lost 100 times more than he has won. The theory shows that of all possible cases the most probable is that in which the numbers of heads and tails are equal. But the probability of this result is  $\sqrt{\frac{2}{\pi n}}$ , and it evidently decreases rapidly as  $n$  increases. Bernoulli's theorem shows that, if the number of trials be about 25,000, the probability that the deviation shall exceed 100 is about  $\frac{1}{10}$ . Hence the chance that A will neither win nor lose the amount of his present fortune soon becomes inconsiderable. One may say, then, that in the long run A will either be ruined or will at least double his fortune; and the chances of these events appear to be even. As a matter of fact A is at a serious disadvantage. For many runs of results which might ultimately be favorable to him are excluded because in their beginnings he has so many losses that he must cease play for lack of money. On the other hand all runs which begin favorably but ultimately become unfavorable must be counted because A does not stop as long as he wins. Hence the equality of the chances is destroyed.

### MATHEMATICAL EXPECTATION.

A person who has a possibility of securing without cost a property of any sort places upon that possibility a value which depends upon that of the property and upon the probability of his securing it. In our subject a definite valuation is placed upon such a possibility. This valuation is called its *mathematical expectation* and is defined to be the product of the value of the property and the probability of getting it. More generally, if there are several gains,  $a_1, a_2, \dots, a_n$ , with the respective probabilities,  $p_1, p_2, \dots, p_n$ , the mathematical expectation arising from these gains is  $E = p_1a_1 + p_2a_2 + \dots + p_na_n$ . In this connection losses may be treated as negative gains. It is not denied that such an estimate involves the disregard of many elements, but unquestionably in the applications of this definition which are generally made such disregard is reasonable. To be more specific, it is extremely unlikely that a poor man would regard a possible gain of \$2000, whose probability is  $\frac{1}{2}$ , as equivalent to the actual possession of \$1000. On the other hand such an estimate is made the basis of all insurance business, and is justified by the results obtained.

The connection between mathematical expectation and gambling is evident. If a person throws a die and is to receive \$600 in case an ace appears, his expectation is  $\$600 \times \frac{1}{6} = \$100$ .

Unquestionably \$100 would be regarded as a fair entrance-fee to one who could afford to repeat the trial a number of times. In this connection the condition under which a game is said to be *fair* may be mentioned. Suppose that a player has to pay a stake  $b$  to enter a game in which his chance of winning a sum  $a$  is  $p$ . Then for a fair game  $b = pa$ , or his expectation after his entry must be equal to his stake.

The derivation from the definition of mathematical expectation of certain results which seemed to him to be impossible of acceptance led Daniel Bernoulli to develop a theory of *moral expectation* which has received some considerable attention. Bernoulli laid down the principle that to the possessor of a fortune  $a$  the *moral value*,  $v$ , of a small gain  $h$  is directly proportional to the amount of the increase, and inversely to this present fortune; or that  $v = k \cdot \frac{h}{a}$  (where  $k$  is a constant); and that if the probability of this gain is  $p$ , the moral expectation arising from it is  $pv = \frac{pkh}{a}$ . The results obtained from this estimate differ widely from those obtained under the preceding one. They do, however, become less widely divergent from the latter as  $a$  increases, and in fact as  $a$  increases indefinitely the two sets of results tend to a perfect agreement.

### PROBABILITIES DERIVED FROM EXPERIENCE.

*Probabilities of Causes.*—Hitherto the determination of the probability of an event has been based directly or indirectly upon certain governing events. A problem of another sort comes up for consideration. In the discussion of this problem and similar ones the word *cause* will be given an unusual meaning. For the present purposes the term will be used to mean a set of circumstances which might have given rise to an event. The problem may be stated as follows:

*It is known that an event E has happened, and it is known that one of several causes has given rise to the occurrence of E; it is required to determine the probability that E arose from a specified one of the causes.*

A concrete example is furnished by the following problem:

*Ex. 7. Two bags contain respectively one white and one black ball, and one white ball and nine black ones. A ball has been drawn from one of the bags, has been observed to be white, and has been replaced. What is the probability that it was drawn from the first bag?*—Let  $p$  be the required probability. There are two ways of computing the probability of drawing a white ball from the first bag. In the first place it is necessary that the first bag should be selected and that, it having been selected, a white ball should be drawn. This gives  $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$  as a result. In the second place it is necessary that a white ball should be drawn and that, having been drawn, it should have come from the first bag. This yields  $(\frac{1}{2} \cdot \frac{1}{2} + \frac{1}{2} \cdot \frac{1}{10})p$ . Hence, equating these values one gets  $p = \frac{5}{6}$ .

Similar reasoning applied to the general case yields the following result:



## PROBABILITY

**Theorem 4.** If an event  $E$  has occurred as a result of one or another of certain causes  $C_1, C_2, \dots, C_n$ , whose respective probabilities previous to the occurrence of  $E$  were  $\pi_1, \pi_2, \dots, \pi_n$ , and if, when any one of the causes, as  $C_i$ , is known to be operating, the probability that it will produce  $E$  is  $p_i$ , then the probability,  $P_i$ , that  $E$  resulted

$$\text{from } C_i \text{ is } P_i = \frac{p_i \pi_i}{p_1 \pi_1 + p_2 \pi_2 + \dots + p_n \pi_n}.$$

Apply the result to the following example:

**Ex. 7.** From a bag containing five balls, each of which is either white or black, four drawings have been made, the ball being replaced after each drawing. The result is 3 white balls and 1 black one. What are the probabilities that the bag contains (1) 4 white, 1 black ball, (2) 3 white, 2 black, (3) 2 white, 3 black, (4) 1 white, 4 black?—There are four causes: (1) 4 white, 1 black, (2) 3 white, 2 black, etc., and before the drawing they were equally probable. Hence  $\pi_1 = \pi_2 = \pi_3 = \pi_4 = \frac{1}{4}$ . Also  $p_1 = (\frac{4}{5})^3 \frac{1}{5}$ ,  $p_2 = (\frac{3}{5})^3 \frac{2}{5}$ ,  $p_3 = (\frac{2}{5})^3 \frac{3}{5}$ ,  $p_4 = (\frac{1}{5})^3 \frac{4}{5}$ . Then  $P_1 = \frac{64}{146}$ ,  $P_2 = \frac{54}{146}$ ,  $P_3 = \frac{24}{146}$ ,  $P_4 = \frac{4}{146}$ .

When the number of causes is very great the formula of theorem 4 becomes unwieldy. It is found that a simpler formula gives an approximate result. The method used in deriving this formula will be illustrated in the following example:

**Ex. 8.** From among an exceedingly great number,  $N$ , of balls, each of which is either black or white,  $n$  balls are drawn, each ball being replaced before the next drawing. Of these exactly  $s$  are white. What are the probabilities for the various possible numbers of white and black balls in the whole set?—Since before the drawings nothing was known as to the desired result, the *a priori* probabilities for all numbers of white balls from 0 to  $N$  are equal. Now the total number of white balls will be known if the ratio,  $r$ , of that number to  $N$  be known. Hence equally probable values of this ratio are all proper fractions having  $N$  as denominator. Since  $N$  is very great,  $r$  varies from 0 to 1 by very small increments. It will now be assumed that for purposes of approximation  $r$  may be treated as varying continuously from 0 to 1. Also, if  $r$  is the correct ratio, the probability that in  $n$  drawings  $s$  white and  $(n-s)$  black

balls would appear is  $\frac{|n|}{|s| |n-s|} r^s (1-r)^{n-s}$ . If  $r$  varies continuously from 0 to 1, the probability of any specified value of  $r$  is zero, but the *a posteriori* probability that the ratio shall lie between  $r$  and  $r+dr$  is  $p_r = \frac{r^s (1-r)^{n-s} dr}{\int_0^1 r^s (1-r)^{n-s} dr}$

$= \frac{|n+1|}{|s| |n-s|} r^s (1-r)^{n-s} dr$ , since the number of values of  $r^s (1-r)^{n-s}$  as  $r$  varies from  $r$  to  $r+dr$  is measured (see next section, *Geometrical Probability*) by  $dr$ ; and the probability that  $r$  shall lie between  $r_1$  and  $r_2$  is

$$P = \frac{|n+1|}{|s| |n-s|} \int_{r_1}^{r_2} r^s (1-r)^{n-s} dr.$$

A general theorem might be formulated embody-

ing this result, and such a theorem jointly with theorem 4 would constitute what is called the Theorem of Bayes.

The maximum value (see CALCULUS, INFINITESIMAL, *Maxima and Minima*) of  $r^s (1-r)^{n-s}$  is obtained by putting  $r = \frac{s}{n}$ , and is  $\frac{s^s (n-s)^{n-s}}{n^n}$ .

Then the most probable case is that in which the actual ratio of the number of white balls to the total number is the same as the corresponding ratio in the observed results.

A discussion of the value of  $P$ , which must be omitted, yields the following notable result:

**Theorem 5.** The probability that, under the conditions of example 8, the ratio of the number of white balls to the total number shall not deviate from its most probable value,  $\frac{s}{n}$ , by more than

$$r \sqrt{\frac{2s(n-s)}{n^3}} \text{ is } \frac{2}{\sqrt{\pi}} \int_0^r e^{-t^2} dt.$$

**Empirical Probabilities.**—The preceding theory finds application in connection with any sets of events which for the purposes of any discussion may justly be compared with the drawing of balls from a bag. In some of the important connections this theory is in fact indispensable. It will be noted that in both of the examples 7 and 8 the inquiry was in regard to the probability of the various possible numbers of white and black balls. But if the ratio of the number of white balls to the total number of balls be known, that ratio furnishes the probability that a further single drawing will produce a white ball; and in general this probability is what is most urgently sought. Probabilities estimated in this way from observed events are called *empirical probabilities*.

Two methods of deriving empirical probabilities are used, one theoretically correct, but leading to troublesome computations, the other avowedly approximate only. The latter method involves the assumption that, of the possible causes of the observed event, that which has the greatest *a posteriori* probability is the true one. These two methods will be applied to example 7.

Suppose that after the drawing of the balls from the bag the question be asked, "What now is the probability of drawing a white ball?" By the first method the answer would be obtained as follows: The most probable state of the bag is that it contains 1 black and 4 white balls. Hence the probability of drawing a white ball is  $\frac{4}{5}$ .

The following is the other method of treatment: The probability that the bag contains 4 white balls and 1 black one and that a white one will be drawn from it is  $\frac{64}{146} \times \frac{4}{5}$ ; that it contains 3 white and 2 black and that a white one will be drawn is  $\frac{54}{146} \times \frac{3}{5}$ ; that it contains 2 white and 3 black and that a white one will be drawn is  $\frac{24}{146} \times \frac{2}{5}$ ; and that it contains 1 white and 4 black and that a white one will be drawn is  $\frac{4}{146} \times \frac{1}{5}$ . Hence the probability that a white ball will be drawn is  $\frac{47}{125}$ .

Where the number of causes is greater the difference between the two values is smaller, and theorem 5 shows that when the number is very great the difference can be very small indeed, as it becomes nearly certain that the

ratio  $r$  differs by very little from  $\frac{s}{n}$ .



## GEOMETRICAL PROBABILITY.

In what precedes it has been assumed except in one case (see preceding section) that the number of equally probable events governing the event *E* is finite. The definition may be extended to include the case in which the number of events is infinite provided appropriate measures for the totalities of cases can be devised. Such measures are available when each case corresponds to a set of values or one or more continuous variables. Problems requiring the adoption of such measures are generally geometrical, and hence this branch of the subject is called *geometrical probability*. Merely an indication of its nature may be given by one or two very elementary examples.

Although the number of points on any line segment cannot be counted, yet their totality may be measured by the length of the segment. Similarly the totality of points in an area may be measured by that area; and so on. The probability that, all values being equally probable, a number less than unity is also less than one-half is  $\frac{1}{2}$  because the totality of cases is measured by a unit segment, and that of the favorable cases by half a unit segment. Similarly, if all points within a circle of radius *a* are equally likely to be selected, the probability that one of them selected, at random, is not distant more than  $\frac{a}{2}$  from the center is  $\frac{1}{4}$ .

Many very interesting problems have been solved, some of them by exceedingly ingenious methods, but this branch of the subject is quite special and cannot receive further attention here.

In what precedes some important parts of the theory have been indicated. A study of its important applications, notably those to the discussion of errors of observations and to problems of insurance, must be sought elsewhere. The growth of the importance of the subject has been remarkable, for in the beginning it was concerned with problems of gambling, and it has become the basis of all forms of insurance. It has attracted and held the deep attention of nearly all the ablest mathematicians from Cardan to Sylvester and Poincaré. Among its devotees have also been Pascal, Fermat, De Moivre, Leibnitz, the Bernoullis, D'Alembert, Euler, Lagrange, Bayes, Condorcet, Laplace, Poisson, De Morgan, Bertrand, and Czuber. The theory has been applied freely, and in many cases rashly, too little attention having been paid to the fact that its applications really lie in the domain of those events whose occurrences may properly be compared to the drawings of balls from a bag. Hence it is necessary to exercise considerable care in connection with the literature of the subject.

*Bibliography.*—Bertrand, ('Calcul des Probabilités'); De Morgan, ('An Essay on Probabilities,' etc.); Laplace, ('Théorie Analytique des Probabilités'); Whitworth, ('Choice and Chance'); Williamson, ('Integral Calculus' (Chapter on Probability)).

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**Probate, Court of.** See COURT.

**Probation After Death,** a doctrine favored by some modern theologians as a means of reconciling the idea of everlasting punishment with that of God's supreme mercy and the universal redemption through Jesus Christ: the

doctrine differs from the doctrine of Universalism in postulating an intermediate state of the soul after death, of which Universalism knows nothing; and in rejecting the Universalist tenet that *all* will ultimately be saved. Something very like this doctrine of *post mortem* probation, and different from the Catholic doctrine regarding Purgatory, is taught by Clement of Alexandria (*Strom.* vi. 18): "Even if a man passes out of the flesh he must *put off his passions* ere he is able to enter the eternal dwelling." And he speaks of the angels "who preside over the ascent" of souls as detaining those who have *preserved* "any worldly attachment."

**Proboscis or Nose Monkey,** a rare Bornean monkey (*Nasalis larvatus*), called "Kahau" by the natives, and characterized by a greatly elongated nose, giving a peculiarly ludicrous appearance to the face. The general body-color is a sandy red; the tail is dark above, but light yellow beneath. These monkeys are arboreal in habits, and appear to frequent the neighborhood of streams and rivers, congregating in troops. They are closely allied to the apes of the genus *Semnopithecus*.

**Probus, Marcus Aurelius,** Roman emperor: b. Sirmium, Pannonia, 232; d. there 282. He early attracted the notice of the Emperor Valerian, who made him tribune and soon placed him at the head of a legion. The brilliancy of his conduct in the African, Persian, Arabian, and Germanic campaigns brought him into still more prominent notice. He was made governor of all the Roman provinces in Asia by the Emperor Tacitus, and when Florianus, who succeeded his brother Tacitus, was murdered in 276 Probus was immediately proclaimed emperor by universal consent. He drove back the Franks, Alemanni, and Vandals, who had invaded Gaul; and in 277 secured the frontier wall between the Danube and the Rhine. He also freed the lands south of the Danube, Egypt and the East from devastating barbarian hordes, and concluded an advantageous peace with the Persians. He gave new dignity to the senate, populated desolate tracts in Thrace and Moesia with barbarians (279) and paid particular attention to agriculture. He kept his soldiers actively employed in public works. Irritated at being charged with occupations which they deemed degrading, a troop engaged in draining a swamp rose in insurrection and killed him. Probus ranks among the ablest of Roman emperors, combining the qualities of a good commander and wise statesman.

**Probus, Marcus Valerius,** Roman grammarian: b. Berytus, Syria, second half of the 1st century A.D. He is chiefly noted for his critical revisions of the most important Latin poets, as for instance Lucretius, Horace, and Virgil. He applied to them the methods of the Alexandrian school of critics. A commentary on the Eclogues and Georgics of Virgil under his name has been preserved but is of doubtful authenticity. A biography of Persius, written by him, remains in a commentary on the works of that poet. An extant fragment of his work ('De Notis') contains the abbreviations used for legal terms. Consult: Kubler, ('De Probi Commentariis Virgilianis') (1881).

**Procaccini,** prō-kāt-chē'nē, the name of a family of artists of the 16th century who under



## PROCEDURE — PROCLUS

the patronage of the Borromeo family, founded a distinct school of Italian painting at Milan, as the Caracci did afterward at Bologna. The principal members of this family were (1) **ERCOLE PROCACCINI**: b. Bologna 1520; d. later than 1591. His works, existing at Bologna and Parma, are not remarkable for talent, but exhibit industry and care, although they are not free from the mannerism of his contemporaries. He was in great request as a teacher. (2) **CAMILLO PROCACCINI**, son and scholar of the former: b. Bologna 1550; d. Milan 1627. He was the most accomplished artist of this school. He profited by studying the school of the Caracci, and took Correggio and Parmegiano for his models. His imitation of them is obvious from his work but the result is equally successful. His works are distinguished for spirited composition, exquisite coloring, and devotional elevation, but are mannered. Among those at Milan are a 'Madonna and Child' in the church of Santa Maria del Carmine, and an 'Adoration of the Magi' in the Brera. (3) **GIULIO CESARE PROCACCINI**, brother of Camillo: b. Bologna, 1548; d. Milan 1626. He likewise strove to equal the school of the Caracci, and took for his model Correggio, whom he imitated with so much success that several of his pictures, though far from reaching the grace and harmony of that great master, have often been ascribed to him. This has been the case especially with cabinet pictures of the Fall. His works are to be met with in many galleries.

**Procedure, Civil.** See ACTION; CIVIL LAW; JURY.

**Process**, (1) in anatomy, an enlargement, such as the zygomatic process of the temporal bone, the vermiform process of the cerebellum, etc.; (2) in botany, any extension of the surface; a protrusion whether natural or monstrous; (3) in law, a term applied to the whole course of proceedings in a cause, real or personal, civil or criminal, from the original writ to the end of the suit; properly, the summons citing the party affected to appear in court at the return of the original writ. This was sometimes called original process, being founded upon the original writ; and also to distinguish it from mesne or intermediate process, which issues, pending the suit, upon some collateral interlocutory matter; as to summon witnesses, and the like.

**Process of Law.** See DUE PROCESS OF LAW.

**Procession of the Holy Ghost**, in theology the relation in the Trinity between the Father and the Holy Ghost. The Western Churches believe in what is called the "double procession" as expressed in the Nicene Creed, "Who proceedeth from the Father and the Son." The Greek Church maintains the "single procession" and omits the words "and the Son." See FILIOQUE.

**Procession, Religious**, a solemn march of the clergy and people, attended with religious ceremonies, prayers, singing, etc., in the churches, or streets of a town for the purpose of returning thanks for some divine blessing, or drawing attention to some great doctrine of the Church. The practice of holding such processions is usually said to have been introduced into the Christian Church in the reign of Constantine. The most celebrated proces-

sions which now take place in the Roman Catholic Church are those of the eucharist on Corpus Christi day, and during the week in which it occurs. They owe their origin to John xxii. The processions in honor of St. Mark and those on Candlemas and Palm Sunday are said to have been instituted by Gregory the Great. Instances of celebrations of this nature are to be found among the Jews in the Old Testament, and as a part of the symbolical worship of nature they were in use among the ancient heathens; thus they formed solemn processions about the fields, which had been sowed, and sprinkled them with holy water to increase their fertility, and to defend them from injuries. The festivals in honor of Bacchus, Ceres, Diana, and other divinities, among the Greeks and Romans, were solemnized with processions, in which the images of the gods were borne about; and similar rites are still found among most heathens. Among the Buddhists these ceremonials are especially imposing. The procession which accompanies the Emperor of China when he goes to offer sacrifices to an idol in some great pagoda is one of the most gorgeous description.

**Procida**, prō'chē-dä, **John of**, an Italian nobleman: b. Salerno; d. Rome 1298. The tradition which makes him the prime mover in the conspiracy alleged to have brought on the Sicilian Vespers (q.v.) has been discredited by careful investigators, but is the subject of a tragedy by James Sheridan Knowles (q.v.) (1840).

**Procida** (ancient PROCHYTA), (1) an island in Italy, Naples, lying nearly midway between the island of Ischia and the coast of the province of Naples. It is about three miles long, northeast to southwest, and little more than one mile broad. The principal town on the island is (2) Procida, or Castello di Procida, which stands on the southeast coast, 12 miles west of Naples. It is fortified, has a good harbor, and a considerable trade. There is a palace on the island which was occasionally used as a residence by the former kings of Naples. On festivals the women assume the Greek costume, consisting of a red upper garment with gold embroidery. It is from this island that Giovanni da Procida, the reputed originator of the massacre known by the name of the "Sicilian Vespers," takes his name. Pop. (1901) 13,964.

**Proclamation of Emancipation.** See EMANCIPATION PROCLAMATION.

**Pro'clus**, philosopher of the Neo-Platonic school: b. Constantinople 412; d. Athens 485. He is usually called the Lycian, because his parents came from Xanthus in Lycia. He received his first education at Alexandria from the famous Peripatetic Olympiodorus the elder, and completed it at Athens under Syrianus, who ultimately appointed him his successor, and under Asclepigenia, who had learned from her father Plutarchus the doctrines of the Orphic and Chaldaic mysteries and the united theurgic sciences. As a teacher at Athens he was very successful and not only endeavored to unite into a single whole all the philosophical schemes handed down from former ages, but made it his aim to embrace all religions by becoming filled with their spirit. Following out this maxim



## PROCONSUL — PROCOPIUS

he composed hymns in honor of the pagan deities, defended and interpreted popular myths, and even conformed to the rites connected with their worship, and considered himself as under their protection. It was probably in consequence of this adherence to the ancient religion of Greece, in opposition to the decrees of the Christian emperors, that Proclus was compelled to withdraw from Athens. He traveled for a year in Asia to study the various religions of its inhabitants. All of them he held in reverence. On his return to Athens, where he remained till his death, he re-opened his school, but now performed his religious services in secret. By his pure morals and religious views he gave his scholars the idea that he had intimate intercourse with gods and demons, and could work miracles. He claims to resemble Plato in supporting his doctrines by an unbroken chain of reasoning, a method that had been altogether neglected by the previous Neo-Platonists. But these pretensions are not borne out by his works. A life of Proclus was written by Marinus, one of his scholars, and his successor in the school at Athens. His extant works include a 'Sketch of Astronomy,' in which he gave a short view of the systems of Hipparchus, Aristarchus, and Ptolemy; 'The Theology of Plato'; 'Principles of Theology'; 'Principles of Philosophy'; 'Commentary on the Works and Days of Hesiod'; 'Life of Homer'; etc. There is a complete edition of his works by Victor Cousin (1820-7). Consult: Kirchner, 'De Procli Neoplatonici Metaphysica' (1846).

**Procon'sul** and **Propraë'tor**, functionary of the ancient Roman empire, to whom the administration of the provinces was entrusted; proconsul or proprætor being one whose term of office had expired as prætor or consul. The first consul who received the title of proconsul, was Q. Publilius Philo in 327 B.C. This was done in order that he might conclude a campaign successfully begun in southern Italy. It was afterward provided by a law of C. Sempronius Gracchus that, at the consular and prætorial elections the senate should distribute the provinces into two consular and six prætorial provinces, for which the consuls and prætors should cast lots or divide them among themselves by agreement, a few days after their entrance upon their term of office, on the expiration of which they took the provinces allotted them. But in 55 B.C. it was provided by a decree of the senate that no consul or prætor should enter on the government of a province till five years after his surrender of office. As the number of provinces increased, proconsuls were appointed who had not previously held the office of consul. The duties of proconsuls or proprætors were the administration of justice, the supervision of provincial affairs, and the command of the troops. They were assisted in their duties by quæstors and legates. Within thirty days after his return to Rome the provincial governor was bound to make a report of his government. The Lex Julia in 61 B.C. further required that a copy of his report (*rationes*) should be deposited in the two chief cities of his province. He was liable to impeachment for extortion, peculation or embezzlement of the public money or for abuses in regard to the army. Notwithstanding

these precautions the provinces were subjected to various oppressions and exactions. From the time of Augustus the government of some provinces was taken out of the hands of the proconsuls and proprætors, and entrusted to legates called procurators, or stewards of the imperial household, who governed under the immediate direction of the emperor. See PROVINCE; PROCURATOR.

**Procopius**, prō-kō'pī-ūs, Byzantine historian: b. Cæsarea, Palestine, about 500 A.D.; d. Constantinople about 565 A.D. After practising as a rhetorician and advocate at Constantinople for a short time he brought himself so much into public notice that Belisarius made him his legal adviser and private secretary. He found abundant opportunity for seeking the making of history at first hand, for he accompanied Belisarius and counseled him on his most important campaigns. He was with him in Africa and Persia. About 542 he returned to Constantinople. The emperor Justinian made him senator and in 562 præfect of the city. He is the historian in chief to the reign of Justinian, to which his three most important works were devoted. These are: the 'Histories' (*Historiæ*) in eight books, the first two relating to the Persian war, the two following to the war with Vandals, and the rest to the Gothic war; the 'Anecdotes' (*Anecdota*), a secret and more personal history supplementing the more formal 'Histories'; the 'History of the Edifices, built or repaired by Justinian' (*Ctismata*). Doubt has been thrown on the connection of Procopius with the 'Anecdotes.' They are the repository of the scandals of Justinian's reign, filled with accusations, often of a ridiculous and improbable nature against Justinian and Theodora. On the other hand the histories are of great value, characterized by accurate personal observation and truthful presentation of conditions. The best edition of the complete works is Dindorf's. Consult: Hanry, 'Prokopiana' (1891); Dahn, 'Prokopius von Cæsarea' (1865).

**Procopius, Andrew**, Hussite chief: b. about 1380; d. Böhmisch-Brod 30 May 1434. He was distinguished as Procopius the Great, or the Bald, from a contemporary at times associated with him known as Procopius the Lesser. He received a good education, traveled extensively and upon his return entered the priesthood, receiving the tonsure from which was derived his nickname, the Bald. He fought with the Hussites under Ziska, and after Ziska's death was chosen commander of the Taborites, the main division of the Hussites, and quickly made himself master of a larger part of Bohemia. Defeating the German troops at Aussig in 1426, he burned that town and soon after drove the Austrians across the Danube. Burning and laying waste large portions of Austria he led his bands toward Silesia; defeated a German army near Mies (1427); and in the next two years ravaged Silesia, Hungary, and Saxony. The bands under the leadership of Procopius had by this time made the name of Hussites a terror throughout the provinces through which they pursued the armies of the Emperor Sigismund. Strife, however, ensued between the extremists, and the more moderate division known as the Calixtines, who in 1433 accepted the terms offered by the Roman Cath-



## PROCRUSTES — PROCTOR

olics. In a factional fight between the two parties Procopius was killed. In the same battle perished Procopius the Lesser, leader of a section of the Hussites called the Orphans, which had co-operated with the Taborites since 1427.

**Procrustes**, prō-krūs'tēz, Attic robber, sur-named Polypemon, or Damastes. He possessed a bed upon which he forced his guests to sleep, and if they were too tall to fit it he had their limbs chopped off, whereas, were they too short he had them stretched. The monster was outwitted by Theseus, who made him suffer on the same bed and slew him on the Cephissus in Attica. The "bed of Procrustes" has thus become a proverbial expression. Another version represents him as having two beds, one short and one long, the first for tall visitors and the second for short ones.

**Procter**, prök'tēr, **Adelaide Anne**, English poet, daughter of Bryan Waller Procter (q.v.): b. London 30 Oct. 1825; d. there 3 Feb. 1864. Her first verses were published in 'Household Words' in 1853 under the pseudonym "Mary Berwick," and attracted much attention, gaining in particular the favorable notice of Dickens, who did much to aid the young poet. While her work is not great it is marked by deep feeling and tenderness. Her poems with few exceptions first appeared in either 'Household Words' or 'All the Year Round.' She became a Roman Catholic in 1851. Her collected poems were published under the title 'Legends and Lyrics' (1858), and a subsequent edition (1866) contains a biographical sketch of the author by Charles Dickens. Many of her poems have received a musical setting, the most famous being 'The Lost Chord,' which was set to music by Sir Arthur Sullivan.

**Procter, Bryan Waller**, "BARRY CORNWALL," English poet: b. Leeds 21 Nov. 1787; d. London 5 Oct. 1874. He was educated at Harrow, subsequently studied law in London, and in 1831 was called to the bar of Gray's Inn. For many years he held the office of commissioner of lunacy, resigning in 1860. His first appearance in literature was in 1819, when he published 'Dramatic Scenes and Other Poems,' under the pseudonym of "Barry Cornwall," which he afterward retained. Later works were: 'A Sicilian Story'; 'Marcian Colonna'; 'Mirandola' (1821), a tragedy performed with great success at Covent Garden; 'The Flood in Thessaly' (1823); 'English Songs and Other Small Poems.' His prose includes 'Effigies Poeticæ, or the Portraits of the British Poets'; 'Life of Edmund Kean'; 'Essays and Tales' (1853); 'Memoir of Charles Lamb' (1866). He will be longest remembered as a song writer, but even so his work has been somewhat overrated. Consult: Patmore, 'Life of B. W. Procter' (1877).

**Procter, John Robert**, American civil service reformer: b. Mason County, Ky., 16 March 1844; d. Washington, D. C., 12 Dec. 1903. He was educated at the University of Pennsylvania, but left there to join the Confederate army in 1864. In 1873 he became assistant in the Kentucky geological survey, and in 1880 State geologist. In this office he was brought into contact with the spoils system, to which his opposition was so uncompromising that he

finally lost his position in 1893. In the same year, however, he was appointed president of the Civil Service Commission, a post which he held till his death. His criticism of the spoils system was based not only on its evil moral and social effects, but also on its absurdity as a method of conducting business, and this view he constantly presented most effectively. His work as president of the commission was the means of increasing the effectiveness of the civil service, and of gaining for it recognition in political life.

**Proctor**, prök'tör, **Alexander Phimistes**, American sculptor: b. Ontario, Canada, 27 Sept. 1862. He was the pupil of Puesch and Ingalbert at Paris, and was awarded the Rinehart Paris scholarship. Not only as a producing sculptor but as a critic of sculpture his reputation is high and he was appointed a member of the sculpture jury at the Paris Exposition of 1900 and at the Pan-American Exposition of 1901, and is a member of the Art Commission appointed by Mayor Low in 1903. Among his works were the quadriga which he furnished for the United States pavilion at the Paris Exposition of 1900, which was much admired. Others of his sculptures may be seen in the parks of New York, Denver, and Pittsfield.

**Proctor, Edna Dean**, American poet: b. Henniker, N. H., 10 Oct. 1838. She was educated in Concord, has traveled extensively in Europe, and has achieved a considerable reputation as a poet. Her most notable poems are: 'Heroes' and 'Shenandoah.' Among her works are: 'Poems' (1866); 'A Russian Journey' (1872); 'The Song of the Ancient People' (1892); 'Mountain Maid and Other Poems of New Hampshire' (1900).

**Proctor, Redfield**, American politician: b. Proctorsville, Vt., 1 June 1831. He was graduated from Dartmouth in 1851, and from the Albany Law School in 1859. He practised law for two years, and in 1861 entered the Federal army as lieutenant; was soon promoted major and then colonel, and commanded a regiment at Gettysburg. After a few years' law practice he devoted himself to business, acquiring large interests in marble quarries in Vermont. He began political life as a Republican member of the lower house of the Vermont legislature, being first elected to that body in 1867, and again in 1868 and 1888; he was a member and president *pro tem.* of the State senate in 1874 and 1875; in 1876 he was elected lieutenant-governor, and in 1878 governor of the State. During his administration he brought about several reforms in the State finances and system of taxation. In 1888 he was chairman of the Vermont delegation to the Republican National Convention, and again in 1896. In 1889 he was appointed secretary of war by President Harrison, and gave especial attention to the improvement of coast and border defense. In 1891 he resigned his secretaryship to accept the appointment to the United States Senate for the unexpired term of Senator Edmunds, resigned, and in 1892 was elected to the Senate for the six years' term. In 1898 and 1904 he was re-elected. In 1898 he visited Cuba to investigate conditions in the island, and on his return delivered a speech in the Senate in regard to the reconcentrados, which aroused the attention of the



## PROCTOR — PROFESSIONAL EDUCATION

whole country. The facts presented by him were also influential in determining the policy of intervention in Cuba by the United States.

**Proctor, Richard Anthony**, English astronomer: b. Chelsea 23 March 1837; d. New York 12 Sept. 1888. He was educated at King's College, London and Cambridge, and began to read for the bar, but in 1863 took up with enthusiasm the study of astronomy and mathematics. He taught mathematics for a time at a private military school at Woolwich, and in 1873 made a lecturing tour in this country. As a lecturer he became at once popular, having in eminent degree the gift of lucid exposition. A second tour to the United States in 1879 and a tour to Australia were followed by his settling at St. Joseph, Mo., in 1884. In 1887 he returned to Florida. He did much to popularize astronomy. His works include: 'Saturn and His System' (1865); 'Handbook of the Stars' (1866); 'Half-hours with the Telescope' (1868); 'Half-hours with the Stars'; 'Other Worlds Than Ours' (1870); 'Light Science for Leisure Hours' (1871); 'The Moon' (1873); 'The Transits of Venus' (1874); 'The Cycloid and Cycloid Curves'; several 'Star Atlases'; 'The Universe of Stars' (1878); 'The Romance of Astronomy' (1880); 'Hereditary Traits' (1882); 'The Great Pyramid' (1883); 'Nature Studies' (1883).

**Proctor** (Lat., *procurator*), one who acts on another's behalf. It has in England these special significations: (1) In the convocations of the two ecclesiastical provinces, Canterbury and York, respectively, the official who represents the lower clergy and the capitular bodies of cathedral and collegiate churches; (2) a person who manages another's cause in an ecclesiastical court or in a court of admiralty; owing to recent changes in the administration of law, the business formerly confined to proctors may now be conducted by solicitors; (3) in the universities of Oxford and Cambridge, two proctors in each are charged with the duty of preserving the peace and repressing disorder among the students; to this end they are empowered to inflict summary punishment and have command of a constabulary force. The proctors must be masters of arts; they are chosen by the several colleges in turn.

**Proc'urator**, among the ancient Romans, an agent, steward, or overseer of an estate; at a later period the title of a provincial officer (see PROVINCE and PROCONSUL), who managed the revenue. In some of the small provinces, or in a part of a large province, the procurator discharged the office of a governor, and had the power of punishing capitally, as was the case with Pontius Pilate in Judæa, which was attached to the province of Syria.

Procurator or proctor, in monasteries, is the conventual to whom is entrusted the care of the temporal concerns.

*Procurator di San Marco* was the title of the chief officers or senators in the Venetian republic. Besides the nine actual *procuratori*, from among whom the doge was chosen, there were also many titular procurators, who paid a great sum for this title, which was much coveted by the Venetian patricians on account of the rank it conferred.

**Procurator-Fiscal**, the public prosecutor in criminal cases which come up in Scotland before the sheriff, magistrates, or justices of the peace belonging to his district. Only when the public interest is concerned must he originate a prosecution; and when complaint is made by a person in a case in which the private interest of the complainant is rather at stake than the public interest, the procurator-fiscal must merely give his concurrence to the prosecution, and not institute the proceedings. He may, however, act as the complainant's agent; but even when he does so, if he only gives his concurrence, he is not liable to an action for malicious prosecution.

**Prod'icus**, Greek Sophist: he came from Julis in the island of Ceos, and was a contemporary of Socrates. He is only known as the author of an apologue of 'Hercules and the Two Paths,' quoted by Xenophon, in which the young hero chooses the hard path of duty, and turns his back on the flowery but dangerous path of pleasure.

**Production, Cost of.** See POLITICAL ECONOMY.

**Proetus**, prē'tūs, in Greek mythology, king of Tiryns. According to Ovid he founded the kingdom after making peace with his twin-brother, Acrisius, who had driven him out of Argos. The tragic legend concerning him deals chiefly with the fate of his three daughters, the Proetidæ. These, rendered mad by Hera or Dionysus, wandered through the Peloponnesus, in time communicating their frenzy to other women, so that they killed their children. One of the three sisters died, the other two were healed by the seer Melampus, who married one and was given a share in the kingdom, his brother, Bias, receiving also a share and marrying the other daughter.

**Pro'fert**, in law, an exhibition of a record or paper in open court. When either party alleges any deed, he is generally obliged, by a rule of pleading, to make profert of such deed; that is, to produce it in court simultaneously with the pleading in which it is alleged.

**Professional Education**, the special training which enables a man to use his knowledge of science in the best way, in order to increase power of production, and to limit time, force, and expenses. The knowledge of science, the liberal education, the general culture to which a study of the arts and sciences contributes and for which such study is essential, should precede the special training. The need of professional education for the most intelligent and effective work in the professions, and also in the trades, is generally recognized. The governments of all civilized countries have taken cognizance of this fact, and have either through the general governments or through subordinate departments encouraged and sometimes enforced professional education for certain professions, as medicine, pharmacy, law, teaching, etc. The general rule for admission to distinctively professional schools is, that satisfactory proof of a liberal education must be furnished. In Europe, the general governments of France and Germany regulate the requirements for professional schools. In Italy such schools are nearly all in charge of the minister of agriculture and commerce, and are supported by the united



## PROFESSIONAL WOMAN'S LEAGUE—PROFIT SHARING

contributions of the state, the provinces, the communes, the chamber of commerce, and the association of mechanics. In Italy and in other countries in Europe, "professional schools" include schools for instruction in trades, industries, and occupations. The professional schools of the British Isles are almost wholly independent of the general government. In France the secondary schools form with the universities a system of liberal education, crowned by specialized training for the learned professions. The apprenticeship system in the trades is being replaced to a large extent by the special training schools. For entrance to the government professional schools or the professional courses in the universities, the bachelor's degree is required. The government has (1902) four schools furnishing complete courses, and 12 preparatory schools for medical and pharmaceutical science, the graduates of which are examined by the university professors. There are also government law schools. In Germany, in 1902, there were graduates in schools under government supervision, in medicine 7,341; in law, 11,335. In Great Britain and Ireland professional education is recognized in the curriculum of Cambridge, Oxford, the University of Dublin, the Royal University of Ireland, the Catholic University of Ireland, the four universities of Scotland, the University of Wales, London, Victoria, and Durham universities, provincial medical schools, normal schools (q.v.), trade schools, and numerous private institutions. In Spain special attention is given to normal schools, schools of medicine, and law. In the Netherlands there is a large proportion of professional schools. In countries of Asia and South America, where the governments have any control over education, professional education in law and medicine has received attention. The theological schools are generally supported by the churches or by generous endowments. In countries where a state church has been established, theological schools of the same church are supported, at least in part, by the government. The need of professional education is becoming more apparent as the work of the world becomes more and more specialized. For other departments, see EDUCATION, PROFESSIONAL, IN AMERICA; SCHOOLS, NORMAL AND TRAINING, and EDUCATION, in articles on different countries. Consult: Reports of the U. S. Commissioner of Education.

**Professional Woman's League, The**, an association founded in New York in 1893, and composed of women engaged in dramatic, musical, literary, artistic, and scientific pursuits. The dues are \$5.50 per annum, the league holds a bazaar each year, and gives occasional entertainments during the winter season.

**Professor, The**, a novel by Charlotte Brontë, published in 1857. It was the first fiction that she produced, but it failed to find a publisher until after her death. "The plot in itself is of no great interest," remarks Mrs. Gaskell, the biographer of Charlotte Brontë, but "she never excelled one or two sketches of portraits which she has given in 'The Professor,' nor, in grace of womanhood, ever surpassed one of the female characters there described."

**Professor at the Breakfast Table, The**, a work by Oliver Wendell Holmes, first published

serially in the 'Atlantic Monthly' in 1859. It furnishes a sequel to the well-known 'Autocrat of the Breakfast Table,' which it resembles in tone and construction.

**Profit Sharing**, a method by which wage-earners receive a share of the profits of an industry in addition to wages. Strictly speaking, profit sharing implies that the bonus shall be given to workmen individually; but benefits and insurance, social and educational funds maintained out of the profits of a business are modified forms of profit sharing. Many systems of profit sharing also provide for the employees obtaining share in the capital stock on special terms, thus becoming part owners of the industry. Profit sharing differs from co-operation, in that it is not democratic; both the initiative in establishing a system of profit sharing, and the control of the industry rests with the employer. It is regarded, however, as a step toward co-operation. The arguments advanced in favor of profit sharing are: (1) Its justice, inasmuch as labor is equally necessary with capital to the welfare and success of an industry, it should justly receive a part of the profits; (2) its practical effect; it tends to interest employees in their work, to increase their efficiency and their care of property. There are two lines of opposition to profit sharing: (1) From the employers, who claim that it is unjust that labor should share in the profits, when it does not share in the loss or risk of the business; and that profit sharing does not necessarily result in increased efficiency; and (2) from the workmen who claim that their freedom is restricted, especially as in many instances a long term of employment and sometimes restriction of labor organization are involved in a profit-sharing system; and that they obtain no compensating share in the management or control of the industry. Profit sharing has been successful in many industries, especially where the labor is skilled, and wages large in proportion to total cost of production; on the other hand, many attempts to establish a profit-sharing system have failed, owing sometimes to industrial depression, sometimes to a trial too short to give fair results, and sometimes to change in management. In the United States between 1889 and 1896, 50 firms had made trial of profit sharing; in the latter year, only 12 continued it permanently, and five had abandoned it temporarily; in 1900, there were 23 firms with a system of profit sharing, 12 of which had adopted it within the year 1899-1900.

France outranks other nations in the number and importance of successful profit-sharing enterprises; there being over 100 in 1900. Among the more important ones are Le Claire's (painter), the Belle Lamaire, the Godin Familistère at Guise, and the Bon Marché (q.v.). Great Britain ranks next, with 95 firms having a system of profit sharing. Among the most important profit-sharing establishments of the United States are the Nelson Manufacturing Company of St. Louis, Mo., and the Proctor & Gamble Company of Ivorydale, Ohio. The Nelson Company established its system in 1886, which, besides the direct sharing in profits by the employees, provides for the payment of sickness and accident benefits by the company as a part of the costs of the business; the employees



## PROGRESS — PROGRESSION

are also encouraged to buy stock in the company. In 1896 an agreement was made by which the employees of the cabinet-making shop were to gradually purchase and take the management of that department; by 1902 they had sole control. The Proctor & Gamble Company introduced profit sharing in 1887; the arrangement was that the employees should receive a share in the net profits in the proportion that wages bore to the whole cost of production. The fact that the employees were largely unskilled labor with low wages, and received the new arrangement with indifference made the management of the system particularly difficult. An improvement was made by classifying the employees into four groups in regard to interest in work, excellence of work, and care of machinery and tools; the best in accordance with this classification received double the regular dividend, the second group, including the greater number of the employees, the regular dividend, the third group one half the dividend, and the fourth none at all. In 1903, the United States Steel Corporation adopted direct profit sharing for its more responsible employees, and a system whereby any of its employees may acquire stock on easy terms, and as long as they remain in the employ of the company, may receive a bonus of \$5 a year extra for each share after the first five years. Later in the same year the Mann Edged Tool Company of Lewiston, Pa., announced a division of all profits above 8 per cent among employees who had been with the company at least four months, in proportion to their earnings. This plan involved a "disconnection with any labor organization outside their own."

Consult: Gilman, 'Industrial Partnership or Profit Sharing' (1890); 'Profit Sharing Between Employer and Employee' (1891); 'A Dividend to Labor' (1899); Taylor, 'Profit Sharing Between Capital and Labor' (1886); and Wright, 'Profit Sharing' (1886).

**Progress**, the advancement of the world, moral, mental, and material, as exhibited in history. Physical science, which has so recently demonstrated the gradual improvement of material types in the animal and vegetable world, has compelled metaphysical speculation to conform its general principles to the axioms formulated by physical observation and experiment. The result of science, of historical inquiry, of inductive activity in every area of investigation may favor neither optimism nor pessimism. They have brought into philosophy a third term, and that is meliorism, a term employed to denote a doctrine so firmly based on fact that none can controvert it. Meliorism embodies the truth that as far as human experience and observation can extend there has been improvement in things, progress in the universe, advancement in the world. Pessimism becomes a contradiction in terms; for the physicist in his laboratory, the historian in his study, the sociologist in his inquiry among men, declares that things have been once worse than they are now, and that from the flower in the field to the beast in the stall, and from the beast in the stall to the working man, the ruler and the general condition of nations, things have been growing better. The lapse of centuries shows a sensible amelioration in the lot of humanity. The slave has been enfranchised, woman has been raised

and enlightened, the rights of labor have been more and more recognized. These, however, are only social and political examples of that universal amelioration and progress by which a nebula is changed into a star, and a star into a peopled and conscious world. Meliorism is the principle that underlies all existence, organic or inorganic and comprehends in its widely extending connotation the discovery of drugs that abolish pain, of economic institutions that diminish poverty, of intellectual institutions that make ignorance and incompetency more and more rare, and of tolerance and enlightenment which give more and more freedom to the creeds, tastes, and idiosyncrasies of individual men. In whatever direction we look over the field of human activity we see this improvement manifesting itself, and the phenomena which are the basis of meliorism furnish the best argument for that hopeful optimism which, as many believe, alone can give the mind a philosophical creed that renders life tolerable.

Meliorism is the doctrine of the positivist, because it is no metaphysical system which interprets facts by *a priori* assumption; it is simply an induction from a summary of those facts which physical science has most recently set forth as the proud results of the newest, the most unbiased, and the most uncontrovertible deductions from experiment and observation, in the whole world of material, social, and political phenomena.

**Progress and Poverty**, a famous work by Henry George, written in 1877-9. The MS. was declined by publishers till the author, a practical printer, had the plates made, and it was then brought out in 1879. The author seeks in this work to solve a problem and prescribe a remedy. The problem is: "Why, in the midst of a marvelous progress, is grinding poverty on the increase?" The remedy is to nationalize the land,—make it public property; leaving that already in use in the possession of those holding it, but confiscating the rent and abolishing all other forms of taxation.

**Progression**, in mathematics, a series or sequence of terms such that each quantity bears the same mathematical relation to the preceding. This relation may be either that of a difference or of a ratio; the first case is that of the *arithmetical progression*, the second that of the *geometrical series*.

In an arithmetical series each term is derived from the preceding by adding to it a constant, called the difference, which may have a plus sign or a minus sign, so that the series may either increase or decrease. In the accepted notation of the arithmetical progression, *a* is the first term, *n* the number of terms, *d* the difference, and *l* the last term. The value of the last term or of any (the *n*th) term may be determined from the formula,  $l = a + (n - 1)d$ , which is merely a notational statement of the evident fact that the coefficient of *d* in any term will be less by one than the number of term, so that the *n*th term must be the sum of the first term and of the difference taken (*n* - 1) times. Letting *s* stand for the sum of *n* terms we may write in ascending or descending order:

$$s = a + (a + d) + (a + 2d) + \dots + (l - d) + l, \text{ or } s = l + (l - d) + (l - 2d) + \dots + (a + d) + a.$$



## PROHIBITION PARTY

Adding these two equations we get the equation,  $2s = (a + l) + (a + l) + (a + l) + \dots + (a + l) + (a + l)$ , or  $2s = n(a + l)$ , it being evident that the factor  $(a + l)$  occurs  $n$  times in the second term of the preceding equation. The formula for the sum will then be  $s = \frac{n}{2}(a + l)$ . Hence, if three of data are given as to an arithmetical series, that is, three of  $a$ ,  $d$ ,  $n$ ,  $l$ ,  $s$ , the fourth (and the fifth, usually) can be found by the regular processes of algebra. Moreover the *arithmetical mean* between two numbers, being the mid-term in a series in which the number of terms is odd, will be one half the sum of the two numbers.

A *geometrical progression* is a series in which each successive term is derived from the preceding by multiplying it by a constant, called the ratio, which may be less or greater than unity, so that the series may decrease or increase, or may be either plus or minus, so that the terms may be either similar or constantly changing in sign. In the accepted notation of the geometrical progression,  $a$  is the first term,  $r$  the common ratio,  $l$  the last (or  $n$ th) term and  $s$  the sum of the series of  $n$  terms. The formula for  $l$ , the  $n$ th term, since the exponent of  $r$  increases by one in each term will be  $l = ar^{n-1}$ .

To derive the formula for the sum of  $n$  terms, get the difference of the two self-evident equations,

$$s = a + ar + ar^2 + \dots + ar^{n-1}, \quad \text{and} \\ rs = ar + ar^2 + \dots + ar^{n-1} + ar^n.$$

The difference is  $rs - s = ar^n - a$ , or  $(r - 1)s = a(r^n - 1)$ . The formula then is  $s = \frac{a(r^n - 1)}{r - 1}$  or  $\frac{rl - a}{r - 1}$ .

With any three of the quantities given in these two formulas the other two may be derived by the use of quadratic equations (and in one instance of logarithms). An interesting variation of the problem of the summation of a geometric series is to find the value of a repeating decimal or repetend; as, for example, to find the value of .545454 . . . . (or . $\dot{5}4$ ). Here  $a = .54$ ,  $r = .01$ , and  $n = a$ . Because of the infinite value of  $n$ , the value of  $l$  is practically zero; hence in the formula for

the sum,  $\frac{rl - a}{r - 1}$ ,  $rl$  becomes negligible, and the

formula takes the form  $\frac{-a}{r - 1}$  or  $\frac{a}{1 - r}$ . Substitut-

ing the values above we have  $\frac{.54}{.1 - .01} = \frac{6}{.11}$ .

A *harmonical progression* is a series in which the reciprocals of the terms form an arithmetical series. Any problem relating to harmonical progressions may therefore be treated as problems in arithmetical progression by the mere inversion of each term. See SERIES.

**Prohibition Party**, a political party in the United States, organized in 1869 for the securing of certain reforms in government, among which the prohibition of the alcoholic drink traffic is supremely important. The attitude of the party in its formation and in its repeated declarations upon the traffic, may be fairly stated in the following resolution incorporated into its National platform of 1892:

(1) The liquor traffic is a foe to civilization, the arch enemy of popular government, and a public nuisance. It is the citadel of the forces that corrupt politics, promote poverty and crime, degrade the Nation's home life, thwart the will of the people and deliver our country into the hands of rapacious class interests. All laws that, under the guise of regulation, legalize and protect this traffic, or make the Government share in its ill-gotten gains, are "vicious in principle, and powerless as a remedy." We declare anew for the entire suppression of the manufacture, sale, importation, exportation, and transportation of alcoholic liquors as a beverage by Federal and State legislation. The full powers of Government should be exerted to secure this result. No party that fails to recognize the dominant nature of this issue in American politics, deserves the support of the people.

The causes that impelled the organization of the Prohibition party may be briefly summarized:

1. Prior to the Civil War, the policy of taxation license and revenues in the manufacture and sale of alcoholic beverages in the United States had not been formulated into State and Federal law. But the need of greatly increased revenues to repair the financial waste and damage of the war was made the plausible pretext for imposing a heavy Federal tax on the manufacture of distilled and fermented liquors. This immense levy, comprising nearly one third of the total direct revenues accruing annually to our government, carried with it the nation's implied and pledged guaranty of protection to the brewery and distillery. Logically, their increased product would have government encouragement in expanding Federal revenues, and the cost of the tax was added to the original price of the alcoholic product, and was paid by the consumer. In the era of speculation and good prices immediately following the war, the modern saloon found the opportune time of its inception and evolution. Habits of dissipation and lax public morals engendered by the war would facilitate its development. Added to these, was the heavy foreign immigration of that period, bringing to our shores from Continental Europe, its well nigh universal habit of wine, beer and ale drinking. The State, and the lesser corporations, following the government's initiative, established a system of local tax or license upon the traffic large enough to appeal to the cupidity of the tax payer. Thus the modern saloon, buttressed in protective legislation, the popular dispensary of alcoholic beverages to its numerous devotees, and grounded in the immense wealth of the traffic, has become a powerful and all controlling political factor in the moral and social destinies of the nation.

2. The organization of the liquor trade itself for offensive and defensive warfare against all prohibitory legislation would impel the formation of a party clearly opposed to their purposes. This trade organization formed during the Civil War, resolved that they would secure if possible the repeal of all existing prohibitory laws, or failing in this endeavor, would prevent their legal enforcement. The Brewers' Congress of 1867 declared they would sustain no candidate of whatever party in any election who was in any way disposed toward total abstinence. The few States that had outlawed the drink traffic within their jurisdiction found it exceedingly difficult if not usually impossible, to enforce the prohibitory law, inasmuch as the officers charged with this duty were either the willing tools of the traffic, or in personal habit and party fealty opposed to the policy of prohibition.

3. The final cause for organizing a Prohibition party was found in the attitude of the Republican and Democratic parties. In national policy neither would declare for prohibition, and both had been arraigned for complicity with the drink traffic. The law of license prevailed in regulating the traffic in the Federal territories and in the District of Columbia, all of which were under direct Congressional control and supervision. The same Federal law of permission applied to the States, even to those that had adopted statutory or constitutional prohibition. By the law of interstate commerce, liquors could be shipped under certain regulations into States where their manufacture and sale had been prohibited. It was believed that with this conflict of State and Federal authority in dealing with the drink traffic, and a fealty to ruling political parties that required cheerful and loyal acquiescence to both a national policy of license and a local law of prohibition, that a new party was demanded which was unreservedly committed to the complete overthrow of the legalized drink traffic in state and nation.

At a session of the Grand Lodge of the Independent Order of Good Templars held at Oswego, N. Y., 27 May 1869, a meeting of those favoring independent political action was held.



## PROHIBITIVE DUTIES

and a committee appointed to issue a call for a national convention to organize a Prohibition party. In response to this call, nearly 500 delegates from 20 States met in Farwell Hall, Chicago, 1 Sept. 1869, adopted a platform of principles, and assumed the name of the National Prohibition Party. The first national nominating convention was held in Columbus, Ohio, 22 Feb. 1872. The platform declared first for entire and absolute prohibition. It also included decisive declarations on the questions of public service, finance, interstate commerce, tariff, labor, education, immigration, and favored equal suffrage for women. Thus in the inception of the party, and for 20 years following in each succeeding nominating convention, there was a full platform of principles set forth, embodying the party conviction on all the leading and ever recurring questions of national issue. In the national convention held at Cincinnati in 1892, a determined effort was made on the part of some to abandon the broad platform, or at least so to minimize its utterances that the only condition of full party fellowship required should be agreement in the suppression of the drink traffic. Although this action was opposed by a strong minority of the convention, the advocates of the measure won a substantial victory in the adoption of the 15th resolution of the platform known as the "dominant issue plank" which declares as follows:

(15) Recognizing and declaring that Prohibition of the liquor traffic has become the dominant issue in national politics, we invite to full party fellowship all those who, on this one dominant issue, are with us agreed, in the full belief that this party can and will remove sectional differences, promote national unity, and insure the best welfare of our entire land.

This action was the entering wedge in a party division which culminated four years later at Pittsburg. In March 1895 twenty-one members of the National Committee issued an address to the party, protesting against the utterances of its Executive Committee wherein an apparent effort was made to "abrogate, or at least disparage, some planks of the National platform, and to create the impression that the party does not consider itself pledged in political faith, fealty, and effort to other than the prohibition plank of its declaration of principles made at Cincinnati in 1892."

In the National Convention held at Pittsburg, Pa., in May 1896, the contest for a narrow gauge platform was renewed. The Committee on Platform presented both majority and minority reports. After a long and quite acrimonious discussion confined mainly to the proposed suffrage and financial planks of the platform, and after the financial plank proposed by the minority had been rejected by the Convention in a majority of 40 out of a full total vote of 814 votes cast, a substitute was offered for the whole platform, reported by the Resolutions Committee, and was upon motion adopted. This was known as the "Single Issue" platform, and declared as follows:

The Prohibition Party in national convention assembled declares its firm conviction that the manufacture, exportation, importation and sale of alcoholic beverages has produced such commercial, industrial, social and political wrongs, and is now so threatening the perpetuity of all our social and political institutions that the suppression of the same by a national party organized therefor is the greatest object to be accomplished by the voters of our country and is of such importance that it of right ought to control the political

action of all of our patriotic citizens until such suppression is accomplished. The urgency of this cause demands the union without further delay of all citizens who desire the prohibition of the liquor traffic.

Therefore, be it resolved, that we favor the legal prohibition by state and national legislation of the exportation, interstate transportation and sale of alcoholic beverages; that we declare our purpose to organize and unite all the friends of prohibition into one party, and in order to accomplish this end we deem it but right to leave every Prohibitionist the freedom of his own convictions upon all other political questions, as the changes occasioned by prohibition and the welfare of the whole people shall demand.

At the evening and closing session of the convention, nominations were made as follows: For President, Joshua Levering of Maryland. For Vice-President, Hale Johnson of Illinois. Prior to this action, the "broad gauge" delegates withdrew from the convention, held an informal caucus, and repairing to Braun's Hall, effected a new organization known as the "National" party. On a roll call of membership, 299 representatives from 27 States responded. A broad platform was adopted, declaring for the following among other reforms named:

Prohibition of the drink traffic; equal suffrage; government issue of all money with free coinage, and government ownership and operating of "Railroads, telegraphs and other natural monopolies."

In candidates the convention selected for President, Charles E. Bentley of Nebraska, and for Vice-President, James H. Southgate of North Carolina. At the election in November the National Party candidates received 13,955 votes. The subjoined table gives the names of the Presidential candidates of the Prohibition Party from its beginning, the year in which they were nominated, and the whole number of votes cast for each:—

Year nominated	For President	For Vice- President	Votes cast
1872	James Black	John Russell	5,607
1876	Green Clay Smith	Gideon T. Stewart	9,737
1880	Neal Dow	H. A. Thompson	10,336
1884	John P. St. John	William Daniel	150,626
1888	Clinton B. Fisk	John A. Brooks	249,945
1892	John Bidwell	James B. Cranfill	270,813
1896	Joshua Levering	Hale Johnson	130,753
1900	John G. Wooley	Henry B. Metcalf	207,820
1904	Silas C. Swallow	George W. Carroll	258,838

It may be said that the "Single Issue" platform was reaffirmed by the National Convention of 1900. The States now under full or modified prohibitory law are Maine, Iowa, Kansas and North Dakota. In South Carolina the State regulates the sale of liquors by a so-called "Dispensary Law." In Georgia, Texas and other Southern States, under the provisions of "local options," many counties and large areas of territory are under local prohibitory law. The same is also true in limited area in other States north and west. The National organ of the Prohibition party is 'The New Voice,' published in Chicago. See also LOCAL OPTION.

CHARLES E. BENTLEY,  
*Presidential Candidate, 1896.*

**Prohibitive Duties**, the taxes or system of tariff imposed by a government on imported articles for the protection and encouragement of domestic industries, or as a retaliatory measure in the case of a nation thus discriminating against the productions of another, or favoring those of other countries.

Protective duties in their various mutations present problems of great commercial and polit-



## PROJECTILES

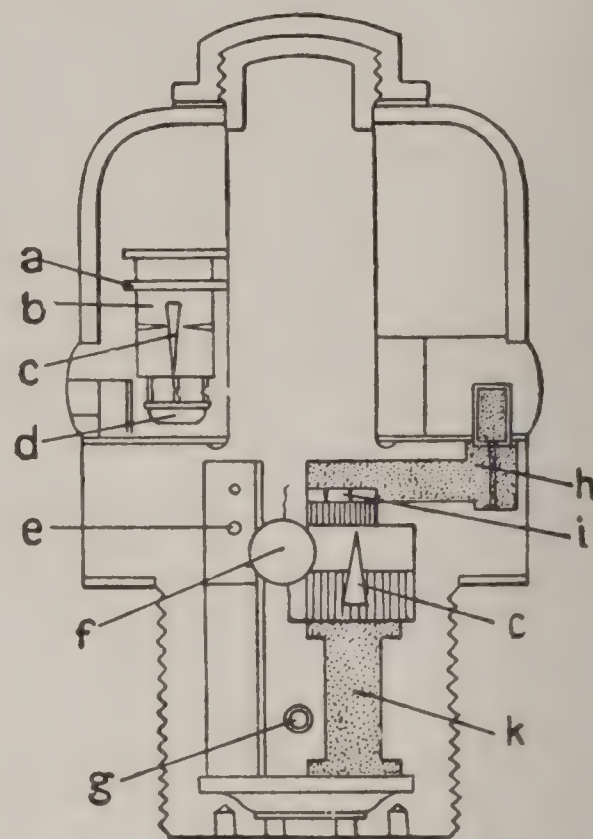
ical importance, affecting, as they do, the value of the markets of one country in regard to those of another. Of the four great commercial countries of the world, the United States at present has a general system of protective duties applied to imports without discrimination as to their origin; Germany has a multiple system composed of a general and a conventional schedule; France has a multiple tariff consisting of a maximum schedule; while Great Britain is practically a free-trading country without protective duties.

These taxes are enacted by the legislative branch of each government, and, in the "general system" as employed in the United States, recognizes the needs of the home country solely, and takes account of foreign commercial relations only, when the latter are in harmony with home interests. The system in use in Germany, that of "general" and "conventional" duties, makes a distinction between goods which come from different nations on the basis of mutual concessions and a general understanding, usually ratified by treaties, in which some countries receive the "most favored nation" or "conventional duties" treatment, while to others not so favored, the original or "general" table of duties is applied. The multiple or double-tariff system of maximum and minimum impositions also consists in having two rates of duties for most dutiable articles. In its application the maximum rate corresponds to the "general" table described above, while the minimum rate is imposed on the "most favored nations." The difference arises from the double-tariff system being framed by the legislature of a country, and not by international treaty, and the two tables exhibit the exact limits in which to negotiate commercial treaties, should occasion arise.

The agitation against heavy protective duties has been continuous, and led to the appointment in 1882 of a tariff commission, which recommended important revisions, some of which were embodied in the act of 1883. The McKinley tariff act was passed in 1890; the Wilson act in 1894, and the Dingley act in 1897. The question has been one of great political importance, and is still (1905) claiming the attention of Congress. See FREE TRADE; PROTECTION; UNITED STATES — HISTORY OF THE TARIFF.

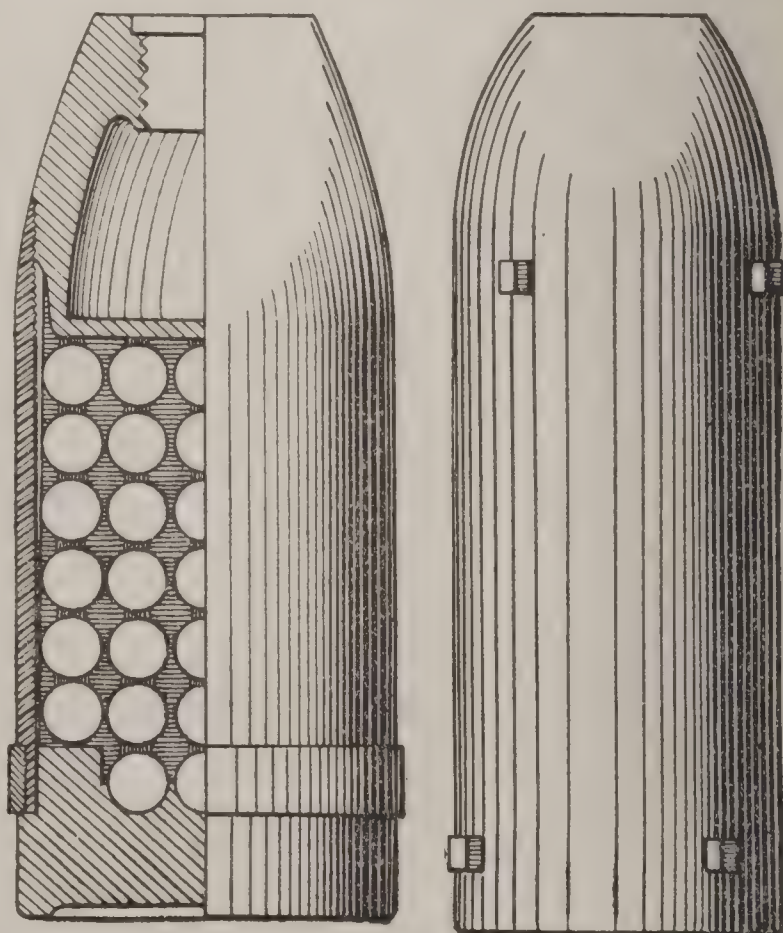
**Projectiles** (from Lat. *projectare*, to thrust forward; Fr. *projecter*, to project). In its broadest sense, the term is applicable to all objects thrown forward for any purpose whatsoever, by a quick impulse. Specifically, it refers to the missiles thrown from the larger forms of ordnance; the term bullet being more applicable to those fired from the various forms of small-arms such as muskets, magazine rifles and pistols, revolvers, etc. (See SMALL-ARMS.) The earliest projectiles used as weapons in warfare were the arrows, darts, and stones, discharged by the various forms of mediæval ordnance such as the ballista and the catapult. (See ORDNANCE.) In the 14th century, when gun-powder cannon came into use, the arrows and darts were entirely superseded by stones, which continued in use, to a greater or lesser extent, during several succeeding centuries, although cast-iron projectiles were introduced for general use in the various European countries about the middle of the 15th century. The bet-

ter shape of the iron projectiles increased the accuracy of gun-fire, while the reduction of the "windage" also added considerably to their velocity. (See ORDNANCE.) Although many attempts were made to perfect a breech-loading



Combination Time and Percussion Fuse — (a) Shearing wire. (b) Hammer. (c) Steel needle. (d) Detonating cap. (e) Shearing wire. (f) Brass ball. (g) Centrifugal bolt. (h) Powder composition. (i) Copper detonator. (k) Powder.

type of cannon, which would have allowed the use of still closer-fitting projectiles, they were practically unsuccessful. Similar conditions at-



Shrapnel.

Muzzle-loading Shell  
(Studded Shell).

tended the attempts to perfect rifled guns, so that the use of smooth-bored guns and spherical projectiles prevailed up to the middle of the 19th century.



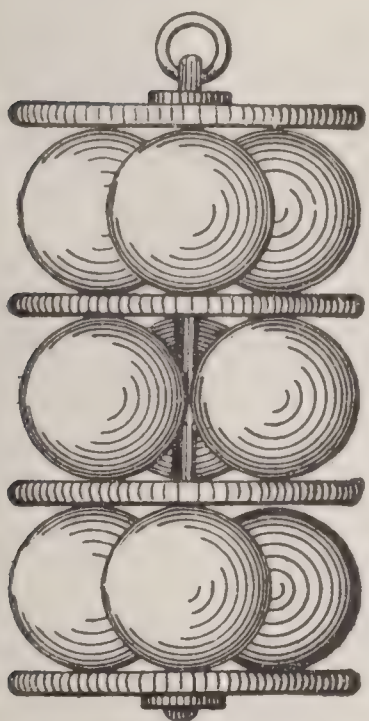
## PROJECTILES

All smooth-bored ordnance were muzzle-loaders. They fired solid round-shot, case, common shell, and shrapnel shell.

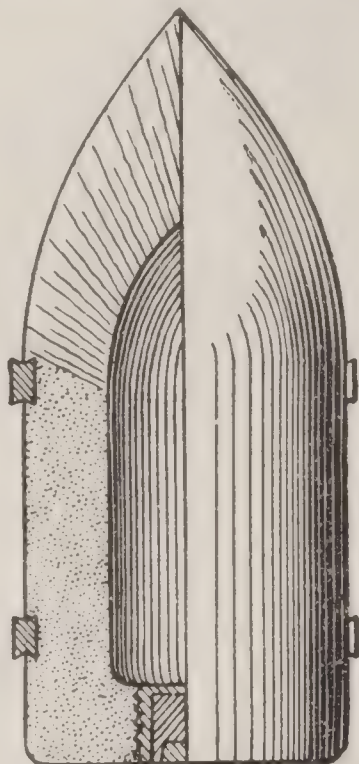
*Solid round-shot* were made of cast iron and were used against the masonry of fortifications, wooden shipping, and massed troops. In naval battles they were often fired red-hot, being heated in special ovens before insertion in the gun.

*Case-shot* consisted of a number of small iron or lead balls packed in metallic cylinders. At first, they were used in a form called "grape," and consisted of a number of balls arranged around a central rod with a disk fastened at each end which together with a series of rings around the several layers of balls, held them in place. The whole was covered by a canvas bag. When fired, the balls were broken loose in the bore of the gun by the shock of discharge, but were held together in the bag for some little distance before final dispersion. Grape was superseded by "canister," invented by Gen. Gribeauval of the French army, in which the thin metallic can containing the balls broke up after leaving the barrel, thus imparting to the smaller

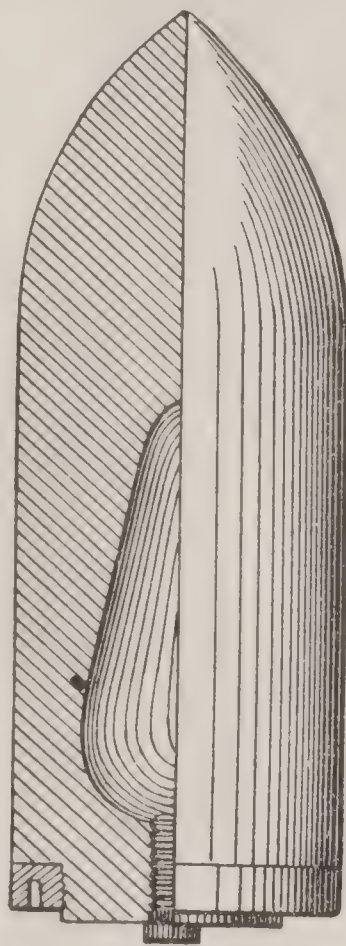
party. They are one of the most important classes of shell, and when handled by skilful artillerists, are capable of producing very destructive results. A shrapnel shell consists of a hollow steel cylinder with walls somewhat thinner than that of the ordinary shell. It is filled with a number of lead or iron balls, and a small powder charge placed either in the front or rear



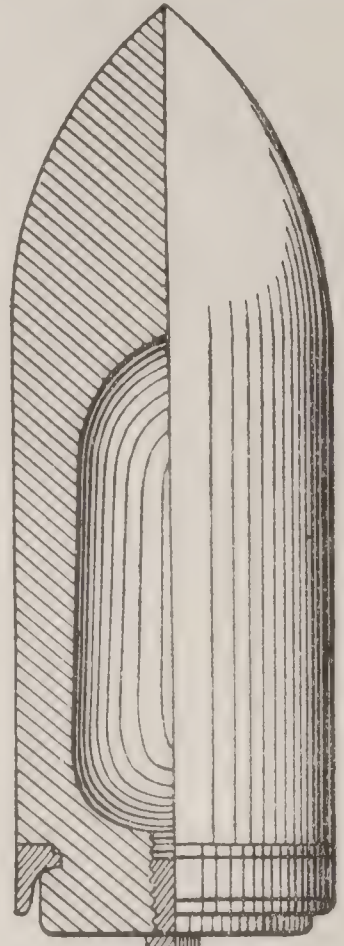
Grape-shot.



Palliser Shell  
(chilled iron head).



Muzzle-loading Shell  
(Butler Shell).



Muzzle-loading Shell  
(Parrott Shell).

shot, at the moment of dispersion, the velocity of the projectile as a unit.

*Common shell* were first made of two hollow hemispheres fastened together and the interior completely filled with gun-powder. They were burst in flight by time fuses. At first, the fuse had to be lighted before inserting the shell in the gun, and resulted in many dangerous premature explosions, but in 1747, the French discovered that, if the earth tamping around the shell were omitted, the fuse would be ignited by the discharge. This not only removed the great danger of shell-fire, but expedited loading, and increased its use.

*Shrapnel*, perfected by Gen. Shrapnel of the British army, were designed for smooth-bored ordnance, but their use has been extended to rifled guns. They were used by the British with great effect during the Peninsular war, especially at the capture of Saint Sebastian, 31 Aug. 1813, when the ramparts were cleared by shrapnel-fire over the heads of the British storming

end, just powerful enough to burst the cylinder and disperse the balls. They are burst by time fuses, or by percussion fuses. In the former, the shock of discharge causes a small plunger to shear a retaining pin and explode a cap which ignites a time train at such a point that it will explode the bursting charge after a predetermined number of seconds. Usually, the calculated time allows the shell to get within 100 yards of the object, when the balls are released by the bursting charge and continue onward in the form of a shower with the velocity of the projectile before bursting. In the percussion fuse, the shock of discharge causes a small plunger to break loose from its retaining wire. When the shell strikes, the plunger is thrown forward against a cap which it explodes, and thus ignites the bursting charge in the shell. Until the earlier part of the 19th century, explosive shell had been fired from mortars and howitzers only, but in 1821, Gen. Paixhans of the French army strongly advocated their use in long guns. His shell guns, the "Paixhans," were adopted in the French navy about 1824, and led to the creation of armor-clad ships which in turn compelled the development of the rifled gun. (See ORDNANCE.) At first, the difficulty of constructing gas-tight breech-mechanisms caused the development of muzzle-loading rifles, but this erroneous system of construction did not last longer than a period of 25 years at the most, and the breech-loading rifle established itself firmly about 1875-80.

*Rifling.*—Rifling was applied to guns to in-

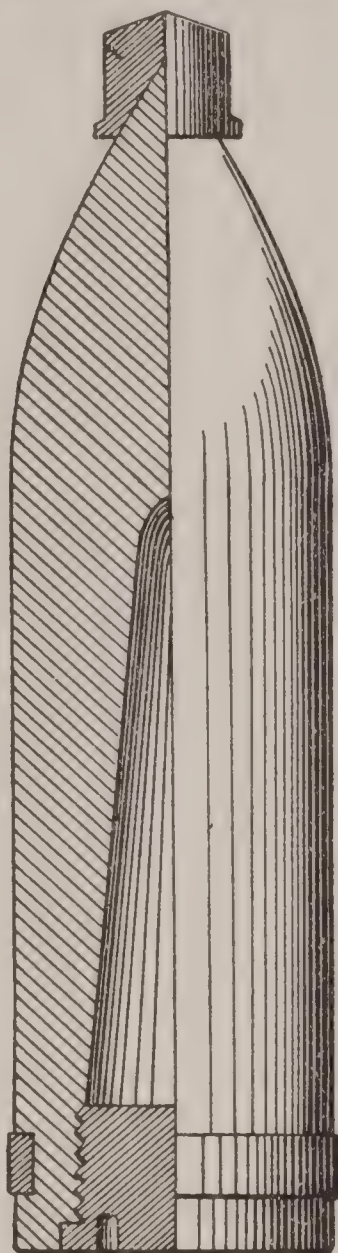


## PROJECTILES

crease the accuracy of aim, and to give greater powers of penetration to the projectiles by increasing their velocity without lessening their weight. In the muzzle-loading smooth-bores the "windage" not only impaired the accuracy, but, by allowing the powder gas to rush past the projectile, reduced the velocity of its delivery;



Muzzle-loading Shell  
(Ribbed Shell).

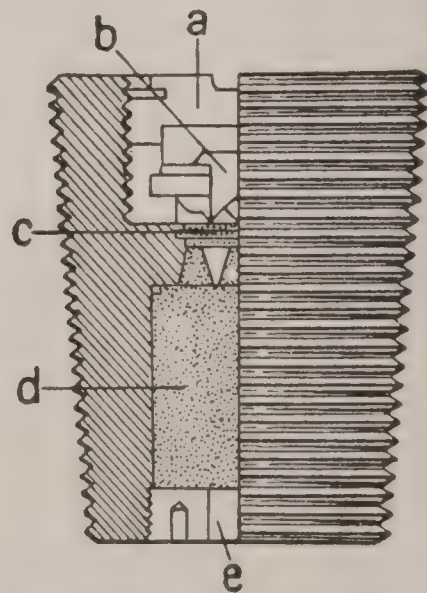


Modern Armor-piercing Shell  
(capped).

while an increase in the weight of the projectile could have been obtained only by an increase of calibre with a consequent loss of power. (See ORDNANCE.) In the muzzle-loading rifle, the rotation imparted to the projectile completely eliminated the inaccuracy of aim due to windage, and by allowing the use of elongated projectiles, enabled an increase in their weight without an increase of calibre, so that the longer and relatively narrower powder chambers concentrated the gas pressure and gave greater velocities. Muzzle-loading projectiles, however, had to be pushed into the gun from the front and were necessarily smaller than the bore, consequently, they still allowed an escape of gas and prevented the maximum effect of pressure. The earlier forms were provided with ribs or studs which fitted into the rifling grooves, but as the guns increased in size, the great strain of imparting rotation at the instant of starting forced out the studs and wore away the driving edges of the grooves. These difficulties were overcome by substituting the system of "increasing twist" rifling for that of the "uniform twist," but did not obviate the shortcomings due to windage. The use of a flanged copper disk attached to the base of the projectile, which expanded under the pressure of the gas and cut off

the windage completely, finally led to the removal of the studs and ribs altogether. About this time the construction of breech-loading rifles had reached such a stage of progress that considerations relative to projectiles were directed into an entirely different channel. In breech-loaders the projectiles are thrust into the gun from behind, therefore they could be used slightly larger than the bore, provided the excess was made of some softer metal that could be forced into the rifling grooves. At first these projectiles were coated with lead but proved quite unsatisfactory. Subsequently they were fitted with copper bands around the base, which, being slightly larger than the bore, were forced into the grooves as the projectile was pushed forward by the pressure, and not only took up the rotation imparted by the rifling, but also acted as an effectual gas check.

*Modern Projectiles.*—The projectiles used in modern guns are common shell, armor-piercing shell, shrapnel, and canister. Excepting the armor-piercing shell, all of them are practically the same as those already described under corresponding names. The first armor-piercing shell were designed by Sir W. Palliser, of England, and were made of chilled iron, or steel, with ogival shaped heads, a form combining strength and sharpness. They were filled with powder introduced through a hole in the base, which was subsequently closed by a strong screw-plug. They were fitted with percussion fuses, arranged to explode them the instant after impact. Modern armor-piercing projectiles are used capped or uncapped. The latest forms of common shell are made with hardened points, and are designed to carry bursting charges



Direct Acting Percussion Fuse—(a) Safety fuse. (b) Steel needles and disk. (c) Detonating composition. (d) Powder. (e) Bottom plug.

equal to five per cent of their own weight, and penetrate armor at least one half of a calibre in thickness; they are used without caps. Armor-piercing shell are made of chrome steel, forged and tempered, and are designed to penetrate any thickness of iron or steel armor, through which they may be driven, without being broken to fragments or deformed by the impact. They are fitted with percussion fuses which are actuated by the impact and explode the shell after penetration. Those exceeding six inches in calibre are not loaded, as their walls are too strong to be burst by charges of ordinary gunpowder. Various kinds of high explosives, such as gun-cotton, nitro-glycerine, and certain picric



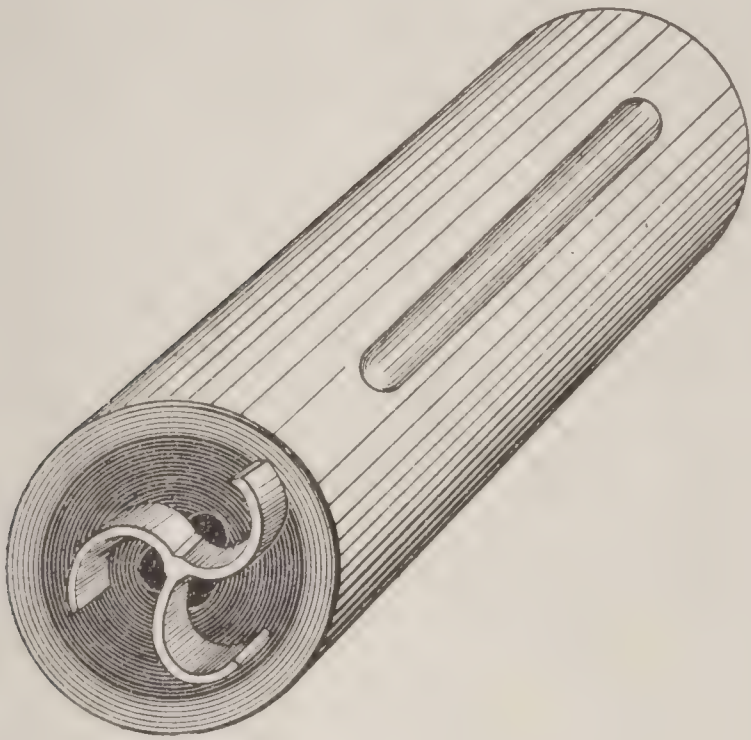
## PROJECTIVE GEOMETRY—PROJECTION

acid compounds, much stronger than any from of gun-powder, have been used as bursting charges with more or less success, but the ever present danger from premature explosions due to the shock of discharge, has probably prevented the general adoption of any of them. (See EXPLOSIVES.) The thickness of homogeneous iron or steel armor they were capable of penetrating was limited only to their striking velocity, but against face-hardened armor they broke into fragments, or were flattened out and welded to the plates. It was discovered that the old compound armor could be easily pierced by them from the soft side. This led to the experiment of fitting soft-steel caps over their points, which were found to add greatly to their powers of penetration. Armor-piercing shells are generally about three and a half calibres in length, and weigh about one half of the cube of

the Hale rocket which is kept point-first by the axial rotation imparted to the cylinder by a three-curved shield attached to its base, and actuated by the pressure of the gas escaping from the vents. Signal or sky rockets are small paste-board cylinders with cone-shaped heads, filled with the composition which generates the propelling gas; a small bursting-charge of powder; and a quantity of other ingredients which, when the rocket bursts at its highest point of elevation, ignite into colored stars of great brilliancy, and visible at a great distance. Life-saving rockets are employed to carry a line over a wreck and thus establish communication between the vessel and the shore.

*Bibliography.*—Special information on projectiles may be obtained from: Cooke, 'Text Book on Ordnance and Gunnery'; Bruff, 'Ordnance and Gunnery'; Ingersoll, 'Text Book on Ordnance and Gunnery'; 'Journal of the United States Artillery'; 'Proceedings of the United States Naval Institute'; 'Text Book on Ammunition (British War Office).'

W. MOREY, JR.,  
Consulting Civil Engineer.



Hale Rocket.

the calibre (expressed in pounds). (See NAVAL GUNS.) The projectiles used in pneumatic guns form a class by themselves. They are best represented by those discharged by the Zalinski, Sims-Dudley, and the Gathmann guns. They were designed to carry large quantities of gun-cotton, nitro-glycerine, or other high explosives. Each Gathmann shell contained at least one quarter of a ton of wet gun-cotton, and under test showed great destructive powers at a range of 5,000 yards. (See ORDNANCE.) Rockets form still another class of projectiles and are of three kinds—war rockets, signal rockets, and life-saving rockets. A rocket consists of a paste-board or a metallic cylinder containing an inflammable composition which, when ignited, generates a quantity of gas of sufficient power to propel it forward. War rockets appear to have been first used in Oriental countries, and probably were invented by the Chinese. They were introduced in the British service by Sir W. Congreve, about 1827, who made them of iron cylinders, and used them for incendiary purposes. Congreve rockets were kept point-first, as they were driven through the air, by sticks fastened to their bases parallel to the axis of the cylinder, and worked on the principle of the feathers of an arrow. They were superseded by

**Projection.** (From the Latin *projicere*, to throw forward). In its general sense, the term signifies the representation of the form of a given figure upon a given surface by means of a pencil of visual, light, or other rays, in such a manner, that the figure in the projection corresponds point by point to the given figure. For example, shadows are the projections of objects upon different surfaces which intercept the rays of light from any source, not already intercepted by the objects themselves. They represent the most elementary forms of plane projections, and while corresponding in general outline to the objects projected, yet differ from them to a greater or lesser extent according to the distance of the object from the source of light, the distance of the plane of projection from the object, the angle between the plane of projection and the direction of the rays of light, the position of the observer's eye, etc.

In the mathematical construction of projections, however, instead of a single plane being used to intercept the projecting rays, another surface, such as one formed by two planes at right angles to each other, is taken and the various points of any object, plane, or in space of three dimensions, projected to that surface from any point assumed as the center of the projection.

When the projection shows three dimensions of the object projected, it is commonly known as perspective, the mathematical theory of which together with the various classes of such projections employed in mechanics and for solving the problems of applied mathematics, will be found under the title Perspective, in this Encyclopaedia. The present article is confined to the consideration of the various projections used in connection with geographical and geodetical work in general, and to their employment in the construction of maps for special purposes.

In geographical and geodetical work, projections are solely used for representing the spherical surface of the earth on a plane. A suitable introduction to this particular phase of the subject is given under the title "Map" in this Encyclopaedia, wherein the three prin-



## PROJECTION

principal perspective projections of the sphere — the orthographic, the stereographic, and the gnomonic, are clearly explained and illustrated. Of these, the orthographic and the stereographic are rarely used at the present time except in the construction of what may be called pictorial maps; but, the gnomonic and several of its modifications are extensively used for the construction of star charts in general, and especially for charts showing the apparent tracks of shooting stars on account of the facility in determining the radiant point, the great circles on the celestial sphere appearing as straight lines on the projection. For similar reasons it is used in the construction of sailing charts showing steamship routes, and is much more satisfactory for this purpose than Mercator's projection, which, although almost universally used for nautical charts, is specially applicable for those used by sailing ships.

The chief value of the perspective projections lie in their adaptability for representing large areas of the earth's surface. Usually, they represent a hemisphere; but, by the employment of the "globular" or "equidistant" projection first proposed by Lahire in 1701, and subsequently modified by Lieut. Col. H. James of the Ordnance Survey of Great Britain and Ireland, fully two-thirds of the sphere can be shown within the bounding circle. This is accomplished by assuming the eye above the sphere at a distance equal to half the radius and perpendicular over the center of the plane of projection. The plane of projection is not that of a great circle, but is parallel to it and removed from it nearer to the eye by 23 degrees.

A simple and easily constructed perspective projection which can be effectively used in representing a hemisphere may be briefly described as follows: Draw a circle and bisect it by horizontal and vertical diameters; divide the circle into equal parts representing degrees of latitude; divide the vertical diameter into a corresponding number of equal parts; and divide the horizontal diameter into equal parts representing degrees of longitude. This will establish three points in every parallel of latitude, *i.e.* two in the circumference and one in the vertical diameter, through which the arc of a circle may be drawn representing the corresponding parallel of latitude, and also three points in every meridian, *i.e.* one at each pole and one in the horizontal diameter or equator, through which the arc of a circle may be drawn representing a meridian.

The general method of constructing developed projections by substituting cylindrical and conical surfaces for the ordinary plane of projection, and then rolling out those surfaces in a plane, has been briefly described under the title "Map" in this Encyclopædia; but, as all modern maps representing data obtained from precise trigonometrical surveys are based upon some form of developed projection, the mathematical theory and the practical methods of construction of such will receive more extended treatment herein.

The basic idea of developed projections results in two well defined types of the same — (1) those employing a cylinder tangent to the surface of the sphere, usually, at the equator, and (2) those employing a cone tangent, usually, at the middle parallel of latitude. It is

obvious that various projections of either type may be obtained by varying the place of tangency relatively to the fundamental circles of the sphere, and also by substituting for the tangent cylinder, or cone, an intersecting cylinder or cone conforming to the condition, that the areas of the spherical zones projected shall bear the same proportion as the corresponding areas on the sphere.

The various projections that may be thus obtained form three definite groups — (1) those possessing straight meridians and parallels, (2) those of mixed systems of straight and curved meridians and parallels, and (3) those in which both meridians and parallels appear as curved lines.

Of the first group, the one most extensively used is Mercator's projection. It was devised to satisfy the following condition: That the loxodromic curve or the course of a ship on the surface of the sea, under a constant bearing or intersecting the successive meridians at the same angle, shall appear on the projection as a straight line having the same angle of bearing

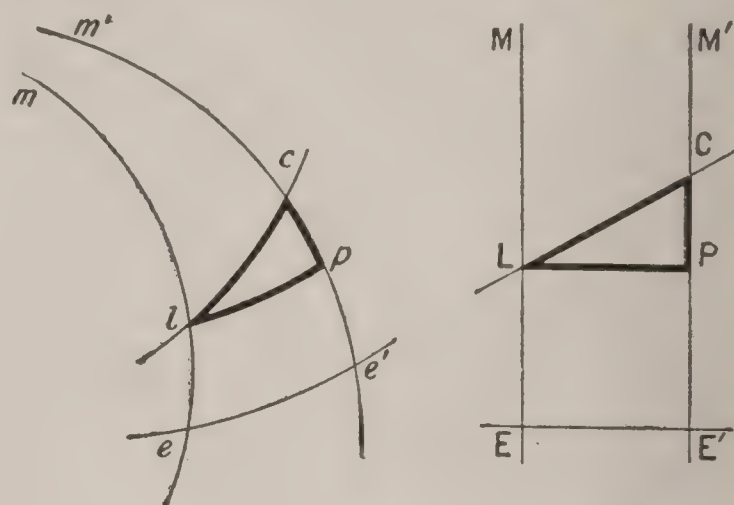


FIG. 1.

with respect to the meridians intersected as that of the loxodromic curve.

This condition is realized by assuming a cylinder tangent to the surface of the earth along the equator, with its axis coincident with the axis of the earth. The eye is assumed at the center of the sphere, and the various points upon the surface of the earth are projected by the visual rays upon the surface of the cylinder, so that, when the cylinder is divided along a meridian and unrolled upon a plane, the meridians appear as a system of equidistant straight lines parallel to each other and perpendicular to the horizontal line representing the equator, and the parallels of latitude appear as a system of straight lines parallel to the equator and intersecting the meridians at right angles, thus forming a system of rectangles the widths of which are variable, increasing from the the equator towards the poles in conformity with the law of progression required by the fundamental condition of the projection.

The formula used in computing a table of "meridional parts" or the "increased latitudes" for determining the distances of the various parallels of projected latitudes from the equator, is obtained as follows: (Modified extract from Projection Tables published by the U. S. Hydrographic Office).

Referring to Fig. 1, let  $l c$  be an element of the loxodromic curve between two consecutive meridians  $m e$ ,  $m' e'$ ; and let  $L C$  represent



## PROJECTION

the corresponding element on the projection between the corresponding meridians  $M E$ ,  $M' E'$ . Let  $l p$  and  $L P$  be taken parallel to the corresponding equatorial elements  $e e'$  and  $E E'$  between the same meridians.

Then, the condition that the angles of bearing  $l c p$  and  $L C P$  shall be equal requires that

$$\frac{C P}{c p} = \frac{L P}{l p}$$

or since  $L P = E E' = e e'$  the element on the terrestrial equator, it is necessary that

$$\frac{C P}{c p} = \frac{e e}{l p}$$

Hence, putting  $d s$  for the meridional element  $c p$  of the terrestrial spheroid,  $d m$  for the meridional element  $C P$  of the projection,  $a$  for the equatorial radius of the earth, and  $r$  for the radius of the parallel represented by the element  $l p$ ; then, on account of the proportionality of the elemental arcs  $e e'$ ,  $l p$ , to their respective radii  $a$ ,  $r$ , we have the fundamental equation

$$\frac{d m}{d s} = \frac{a}{r}$$

which expresses the law of the Mercator projection.

Then, if  $L$  be the latitude of the terrestrial parallel under consideration,  $R$  the radius of curvature of the terrestrial meridian at its point of intersection with the parallel,  $c$  the compression of the earth, and  $e$  its meridional eccentricity: we have the following expression for the properties of  $r$ ,  $R$ , and  $e$  of the terrestrial spheroid considered as an ellipsoid of revolution:

$$r = \frac{a - \cos L}{(1 - e^2 \sin^2 L)^{\frac{1}{2}}}$$

$$R = \frac{a (1 - e^2)}{(1 - e^2 \sin^2 L)^{\frac{3}{2}}}$$

$$e = \sqrt{2c - c^2}$$

Now, since the radius of curvature varies inversely as the angle between consecutive normals, the element of the terrestrial meridian at its intersection with any parallel of latitude is equal to the product of the radius of curvature and the element of latitude at that point, and

$$d s = R. d L,$$

which being substituted in the fundamental equation gives us the expression

$$d m = \frac{a R. d L}{r}$$

for the element of the projected meridian, or by substituting the preceding values of  $r$  and  $R$ , we have

$$d m = \frac{a (1 - e^2) d L}{(1 - e^2 \sin^2 L) \cos L},$$

which when integrated between the proper limits give the required length of any finite portion of the projected or chart meridian corresponding to the meridional arc on the terrestrial spheroid within the same limits.

For this integration, multiplying  $e^2$  in the numerator by  $\sin^2 L + \cos^2 L$ , we have

$$d m = \frac{a. d L}{\cos L} - \frac{a e^2 \cos L. d L}{1 - e^2 \sin^2 L},$$

again, multiplying the numerator and denominator of the first term by  $\cos L$ , substituting  $1 - \sin^2 L$  for  $\cos^2 L$ , and resolving both terms into partial fractions, we have the expression

$$d m = \frac{a}{2} \left( \frac{\cos L}{1 + \sin L} + \frac{\cos L}{1 - \sin L} \right) d L - \frac{a e}{2} \left( \frac{e \cos L}{1 + e \sin L} + \frac{e \cos L}{1 - e \sin L} \right) d L,$$

whence, by performing the integration for the limits of  $O$  and  $L$ , we find for the length of that part of the meridian of the projection included between the equator and the parallel of latitude  $L$ , the expression

$$m = \frac{a}{M} \left( \frac{1}{2} \log \frac{1 + \sin L}{1 - \sin L} - \frac{1}{2} e \log \frac{1 + e \sin L}{1 - e \sin L} \right),$$

in which the logarithms belong to the common system, of which  $M$  is the modulus.

Substituting for

$$\frac{1 + \sin L}{1 - \sin L}$$

its trigonometrical equivalent, and for

$$\log \frac{1 + e \sin L}{1 - e \sin L}$$

its algebraic development, we have the final expression

$$m = \frac{a}{M} \log \tan \left( 45^\circ + \frac{1}{2} L \right) - a (e^2 \sin L + \frac{1}{3} e^4 \sin^3 L + \frac{1}{5} e^6 \sin^5 L)$$

which is the formula required for computing the meridional parts for the terrestrial spheroid.

This formula consists of two parts — the first term being the ordinary formula for computing meridional parts with the earth regarded as a sphere, while the second term consists of a series of negative terms, and represents the correction which must be applied for the meridional eccentricity of the earth under the hypothesis that it is an ellipsoid of revolution.

In using the formula to compute the accompanying table, the following numerical values with their respective logarithms have been employed for the several constants.

The equatorial radius is expressed in minutes of arc, therefore, the unit of measure of the meridional part  $m$  becomes a minute of the equator or a geographical mile.

$$a = \frac{10800'}{\pi} = 3437'.74677 \dots \log 3.5362739$$

The reciprocal of the modulus of the common logarithms,

$$\frac{1}{M} = 2.3025851 \dots \log 0.3622157$$



PROJECTION

Bessel's determination of the compression,

c = 1 / 100.1528 = 0.003342773....log 7.5241069

The meridional eccentricity of the earth,

e = √ 2c - c² = 0.0816968.....log 8.9122052

The values of the several coefficients with their logarithms deduced are as follows:

a/M = 7915'.7055.....log 3.8984896
ac² = 22'.9448.....log 1.3606843
1/3 ac⁴ = 0'.05104731.....log 8.7079734
1/3 ac⁶ = 0'.000204425.....log 6.3105351

On account of the rapid convergence of the series of coefficients involving the eccentricity, two terms are generally sufficient for practical use, and the formula becomes

m = 7915'.7055 log tan 45° + L/2 - 22'.9448 sin L + 0'.05104731 sin³ L.

TABLE OF MERIDIONAL PARTS OR INCREASED LATITUDES FOR THE TERRESTRIAL SPHEROID — COMPRESSION 1/299.1528.

Table with 6 columns: LATS., INCREASED LATS. (M), LATS., INCREASED LATS. (M), LATS., INCREASED LATS. (M). Rows 1-30.

On account of the space limitations, the table gives the meridional parts for even degrees of latitude only; the values for intermediate minutes or seconds of arc may be computed by the formula.

If the chart for which the projection is made includes the equator, the values given may be measured off for the successive degrees of latitude directly from the equator; but, if the equator is not included in the map, the parallels of latitude to be projected should be successively measured from a principal parallel, preferably the lowest parallel drawn upon the map, and the distance of any parallel from the principal

parallel will be the difference of the values given for the two in the table.

These values, given in minutes of arc, may be converted into their equivalents in inches, yards, meters, etc., and laid off on the projection by means of properly divided corresponding scales, proportionately to the scale adopted for the map, or the values given may be laid off without previous numerical conversion, by means of a diagonal scale constructed on the map.

For example — suppose a Mercator projection is required to embrace the coasts of Iceland, on a scale of 1-inch = 150 statute miles. This island lies between latitudes 63° and 67° north, and between longitudes 13° and 25° west from Greenwich. The projection will include four degrees of latitude, and twelve degrees of longitude. The central meridian will correspond to longitude 19° W., and the lowest parallel will correspond to latitude 65° N. See Fig. 2.

Draw in the centre of the sheet a vertical straight line A B, for the central meridian, and near the bottom of the map construct very carefully a horizontal line C D, at right angles to A B, for the parallel of 63° N., and assume it as the principal parallel of the map. From the table obtain the value 4884'.46 for lat. 63°, and 5452'.84 for lat. 67°, the difference of which or 5452'.84 - 4884'.46 = 568'.38, the value of the meridional arc included between the lowest and the highest parallels of latitude of the map, for which one minute of arc of the equator = 1.012 statute miles is taken as the unit of measurement. Converting this value to its equivalent in statute miles and reducing it to the scale of the map, gives 568'.38 ÷ 60' = 9°.47; 9°.47 × 69.77 statute miles (equivalent to a degree of longitude on the equator) = 660.72 statute miles; 660.72 ÷ 150 = 4.40 inches or the distance of the parallel of 67° from the parallel of 63° on the map, on a scale of 1-inch = 150 statute miles. It is obvious that this measurement may be laid off on the map by means of any scale divided to the decimals of an inch, and the distance of each of the other parallels from the principal may be obtained by the same method of conversion and laid off in a similar manner; but, having obtained the value 4.40 inches equal to the vertical extent of the map, we are enabled to determine a constant multiplier by the use of which the tabular values may be laid off directly by means of a diagonal scale of one inch without previous numerical conversion. As 1' of arc of the equator is taken as the unit of the meridional arc, 1' of arc of latitude will measure 4.40 inches ÷ 568'.38 = 0.0077 inches, which corresponds to the scale of the map and by which all the values obtained from the table must be multiplied if they are to be laid off on the projection by means of a diagonal scale of one inch.

The distances of the successive parallels from the parallel of 63° thus obtained are as follows:
0.0077 × (5018.76 - 4884.46) = 1.03 in. (64°)
0.0077 × (5157.98 - 4884.46) = 2.11 in. (65°)
0.0077 × (5302.51 - 4884.46) = 3.22 in. (66°)
0.0077 × (5452.84 - 4884.46) ÷ 4.40 in. (67°)

These distances may now be laid off upon the central meridian from its intersection with the principal parallel in the order 1, 2, 3, 4, shown



## PROJECTION

on Fig. 2, and through the points thus obtained straight lines may be drawn parallel to the principal parallel, and corresponding to the terrestrial latitudes of  $64^{\circ}$ ,  $65^{\circ}$ ,  $66^{\circ}$ , and  $67^{\circ}$ .

The second group of projections, those having mixed systems of straight and curved meridians and parallels, includes various kinds of "equal surface" and "conic" projections, of

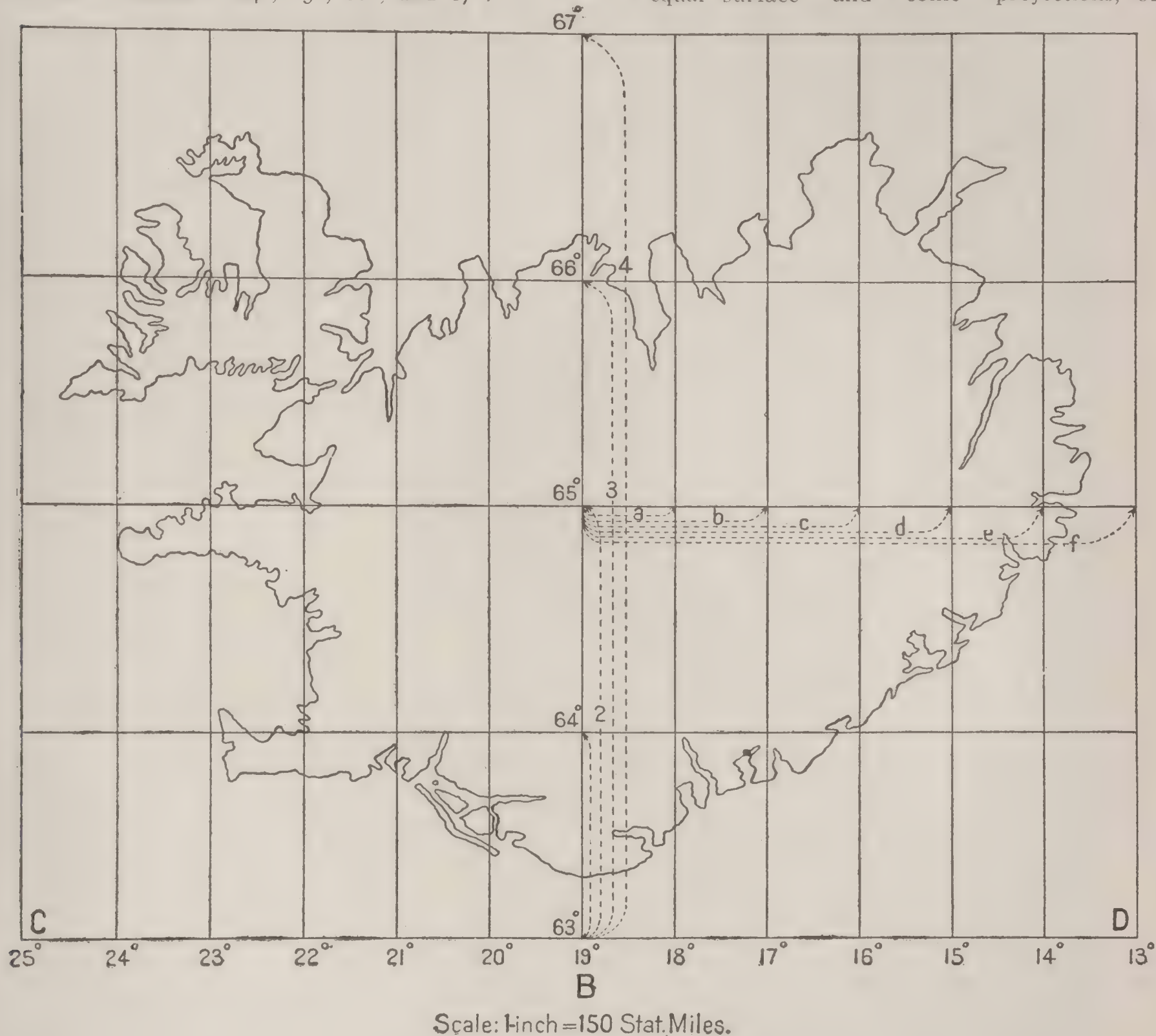


FIG. 2.

On this map, a degree of longitude will measure 0.0077 inches  $\times 60 = 0.46$  inches, and the distances of the successive full degrees of longitude east and west of the central meridian will be 0.46, 0.92, 1.39, 1.83, 2.31, 2.77 inches. Lay off these values on the lowest, middle, and highest parallels of latitude, east and west from the central meridian, in the order a, b, c, d, e, f, and through the points thus obtained draw straight lines parallel to the central meridian, and corresponding to the terrestrial longitudes of  $13^{\circ}$ ,  $14^{\circ}$ ,  $15^{\circ}$ ,  $16^{\circ}$ ,  $17^{\circ}$ ,  $18^{\circ}$ ,  $19^{\circ}$ ,  $20^{\circ}$ ,  $21^{\circ}$ ,  $22^{\circ}$ ,  $23^{\circ}$ ,  $24^{\circ}$ , and  $25^{\circ}$ , west from Greenwich.

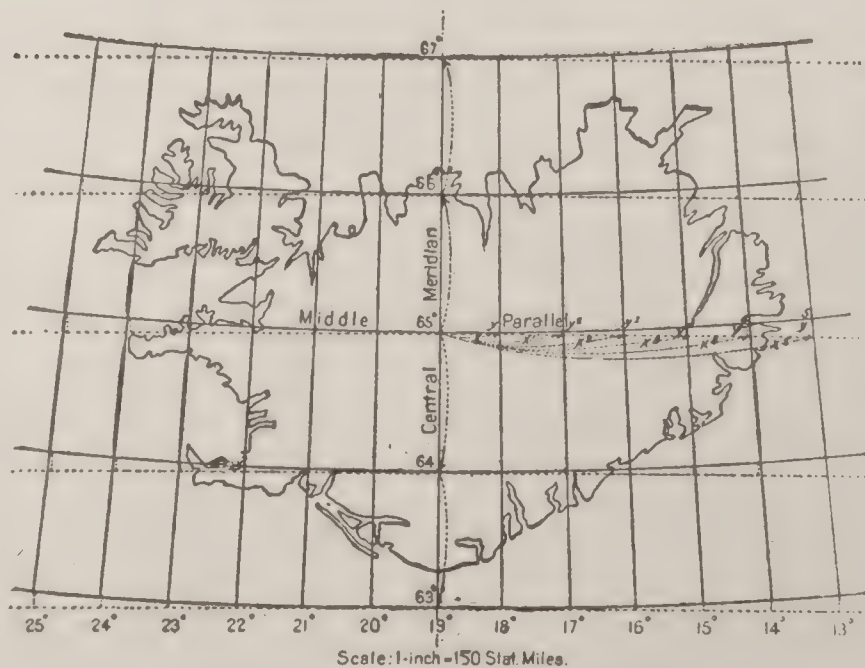


FIG. 4.

which the "simple conic" is the most valuable for general purposes. In this projection it is assumed that a cone, the apex of which lies in the axis (produced) of the sphere, is tangent to the surface of the sphere along a parallel of latitude. When the surface of the cone is developed on a plane, the parallel of tangency becomes an arc of a circle, having for its radius the slant side of the cone which is equal to the cotangent of the latitude. A part of this de-

veloped arc of a circle, of sufficient length to include the desired number of degrees of the proposed map, is drawn through the middle



## PROJECTION

point of the central meridian and forms the middle parallel of the map. The central meridian north and south of this line is divided into degrees of latitude laid off according to scale proportional to their true lengths on the sphere, and parallels of latitude concentric to the middle parallel are drawn through the several points thus obtained. In a similar manner, the middle parallel is divided into degrees of longitude east and west of the central meridian and straight lines representing meridians are drawn through those points to the centre from which the concentric parallels were swept. In the system of co-ordinates thus established, the parallels and meridians intersect each other at right angles, precisely the same as on the sphere, and corresponding infinitely small parts on the sphere and projection are similar in figure. The lengths of the degrees on the central meridian and on the middle parallel are proportionately the same as those on the sphere, and the lengths of the degrees on all the other meridians and parallels are but slightly different from what they would be if laid off their true length proportional to those of the sphere.

The foregoing brief description of the "simple conic" projection serves to illustrate the employment of tangent cones in the construction of developed projections, and leads the way to the consideration of the theory of those of the third group, in which both meridians and parallels are curved lines; approaching much closer to the actual positions on the earth's surface, and therefore more suitable for use in the construction of accurate maps.

Of this class, one of the most useful and extensively used is that devised by Bonne. It is sometimes called Flamsteed's modified projection, but the latter is really a particular case of the former. Bonne's projection differs from the "simple conic" in that each of the concentric parallels of latitude is divided into degrees of longitude, the lengths of which are proportional to their true lengths on the sphere, and curved meridians are drawn through each corresponding series of points. The central meridian remains a straight line, and the curvature of the arcs of the successive parallels is the same as that of the middle parallel, the radius of which is equal to the cotangent of the corresponding latitude. Thus, all the meridians intersect a parallel near the middle parallel at right angles, and the outlines of areas on the projection are very nearly similar to those on the sphere. It not only preserves the proportionate equality of the areas on the sphere and projection, but permits of the use of the same linear scale for all parts of maps of only a few degrees in extent. This projection was adopted as the base for the important map of France constructed by the *Depôt de la Guerre* in 1803.

The step from the simple conic to the Bonne was an important one; but, the great obliquity of the meridians and parallels in the higher latitudes, made it unsuitable for maps of large extent and led to the invention of the "polyconic" projection, which appears to have been conceived by F. R. Hasler, superintendent of the United States Coast and Geodetic Survey, between 1816 and 1820. It was proposed by him as the most suitable base for the maps of the Atlantic coast of the United States, the

great length of which, north and south, together with its direction nearly diagonal to the meridians and parallels, made it subject to inadmissible deviations in magnitude and figure upon a Bonne projection.

In the polyconic projection, it is assumed that each parallel of latitude is developed upon its own cone, the vertex of which is on the axis of the sphere at its intersection with the tangent to the meridian at the parallel. Theoretically, this involves the employment of an infinite number of tangent cones, and the independent development of an infinite number of parallels of latitude. This has the effect of increasing the lengths of the successive degrees of latitudes and longitudes as their distances from the central meridian increases; but, the angles at which the meridians intersect the parallels, over the entire map, very closely approximate to right angles, thus preserving a close similarity between the figure on the projection and the corresponding figures on the sphere.

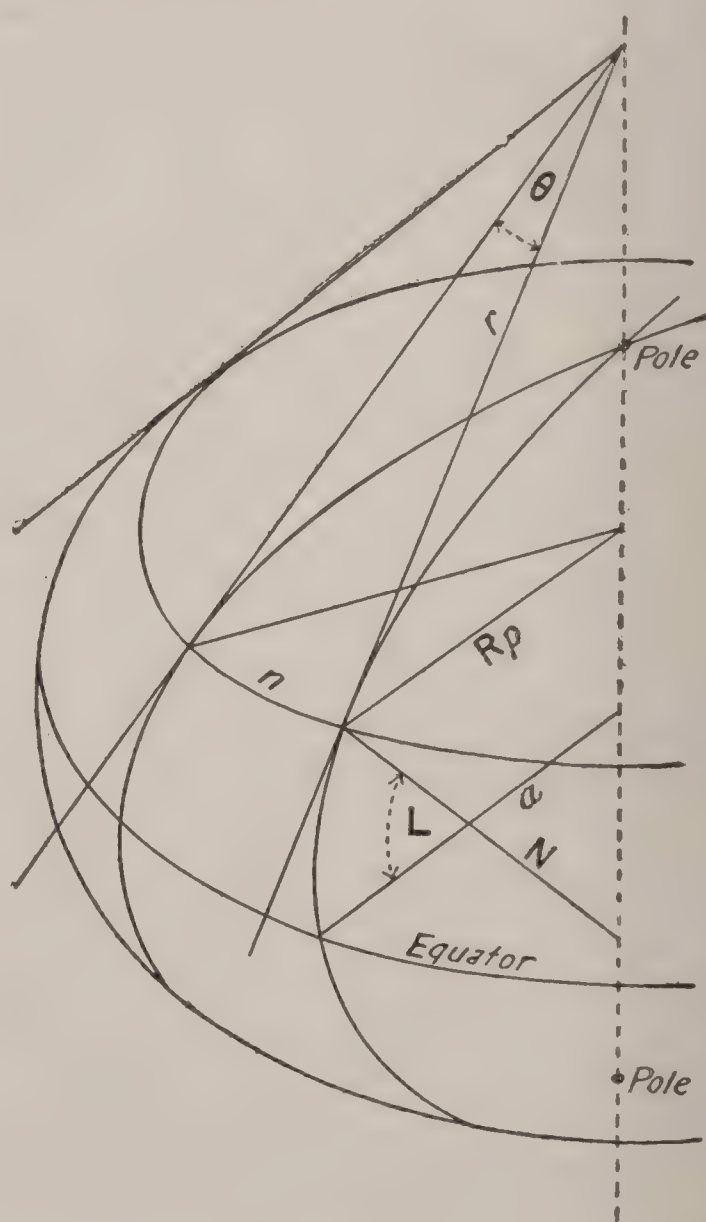


FIG. 3.

The mathematical theory of this projection may be briefly stated as follows: Referring to Fig. 3, the equatorial radius being  $a$  the eccentricity  $e$ , and the latitude  $L$ , the normal produced to the minor axis is

$$N = \frac{a}{(1 - e^2 \sin^2 L)^{\frac{1}{2}}};$$

the radius of the parallel

$$Rp = N \cos L;$$



## PROJECTION — PROLOGUE

and the sides of the tangent cone or radius of the developed parallel

$$r = N \cot L.$$

If  $n$  be any arc of the parallel to be developed, and  $\Theta$  the angle which subtends it at the vertex when developed

$$\Theta = n \sin L;$$

and as the developed parallels are circular arcs, the co-ordinates of curvature are

$$x = r \sin \Theta, \\ y = r \operatorname{versin} \Theta = 2r \sin^2 \frac{1}{2} \Theta = x \tan \frac{1}{2} \Theta.$$

The radius of curvature in the meridian is

$$Rm = \frac{a(l - e^2)}{(l - e^2 \sin^2 L)^{\frac{3}{2}}} = N^3 \frac{l - e^2}{a_2};$$

whence the length of a degree of latitude is

$$3600 Rm \sin l'',$$

and that of a degree of longitude is

$$3600 Rp \sin l''.$$

For maps of large extent, on a small scale, it is sufficient to compute  $r$  and  $\Theta$ ,  $x$  and  $y$ , for every whole degree, but for those of small extent, on a large scale, a more detailed projection becomes necessary and these values have to be computed to every minute or fractions of a minute according to the nature of the data to be represented, and the value of the scale adopted.

To make a projection from the data furnished by a polyconic projection table, draw a straight vertical line for the central meridian and lay off thereon the distances corresponding to the intervals between the successive latitudes required, and through the points thus obtained draw horizontal lines at right angles to the central meridian. These horizontal lines will be tangent to the developed parallels.

Now suppose, that as in the case of the Mercator projection hereinbefore illustrated, the polyconic projection is required to embrace the coast of Iceland, which lies between lats.  $63^\circ$  and  $67^\circ$  north, and between longs.  $13^\circ$  and  $25^\circ$  west from Greenwich, and that the scale of the map is adopted as 1-inch = 150 statute miles.

Referring to Fig. 4, inserted under Fig. 2, the central meridian of the map will correspond to longitude  $19^\circ$  west, and the middle parallel will correspond to  $65^\circ$  north. On the central meridian lay off to the north from its intersection with the middle parallel, according to the adopted scale, 69,268 miles for latitude  $66^\circ$ , and 69,277 miles for latitude  $67^\circ$ , and in a similar manner lay off to the south, 69,258 miles for latitude  $64^\circ$ , and 69,248 miles for latitude  $63^\circ$ . Through these points draw horizontal lines at right angles to the central merid-

ian, and upon each of them set off to the east and to the west of the central meridian the values of  $x$  given in the table for the corresponding parallels of latitude. Through the points  $x$ ,  $x^1$ ,  $x^2$ , etc., thus obtained, draw perpendiculars towards the pole, and on them set off the proper tabular values of  $y$ . Through the final points thus obtained, draw continuous curves for parallels of latitude and meridians.

Space limitations in this Encyclopedia make it absolutely impossible to insert a polyconic table computed to even full degrees only, and one giving the values of  $x$  and  $y$  for greater latitudinal and longitudinal intervals would be more or less useless. Tables of this kind may be readily obtained from the U. S. Coast and Geodetic Survey, and the U. S. Hydrographic Office, Navy Department.

Fig. 4 is placed under Fig. 2 in order to afford a direct comparison of the two projections.

*Bibliography.*—For further information consult the various authorities given under the title MAP in this Encyclopedia.

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**Projective Geometry.** See GEOMETRY, PURE PROJECTIVE.

**Prolapsus Ani**, falling of the anus. See RECTUM.

**Prolapsus Uteri**, falling of the womb. See WOMB.

**Proletariate**, prō-lě-tā'ri-āt, a general term applied to those Roman citizens who stood in the sixth class, possessing less than 1,500 asses, or nothing at all. They were ever afterward distinguished by the name of *capite censi*, apparently because they were taxed only by head. The term has been revived in modern times as a designation of the lowest class of the community who possess no capital; and is frequently used in socialistic literature.

**Proloc'utor**, in the Lower House of the English Convocation, a member chosen by the House, and presented to the bishops who form the Upper House as the person through whom all resolutions will be communicated to the Upper House. The prolocutor acts as chairman and moderator of the Lower House.

**Prologue**, in dramatic poetry, (1) in the Greek drama, that part of a tragedy preceding the first appearance of the chorus. (2) In the Roman and English drama, an address to the audience preceding the piece itself. It may be either in prose or verse, and is usually pronounced by one person. Among the Romans the player who delivered this address was called the *prologus*, and usually considered as a person of the drama. Thus in the 'Amphitryon' of Plautus (q.v.) Mercury appears as *prologus*. Prologues sometimes relate to the drama itself, and serve to explain to the audience some circumstances of the action, sometimes to the situation in which the author or actor stands to the public, and sometimes have no immediate connection with either of these persons or subjects. Shakespeare makes use of the prologue, as in 'Henry V.' and the Restoration drama almost invariably employed it. It long since fell into disuse, but is occasionally revived for the effect of quaintness.



## PROME — PRONGBUCK

**Prome**, prôm, India, (1) a town of Lower Burma, capital of a district of the same name, on the Irawadi, about 160 miles from Rangoon by rail. It is a large town surrounded by a wall, with extensive suburbs; owing to the flat ground on which it is built it is subject to inundations from the river. It has silk-weaving and other industries, and exports silk, rice, cotton, etc. Pop. (1901) 27,375. (2) The district has an area of 2,914 square miles, and a pop. (1901) 365,860.

**Promessi Sposi**, I, prō-mēs'sē spō'zē ē, an Italian romance by Alessandro Manzoni, published in 1825, dealing with Milan under the Spanish rule of the 17th century. In fidelity to life, the interest of its principal characters, and the beauty and truth of its descriptions, it stands as the greatest Italian historical romance, and its author as the creator of a school of historical novelists.

**Prometheus**, prō-mē'thūs, in Greek mythology, son of Iapetus the Titan and Clymene, or Themis (according to Æschylus), or Asia (according to Apollodorus). He is the legendary giver of fire and all its benefits to men. Hesiod and Æschylus, the latter of whom made his story the subject of a trilogy of which one tragedy, 'Prometheus Bound,' is alone extant as a whole, are our chief authority for the myth concerning Prometheus. He is represented as the brother of Atlas, Menœtius, and Epimetheus. According to Æschylus, Prometheus took part with Zeus against his brother Titans and by his craft and sage counsel rendered Zeus victor, and enabled him to ascend his father's throne. Later, objecting to the plan of Zeus to destroy mankind and create a new generation of beings, he helps the weak race of mortals by stealing fire from the lightnings of Zeus and giving it in a hollow reed to men, to whom it had been till then denied. In revenge Zeus has Prometheus chained to a rock in the Caucasus by Hephæstus and his helpers Kratos and Bia, and sends a vulture to tear forever at his vitals, not allowing him to end his pain by death. Steadfastly Prometheus bears his doom, aware that in time Zeus will fall by the hand of a son born to himself and Thetis. Heracles, with the consent of Zeus, slays the vulture and releases Prometheus, who returns to Olympus and thereafter is the wise counsellor of the gods. It is in the above form that the myth has been most generally accepted, but it was varied in many ways by different poets and philosophic interpreters. His Greek name, meaning "Forethought" (that of his brother Epimetheus, signifying "Afterthought"), makes the underlying allegory apparent. Prometheus, as the friend of men, the wise helper in necessity, and in some interpretations as a rebel against unjust authority, has been much referred to in literature, and in modern times was made the subject of Shelley's 'Prometheus Unbound,' and of the fragment of a tragedy by Goethe. He has also been frequently represented in plastic art. Consult: Weiske, 'Prometheus und sein Mythenkreis' (1842); Holle, 'Die Prometheusgeschichte' (1879).

**Promise**, an engagement entered into by one person to perform or not perform some particular thing. When there is a mutual promise between two parties it is termed a contract.

A promise may either be verbal or written. See CONTRACT.

**Promise, Breach of.** See BREACH.

**Promissory Note**, is an unconditional promise in writing for the payment of money in a sum certain, absolutely, and at all events; it is negotiable when it is transferable from one person to another by endorsement or delivery, so as to vest in the party taking it the legal title to the note and to the property it represents: they are of ancient origin and were in use by the Romans. Under the law, generally, notes are assignable, so that the assignee may bring an action thereon in his own name. The usual parties to a promissory note are the drawer, the payee to whom it is drawn and the endorser. The important characteristic of a negotiable note is that the person receiving it does so for value and without notice of any question of title of the previous holder. Anything on the face of a note sufficient to put a transferee upon inquiry, subjects him to any defenses between all the original parties; one taking negotiable paper that is overdue, does so under like conditions. Possession of a negotiable note which is payable to drawer, or which is endorsed in blank, or to the holder specially, is presumed to be legal in every respect. A note to which any signature is attached, through which the holder claims, that has been forged, is not good. The holder of a note can bring an action thereon, except that it is payable to another, especially a note endorsed in blank. If a note is made subject to any conditions as to demand or notice, same must be first complied with before action can be brought. Protesting of a note is the declaration by the holder against any loss on account of non-payment; its object is to give notice to the endorsers of their consequent liability; such notice is essential, and it is customary that protest be made by a notary public. Many important subjects in relation to the laws governing promissory notes are the subject of statutes, which differ in various jurisdictions. See also INDORSEMENT; NEGOTIABLE PAPER; NOTE.

**Prong'buck**, the American pronghorned goat-antelope (*Antilocapra americana*), one of the two sole living representatives on the American continent of the large series of Old World antelopes (*Bovidæ*), the other being the Rocky Mountain goat (*Oreamnos montanus*), which is more nearly a true antelope than a goat. Although almost universally known as "antelope," the pronghorn differs so greatly from the true antelopes that it is made the type of a distinct family (*Antilocapridæ*), having affinities alike with the giraffes, deer, and goats. The horns, while resembling those of the true antelopes and the *Bovidæ* generally in consisting of a bone-core covered by a horny sheath, differ from those of all *Bovidæ* in the presence of a short anterior spur or branch. Furthermore they are more or less densely and extensively covered with hair, thus resembling the horns of the giraffe. But by far the most remarkable peculiarity of these horns is that they are shed annually like a deer's antlers. So skeptical were zoologists as to the possibility of a hollow-horned ruminant shedding its horns, that, although the fact was known to hunters for



## PRONOUN — PRONUNCIATION

many years, and had been repeatedly reported, it was not until 1865 to 1868 that the truth of these reports became fully established. The entire horn is not shed as in the case of deer, but only the horny sheath, the bony core remaining intact and permanent, and its epidermal covering immediately beginning to regenerate a new horn.

The pronghorn is about three feet high and five feet long, with a very short tail, slender legs, pointed, erect ears, and extremely large eyes. Two important characteristics are the absence of the small accessory hoofs from both fore and hind feet, and the hairiness of the end of the muzzle except along a narrow median line. The color is a variable and somewhat mottled brown, with a chestnut colored mane and a brilliant white rump patch or so-called recognition mark. Both sexes have horns; but those of the female and young are smaller and simple. Since the disappearance of the bison, the prongbuck is the most characteristic ruminant animal of the great western plains. Although the progress of settlement has much diminished its numbers and reduced the limits of its range both easterly and westerly, the prongbuck still holds its own over an area extending for about 30 degrees from Saskatchewan on the north to the Mexican state of Zacatecas on the south, and from the Dakotas and Kansas westward through the Rocky Mountains and in the Cascades into Oregon. It occurs in Arizona and at a few points in California, but is absent from large areas in Colorado, Utah, New Mexico, and Arizona. Prongbucks live in bands on the open plains or in the hilly countries; bucks, does, and fawns associating during the greater part of the year, but at the close of the gestation period, which varies from March to September, according to latitude, the pregnant does separate to drop their two fawns in solitude, and the old bucks wander into the wooded hills. Their natural food consists almost entirely of grass, though grain, apples, etc., will be eaten in captivity. They are wonderfully alert animals, with keen senses, and so timid that they retreat on the slightest alarm, but withal so curious that they soon pause to gaze at the cause of their alarm. Their speed is marvelous, and their bounds of tremendous extent, but their power of endurance is not great and they never leap over an obstacle of any height. They may be domesticated with comparative ease and sometimes breed in captivity; and it is said that a fence of only three or four feet high is quite sufficient to confine them. Owing to the excellence of their flesh, though it is rather dry, and their splendid game qualities, they are much sought by hunters. The methods most in vogue are coursing with grey or deer hounds, running with relays of horses, and stalking, the latter especially requiring much skill, though they may be lured toward the concealed hunter by an appeal, by means of a fluttering colored cloth or handkerchief, to their inordinate curiosity. The Indians hunted them by stalking, sometimes dressed in the skin of one of their kind; by driving them into brush enclosures, over which they would not leap; and in other ways. Consult: Caton, 'Antelope and Deer of America' (Boston 1881); Roosevelt, 'American Big

Game Hunting' (New York 1901) and 'The Deer Family' (New York 1902).

**Pro'noun**, a part of speech which takes the place of the noun, to avoid too frequent repetition of the noun. It differs from the noun in this, that whereas the noun stands always for some definite object or concept or class of concepts, for example, Chicago, man, house, the pronoun may stand now for a given concept or class of concepts; but again for a totally different one: thus the pronoun has no fixed denotation: "it" may stand for "Chicago," or "horse," or "universe." A usual classification of pronouns divides them into those personal (I, thou, he, she, it, me, you, they), demonstrative (the, this, that), interrogative (who? which? what?), possessive (my, thy, his, her, hers, its, our, ours, your, yours, their, theirs, whose), relative (who, whom, which, that), and indefinite (any, aught, some, each, every, other, etc.): but the demonstratives and the indefinites do not, as a rule, fall under the definition of pronoun. Worthy of note is the general going out of use (at least in polite society when equals address equals) in all modern languages, of the personal pronoun (and its possessive) of the second person singular, thou, thy, thine, and the substitution for it of the second person plural, or (in German) the third person plural, or of a form signifying "your worship" or the like.

**Pronun'ciamen'to**, in Spanish-American republics a proclamation against the existing government, intended to serve as a signal of revolt. The word *contrepronunciamento*, that is, counterproclamation, also occurs.

**Pronuncia'tion**, the act of uttering words or articulate sounds of the voice. The alphabetic characters are designed to represent with more or less precision the voice-sounds of a language; and if all those sounds have each its proper sign, a written word will be a sure index of its pronunciation. The alphabet of the Spanish language is nearly perfect in this respect. In Spanish the vowels have each one quality of sound: in whatever situation, they have each but one value, and a, e, i, o, and u are pronounced respectively as a in father, ei in rein, ee in see, o in lone, and oo in moon. The consonants, too, have only one sound, except that before the vowels a, o and u, and before consonants, c has the sound of k, and g the hard sound of g in get; also, to represent special sounds, l is doubled (lino, pron. l'iamo) or a diacritical mark is used (año, pron. ahnyo). Not so in English. In English each of the vowel and consonant signs designates various sounds. Thus the vowel sign a denotes at least six different vowel sounds; e at least four; i at least three; o (including oo) seven, and u in four; often they are silent, representing no sound. Many of the consonants, too, though not to the same extent as the vowels, represent each, whether singly or compounded, two or more different sounds; examples: cede, call, child, machine, chemic. Other consonants which stand for more than one sound are s (sat, has, sure), t (tan, thin, thine, nation), n (sin, sing); etc.

The different sounds represented by the vowel sign a are: (1) the short vowel sound which it oftenest represents: it is heard in man, cab; this sound is almost peculiar to English; it differs slightly from the short a of French, and consid-



## PRONY — PROOF-READING

erably from the short a of German; Germans who are beginning to learn English have difficulty at first in producing this English vowel sound and instead of man say men, het instead of hat. (2) The long sound of a as in hate, late: its sound is that represented in other languages by the second vowel e; in German and other languages the sound of the word bane would be represented by ben or behn or bēn, etc. (3) The sound of a (however represented—by a, or ei, or ea, etc.)—before r in the same syllable, as in share, bear. A vulgar mispronunciation of such words is shar, bar; in Irish pronunciation the a in share, bear, pear, etc., has precisely the same sound as in shape, lane, bane. (4) The sound of a in father, calm, far: this is usually styled the Italian sound of a. (5) The sound of a in ask, branch, pass, differing from the pronunciation of the same letter in at, tan, pan: it is the short sound of the a in father. In England and New England the distinction is made between the sound of a in branch, ask, etc., and the a in ban, ran; elsewhere in the United States it is not observed. (6) The sound of a in all, warm, talk, is peculiar to English; it is much broader than a in German words all, fall. (7) The sound of a in what, wander, is peculiar to English; it is represented by o in not, gone, etc. The sounds of e are (1) its short sound as in net, sent; (2) the long sound as in obese, mete, green: this sound is represented in most other languages by the third vowel i; (3) the sound which it has in vein, rein: in other languages this is the primary sound of this vowel; (4) the sound, peculiar to English, which it has before the letter r as in per, confer. Three sounds are represented by i; namely: (1) the short sound as in pin, bin; (2) the corresponding long sound as in marine: this is the regular sound of i in other languages; in English i is so sounded only in a few words; (3) the long sound heard in pine, ride: this is a diphthong and equal to ei or ai. The vowel o represents the following sounds: (1) Its primary sound in English and other languages, as in ode, lone; (2) a short sound peculiar to English, as in not, nod: this is not the o of ode shortened; the shortened o of ode is unknown in English; (3) the obscure short sound (same as that of u in but) heard in other, son, done; (4) the sound heard in prove, move: this is the long vowel u of German, Spanish, etc., and the ou of French; (5) the same sound shortened, as in wool, book, took; (6) a sound closely resembling that of a in all: it occurs when o is followed by r in the same syllable, as in order, corner; in Irish pronunciation this o has the same sound as a in all. The sounds represented by u are: (1) that heard in rule, rumor, Lucifer: here it is equal to oo in moon, and it represents the sound of u in German, Spanish, Italian, etc., but not in French; (2) the corresponding short sound heard in put, bull; (3) the peculiar sound given it before r in the same syllable, as in urge, urn; (4) the diphthongal sound that u has in union, pure: here u is equal to yu or eu. In the United States long u after l has always the sound of oo in ooze: but dictionaries which represent the pronunciation of such words as lurid, luce, in England, give to the u the same value it has in cure, that is, the diphthongal sound (l'yurid, l'yuce), though in the same dictionaries the u in luna, lunary, ludicrous, etc., is represented the same

as in rule. In the United States the u in such words as duty, tulip, is commonly mispronounced as dooty, toolip, instead of d'yuty, t'yulip; the Irish mispronunciation of such words is jooty, tshoolip.

In the pronunciation of various consonants English is peculiar, or differs from other languages in sundry respects; for example, ch in English words is equal to tsh (chat), or to sh (chivalry) or to k (chemism). The d and t of English are pronounced with the tip of the tongue touching the gums well above the teeth; in other languages the contact is at the roots of the teeth. The th in thin is almost peculiar to English, but the same sound exists in Spanish; the sound of th in thy, that, is peculiar to English. In Irish pronunciation the sound of th in thank, thousand, is produced by firm contact of the end of the tongue with the teeth and forcible emission of the breath. In the Irish pronunciation of thy, that, there is also contact of the tongue with the teeth and gums.

**Prony**, prō-nē, **Gaspard Clair François Marie Riche**, BARON DE, French engineer: b. Chamelet, Rhone, 22 July 1755; d. Asnières, Seine, 28 July 1839. He received his technical education at the Ecole des Ponts et Chaussées. As assistant to the civil engineer Perronet he was employed in building the bridge De la Concorde at Paris, and the restoration of the harbor of Dunkirk. Made head of the board of survey, in 1791 he superintended the construction of new trigonometrical tables, extended to 25 decimal places, necessitated by the establishment of the metric system. This great work in 17 volumes is preserved in manuscript at the Observatory at Paris. In 1794 he was appointed professor of mathematics at the polytechnic school, and in 1798 director of the Ecole des Ponts et Chaussées. Under Napoleon he executed improvements in the harbor of Genoa, Ancona and Venice, and in the navigation of the Po. He wrote several works of a technical character connected with the engineering operations of which he had charge.

**Proof** (in law). See EVIDENCE.

**Proof, Ontological, or Ontological Proof.** See ONTOLOGY.

**Proof-reading**, in typography, the corrections to be made on a "proof" of printed matter are marked on the margin; and for this purpose an established set of signs is used. The following specimen of a proof exhibits the application of most of these signs:

'To rule the nations with imperial	
swφy, to impose terms of peace, to	1 a
sparc the humbled, and to rcush the	2 tr.
proud, resigning itto' others to de-	3 #
scribe the courses of the heavens, and	4
explain the rising stars; this, to use	
the words of the poet of the <u>Æneid</u>	5 <i>Italic.</i>
in the apostrophe of Anchises to	
Fabius in the Shades, was regarded	6 ,/
as the proper province of a <u>Roman</u> .	7 <i>S. caps.</i>
The genius of the people was <del>even</del>	8 stel.
more adverse to the cultivation of the	9 9
physical sciences than that, the Euro-	9 of



pean Greeks, and [seen] we have that the latter left experimental philosophy chiefly in the hands of the Asian and African colonists. The elegant literature and metaphysical speculations of Athens, her histories, dramas, epics, and orations, had a numerous host of admirers in Italy, but a feeling of indifference was displayed to the practical science of Alexandria. [This repugnance of the Roman mind at home to mathematics and physics, extending from the Atlantic to the Indian Ocean, from Northern Britain to the cataracts of the Nile, annihilated in a measure all pure sciences in the conquered districts where they had had been pursued, and prohibited attention to them in the mother country.]

Long, indeed, after the age of Ptolemy, the school in connection with which he flourished, remained in existence; &c.

The corrector has also to direct his attention to the numbering of the pages; to the arrangement of chapters, paragraphs, and notes; to running titles, etc. It is part of his business to observe the mechanical defects of the work—defective types, turned letters, inequalities of spacing between words, sentences, and lines, crooked lines, and to secure symmetry in verses, tables, mathematical operations, and such like. In almost all cases two proofs are taken, and in difficult works, such as those in foreign languages, tables, etc., even more. Lastly follows the revision, in which little more is done than seeing that the compositor has made all the corrections marked on the last proof. It is usual for the writer or author to reserve the correction of the second proof for himself. The work of a proof-reader is more difficult than the uninitiated would believe. It requires extensive and varied knowledge, accurate acquaintance with the art of typography, and, above all, a peculiar sharpness of eye, which, without losing the sense and connection of the whole, takes in at the same time each separate word and letter. See PRINTING; TYPOGRAPHY.

**Propagan'da**, a shortened name for the *congregatio de propaganda fide* (congregation for propagating the faith), founded by Gregory XV. in 1622. It consists of a number of cardinals with the cardinal prefect at their head, has a secretary and five subalterns as heads of five chief departments, and a vast number of inferior agents or employees. It is the central missionary association of the whole Roman Catholic Church, and superintends and guides missionary operations in all parts of the world. Connected with it is the *collegium seu seminarium de propaganda fide*, instituted by Urban VIII. (1627) for the education of missionaries, students of all nationalities being here received and trained and maintained free of expense, from the age of 14 years. Converts to the Roman Catholic Church who have come to Rome are instructed and supported by its funds. Bishops and other clergy who have been missionaries are also welcomed and supported there. The Roman Propaganda has a printing-press, celebrated for the works which issue from it. The efforts of the propaganda are directed particularly to countries outside of Europe. All the earth is divided by it into provinces. In close connection with it stand a number of seminaries or colleges for missionaries in various countries, including England and Ireland.

**Propagation of the Gospel, Societies for.** See MISSIONS, FOREIGN PROTESTANT.

**Propeller.** See SCREW-PROPELLER.

**Propertius**, prō-pēr'shī-ūs, **Sextus**, Latin poet: b. Assisium, Umbria, about 50 B.C.; d. Rome about 15 B.C. He is ranked as the greatest elegiac poet of Rome. He was deprived of his estate in the course of the agrarian confiscations and reduced to comparative indigence. Nevertheless he acquired a good education and was urged to take up the profession of advocate, but seems to have preferred devoting his energies to light literature and affairs of the heart, in which his love for the woman in his poems called "Cynthia" (her real name was Hostia), finally gained the ascendant and is reflected in much of his best writing. Propertius numbered among his friends Virgil and Ovid and engaged

(1) A wrong letter. After every mark of correction a line | should be drawn, to prevent its being confounded with any other in the same line. (2) A word or letter to be transposed. Where letters only are to be transposed, it is better to strike them out, and write them in their proper sequence in the margin, like a correction. (3) A space wanted. This mark is also used when the spacing is insufficient. (4) A space or quadrant sticking up. (5) Alteration of type. One line is drawn under the word for *italics*, two for SMALL CAPITALS, three for CAPITALS. (6) Correction or insertion of stops. (7) A word struck out, and afterward approved of (Latin *stet*, "let it stand"). (8) A turned letter. (9) An omission. (10) A letter of a wrong font. (11) A word or letter to be deleted. (12) Alteration of type. (13) A new paragraph. (14) Insertion of a clause. (15) A space to be removed or diminished. (16) A wrong word. (17) When letters or lines do not stand even. (18) Mark for a hyphen. (19) No new paragraph. (20) The manner in which the apostrophe, inverted commas, the star, and other references, and superior or "cock-up" letters and figures are marked.

The immediate object of a proof-reader or corrector is to observe and mark every error and oversight of the compositor, with a view to make the printed sheet a perfect copy of the author's manuscript. This is on the supposition that the manuscript itself is quite correct, which is seldom the case; and therefore the duty of a good reader extends to seeing that there are no inconsistencies in orthography, punctuation, abbreviations, etc., and in many cases to the verification of quotations, dates, and proper names. Where extensive alterations, omissions, or additions are likely to be made by writer or editor, it is more convenient to take the proofs on long slips, before division into pages. The making of new paragraphs, or the suppression of those in type, should be avoided as causing trouble and expense.

The duty of securing consistency in spelling and punctuation is especially important in the case of works on which several writers are employed, such as newspapers and cyclopædias.



## PROPERTY — PROPOLIS

the patronage of Mæcenas. With Horace his relations do not appear to have been friendly. He was of a delicate constitution, pale and thin in person and of an emotional temperament in which melancholy seems to have had a large share, particularly in his late years. It is said of him that he was very careful about his personal appearance, almost foppish in his attention to dress and gait. The poems of Propertius consist of a collection of elegies in four books, which, however, contain many gaps and have been in some instances more or less disfigured by corruptions. They are in their outward form modeled somewhat after the manner of the Alexandrine poets Callimachus and Philetas. He excels in the presentation of quiet description and emotion, "a fine and almost voluptuous feeling for beauty of every kind, and a pleading and almost melancholy tenderness." English translations have appeared by Palmer, Paley, and Postgate. The best texts are those by Hertzberg (1843-5); Keil (1850); and Haupt (1885).

**Property**, in law, is the right and interest which one has in lands, and chattels, to the exclusion of others; the term includes everything that is the subject of ownership, and in its proper sense the term means tangible things and rights which accompany, or are incident to, the use and enjoyment or disposition of things. Property is usually divided into two classes, real and personal. Real property includes land, and as well, all rights in connection therewith. Personal property may be divided into two classes—absolute and qualified; the former is that which is one's own without any qualification whatever; qualified property consists in the right which one may have in it, but which right is lost when possession or dominion ceases,—such for instance as wild animals. One in possession of goods on which he has a lien, though not the owner, has a qualified property in them, while the owner has the absolute property. Personal property may be in possession or in action; the former being tangible objects, and the latter consists of a legal right,—such as the right to sue. Property is lost through the act of the owner conveying or alienating it, which can be done if the legal capacity to make a contract exists, by absolutely abandoning the title, or by the operation of law, as a forced sale, to complete the fulfillment of an obligation; by confiscation, prescription, capture by public enemy; or property may be lost by the act of God, as in the death of an animal, or by destruction through natural causes. Some classes of property are described as mixed property, that is, not altogether real, or personal, but composed of both,—such for example as heirlooms or monuments. In many jurisdictions of the United States what constitutes personal property is defined by statute. The most important distinction between real and personal property is the fact that real property is generally immovable, including land or anything that is physically attached or affixed to it, and certain things that may ordinarily be regarded as real property, are under some circumstances deemed to be personal property—such for example as the buildings placed on the land of another under an agreement to remove them, growing crops, trees, or minerals in the earth. Personal property may become real

property by being attached to the soil. Property is frequently termed a chattel, a term somewhat more extensive than goods. Chattels are divided into two classes, real, and personal, an instance of the former being limited estate in land, and an instance of the latter, any movable property. The ownership of personal property includes the right to use and dispose of it at will, provided such disposition is consistent with the rights of others and the public welfare. Through contract one may become a limited or qualified owner of personal property. In the United States ownership of property and the rights connected therewith are expressly protected by constitutional provisions, the most important of which are to the effect that private property shall not be taken for public use without just compensation, and that no person shall be deprived of property without due process of law; thus, it will be seen, for the public welfare, one may be dispossessed of property if duly compensated. Property may be the subject of legal or equitable ownership; legal ownership being such as would be recognized in a court of law, and is absolute; equitable ownership is the right one has in property which would be protected by a court of equity,—such for example as a lien. Real or personal property may be owned exclusively by one person or by a number. Property is regarded as lost in a legal sense when it has been involuntarily parted with by the owner, and under such circumstances the finder acquires no title as against the real owner, and, therefore, could not transmit the title to another. Legal distinction is drawn between property, and a thing which is merely an evidence of property,—such for example as a bill of exchange (q.v.), or a promissory note (q.v.). Property may be acquired by accession, which is the right to all that one's property produces, and a distinct property right belongs to authors and inventors to the exclusive profit of their productions, which may be protected through the patent or copyright (qq.v.) laws. To this class of property also belongs the right of one to the exclusive use of a trademark. A person who by force or fraud unlawfully takes possession of the personal property belonging to another, or if after obtaining possession of such property unlawfully detains it, can be compelled to return the things taken, or detained, and to pay damages for the loss sustained, or money for the value thereof. There is also a criminal liability fixed by statute relating to personal property, the more important of which are forgery, embezzlement, theft, robbery and receiving stolen goods.

**Property Tax.** See TAXATION.

**Prophecy.** See OLD TESTAMENT.

**Prophet, or Soothsayer,** an insect, the praying mantis. See MANTIS.

**Prophets.** See OLD TESTAMENT.

**Propitia'tion**, the act or means of making propitious or favorable. It is a Biblical and theological term applying especially to Christ and his death. Saint John (I, ii. 2) says, "He (that is, Christ) is the propitiation for our sins." The end of all the sacrifices prescribed in the Old Testament was to obtain propitiation, to propitiate an offended Creator. See ATONEMENT.

**Prop'olis.** See BEE-KEEPING.



## PROPONTIS — PROROGATION OF PARLIAMENT

**Propon'tis.** See MARMORA, SEA OF.

**Proportion**, an equality of ratios; a series in which the first of any even number of terms bears the same mathematical relation to the second term as each other odd-numbered term does to the even-numbered term which immediately follows; thus 4, 12; 5, 15; 6, 18 (or  $4:12=5:15=6:18$ , or  $4:12::5:15::6:18$ , these forms being read "4 is to 12 as 5 is to 15 as 6 is to 18," etc.) is a *geometrical* proportion. The definition given above using the words "same mathematical relation" shows that there may be other than geometrical proportions, in which the relation is the fundamental one of multiplication (or division). The fundamental relation of addition (or subtraction) also gives rise to a proportion, the so-called *arithmetical* proportion; thus 4, 6; 7, 9; 11, 14, or, generalizing,  $a, a+d; b, b+d; c, c+d$ , are in arithmetical proportion as each odd-numbered term is related to its corresponding even-numbered term by the difference 3. The distinction between geometrical and arithmetical is here the same as in progressions (q.v.), and the proportion is merely a special case of progression. It is perfectly obvious that the concept of the proportion may be applied elsewhere, the relation for example being not that of multiplication (or division) nor that of subtraction (or addition), but that of evolution (or involution); thus 4, 16; 5, 25; 11, 121, is a series in which the analogy between terms 1 and 2, holds in the case of terms 3 and 4, as well as terms 5 and 6, the relation being that of the root to the square. But this general concept of the proportion or analogous relation finds small place in mathematics, even the most modern theory being little fresher than Euclid's Fifth Book, which was derived in part from Pythagoras, and which is, save for the difficulty in the treatment of incommensurables, far superior, though reckoned more difficult, than the numerical treatment which came into vogue in the Middle Ages; Euclid's method is concerned with lines, instead of numbers. To all intents and purposes the modern method like Euclid's is concerned merely with geometrical proportions. In a geometrical proportion the odd-numbered terms are called the antecedents, the even the consequents; the first and fourth terms the extremes, the second and third, the means. A mean proportion has the second and third terms identical as  $a : b = b : c$ , which may more conveniently be written  $\frac{a}{b} = \frac{b}{c}$ . The chief properties of a geometrical proportion, say  $\frac{a}{b} = \frac{c}{d}$ , are the following: (1) the product of the means equals the product of the extremes,  $bc=ad$  (clear of fractions); (2) the terms are in proportion by composition,  $\frac{a+b}{b} = \frac{c+d}{d}$  (add 1 to each member of the original equation); (3) the terms are in proportion by division,  $\frac{a-b}{b} = \frac{c-d}{d}$  (subtract 1 from each member); (4) the terms are in proportion by composition and

division,  $\frac{a+b}{a-b} = \frac{c+d}{c-d}$  (divide the equation in (2) by the equation in (3)).

**Proportional Representation**, in politics, a system of representation by which political parties are represented according to their numbers, and not in such a manner as that the majority elects all the representatives. Two plans in particular for securing proportional representation have been tried, the one being by providing that voters shall only vote for a proportion of the representatives, say two out of three, or half when the number is even; the other being to give each elector a vote for every one of the representatives and let them give their votes as they please. In 1900 Belgium adopted a system of proportional representation, and a similar method of election is in operation in some Swiss cantons.

**Proposition**, (1) in mathematics, a statement in terms of something proposed to be proved or done. (2) In grammar, a sentence, or part of one, consisting of a subject, a predicate, and copula. (3) In logic, a sentence, or part of a sentence, affirming or denying a connection between the terms; limited to express assertions rather than extended to questions and commands. Logical propositions are divided: First, as to substance, into categorical and hypothetical; secondly, according to quality, into affirmative and negative; and thirdly, according to quantity, into universal and particular. (4) In poetry, the first part of a poem, in which the author states the subject or matter of it. (5) In rhetoric, that which is proposed, offered, or affirmed, as the subject of a discourse or discussion.

**Propræ'tor.** See PROCONSUL.

**Propri'etaries**, in American history, a common name applied in colonial days to those local governments instituted in America by the crown, as New York, New Jersey and the Carolinas. Only Pennsylvania, Delaware and Maryland remained such until the time of the Revolution. In proprietary governments, the proprietor appointed the governor, and in general performed all those acts of government which in royal governments were performed by the crown. The laws of Pennsylvania and Delaware were subject to the supervision and control of the crown; those of Maryland were not.

**Propyl** ( $C_3H_7$ ), the third radical of the series  $C_nH_{2n+1}$ . It does not exist in the free state, but enters into the composition of a large series of important compounds.

**Propylæa**, pröp-ī-lē'a, in Greek architecture, the entrance to a temple. The term was employed particularly in speaking of the superb vestibules or porticoes conducting to the Acropolis or citadel of Athens, which formed one of the principal ornaments of the city. This magnificent work, of the Doric order, was constructed by Pericles (437-433 B.C.) after the designs of Mnesicles, one of the most celebrated architects of his age. Pausanias says it was covered with white marble, remarkable for the size of the blocks and the beauty of the workmanship.

**Prorogation of Parliament**, in Great Britain, the continuance of Parliament from one



session to another, as adjournment is a continuance of the session from one day to another, or for a longer period. Prorogation determines the session; but adjournment does not. After a prorogation any bill which has previously passed both houses, or either house, without receiving the royal sanction or the concurrence of the other house, must be taken up *de novo*. Parliament is prorogued by the king in person, or by his commissioners. See PARLIAMENT.

**Prosau'ria**, a subclass and also an order of Palæozoic reptiles. See HERPETOLOGY.

**Proscenium**, prō-sē'nī-ŭm, in Greek and Roman theatres, the place where the actors appeared. The front part of it, where the actors stood, was called in Greek *logeion* or *ocribas*, and in Latin *pulpitum* and was elevated above the rest of the stage. The orchestra was in front of it. The place where the actors dressed and undressed, was called *postscenium*. Projecting wings on each side of the proscenium were called *parascenia*.

**Proscrip'tion**, in Roman history, a mode of getting rid of enemies, first resorted to by Sulla in 82 B.C., and imitated afterward in the years that closed the republic. It literally signifies "a writing before," and commonly meant an advertisement or announcement of articles to be sold. But Sulla applied it to a proclamation containing names of citizens and promising a reward to any person who should kill those named in the lists, and a threat of death to those who should aid or shelter them. The persons named were said to be proscribed. Their property was confiscated and their children were declared incapacitated for public office. The most notorious proscription after that of Sulla was that posted by the second triumvirate — Antony, Octavius Cæsar, and Lepidus (43 B.C.), in which was included the name of Cicero.

**Pros'ecutor**, in law, is one who prosecutes another for a crime in the name of the government, whether public or private. A public prosecutor is an officer appointed by the government to prosecute all offenses. In the United States the chief law officers that are public prosecutors are the attorney-generals of each State, and there are subordinate officers known as State, district or county attorneys. A private prosecutor is one who prefers accusations against a person whom he suspects to be guilty, and if he acts from proper motives he will not be responsible to the party in damages, although he was mistaken in his suspicions, but if from a motive of revenge he caused a criminal prosecution without reasonable foundation, he would be liable in an action for malicious prosecution. A prosecuting attorney bringing an action in the name of the people is presumed to have authority.

**Pros'elyte** (Greek, an arrival or new-comer), he who leaves one religion for another. In New Testament times there were proselytes of two degrees, the proselytes of the gate who renounced idolatry and worshipped the only true God according to the (so-called) seven laws of the children of Noah, without subjecting themselves to circumcision and the other commands of the Mosaic law, and were only admitted to the court of the temple, and stood at the door of the inner temple, whence their name; having the right of dwelling in the land of

Israel, but only in suburbs and villages; and the proselytes of righteousness who had been fully converted from paganism to Judaism, had been circumcised, and bound themselves to observe the Mosaic law. Before their circumcision they were examined respecting the grounds of their conversion; after their circumcision they received baptism, being immersed with their whole body in a cistern full of water, on a festival, in the presence of three judges. This baptism, known under the name of proselyte baptism, was repeated in the case of those children of a proselyte who had a heathen mother. Boys under twelve and girls under thirteen could not become proselytes without the consent of their parents, or, in case of their refusal, the aid of the magistrates. By the baptism every one was considered as born anew, so that his parents were no longer regarded as such, and slaves thus baptized were set free.

**Proserpina**, prō-sēr'pī-nā. See PERSEPHONE.

**Prosody** (Greek, *prosōdia*), the part of grammar that treats of quantity, accent, and the laws of versification. See RHYME, RHYTHM, and VERSE.

**Prosper** (Fr. prōs-pār) of Aquitaine, Saint, French poet and religious controversialist: b. Aquitaine about 403; d. later than 463, probably at Rome. He was a layman, probably a teacher of rhetoric and had settled in some city of Provence (perhaps Marseilles) when Augustine's work on 'Correction and Grace' reached Southern Gaul. In that country there were many Semi-Pelagians, who taught that Augustine's doctrine of grace militated against the notion of Free Will. Prosper with a companion went to Rome after the death of Augustine in 431 and induced Pope Celestine to write a letter against the Gallican Semi-Pelagians. Prosper also wrote a Latin poem 'On the Ungrateful' as he styled the Semi-Pelagians who seemed ungrateful for the gift of divine grace; many essays on 'Grace and Free Will' and a most valuable chronicle, which brings the history of the French church down to 455; and he compiled a *Liber Sententiarum* from Augustine's works. Consult: Migne, 'Patrologia Latina,' Vol. LI.; Worter, 'Prosper von Aquitanien über Gnade und Freiheit' (1867).

**Pros'pero**, one of the principal characters in Shakespeare's romantic drama, 'The Tempest.' He is the rightful duke of Milan, but is dispossessed of his dukedom by his brother Antonio and the king of Naples, and with his daughter Miranda is put adrift at sea in a leaky boat. Having reached a desolate island he establishes a refuge for himself and daughter, with Caliban, a half-human monster, the only inhabitant he found on the island, as servant. He takes up the practice of magic which he had studied at Milan, raises a tempest which wrecks upon his island coast Antonio, the king of Naples and their suites, and saves them from drowning only to subject them to various punishments until he finally reveals himself, and gives them his forgiveness. All prepare to return home, Miranda meantime betrothed to the king's son Ferdinand. Prospero then breaks his wand and renounces magic.

**Prossnitz**, prōs'nīts, Austria, a town of Moravia, in the circle of and 11 miles southwest



## PROSTATE GLAND -- PROTECTION

of the town of Olmütz, on the Rumza. It has extensive manufactures of woolen and linen cloth, cashmere and cotton goods, in all of which it carries on an important trade; numerous distilleries of brandy and rosolio, and one of the largest corn-markets in Moravia. Pop. (1900) 24,054.

**Prostate Gland**, a pale, firm glandular body, resembling a chestnut, which surrounds the neck of the bladder and the urethra in the male. It consists of two lateral lobes and one middle lobe. Muscular tissue constitutes the proper stroma of the prostate. The excretory ducts from the glandular substance of the organ open into the prostatic portion of the urethra. It is well supplied with blood-vessels and nerves and is enclosed in a thin but firm fibrous capsule. Enlargement of one or more lobes of the prostate is very common in men over 55. The cause is not known. It is said that it has never been found in eunuchs, or where the testicles have been lost. The enlargement encroaches on the rectum and urethra, interfering with their functions, the bladder becoming distended; its walls may be thin and inefficient and a cystitis may be set up. In this disorder the stream of urine becomes slower; there is a frequent desire to urinate, even at night, but only a few ounces of urine are passed each time. Exhaustion, sepsis from retained urine, and sometimes local hemorrhage cause enlarged prostate to be a serious condition. Treatment includes mild and easily digested food, regulation of the bowels, freedom from exposure to cold and damp, and the careful use of the catheter. Sometimes enucleation of the enlarged gland (prostatectomy) is of value; so are Bottini's operation, burning a channel through the obstructing mass, and vasectomy, the cutting of the vas deferens. Removal of the testicle to reduce the size of the prostate is sometimes resorted to. Acute prostatitis, an acute inflammation, is most often due to gonorrhœa or to strong injections for its relief, but may arise from the irritation of calculi or the use of instruments, etc. The symptoms are painful and frequent micturition, swelling, high fever, retention of urine, and tenderness in the region of the lower bowel and the neck of the bladder. The inflammation may progress so far that suppuration (prostatic abscess) occurs. The treatment requires rest in bed, hot anodyne fomentations, leeches, purgation, and opening of an abscess. Chronic prostatitis may be the sequel of the acute form, or it may be primary. There is less swelling, pain, and tenderness than in the acute. It is a condition which needs the supervision of the physician or surgeon. Tubercular disease of the prostate may either be primary or be secondary to similar disease of the testes. There are nodular lumps, which may break down and produce an abscess. The disease may invade the bladder and the whole urinary tract. The prostate is subject to malignant tumors, carcinoma, and sarcoma. Prostatic calculi about the size of millet-seed are quite common in old men. They rarely give rise to symptoms unless inflammation occurs. Sometimes they are voided, or they may form the nucleus of a prostatic calculus.

**Prostyle**, in architecture, a portico in which the columns stand in advance of the building to which they belong. The term *amphi-*

*prostyle* is used when there is such a portico attached to a building both in front and behind.

**Protagoras**, prō-täg'ō-ras, Greek sophist: b. Abdera, Thrace, about 480; d. 410 B.C. He studied the old Ionian philosophy paying especial attention to Heraclitus, and he was the first to assume the title of Sophist, and to teach for pay, a practice which, Plato informs us, proved very remunerative. He taught principally at Athens. When, about 443, a number of Athenians left the city to join in founding the new colony of Thurium, Protagoras was appointed by Pericles to accompany them and subsequently drew up a constitution for the Thurians. Before returning to Athens he lived for some time in Sicily, where he acquired great fame. He returned to Athens before 430. In 411 he was brought before the Areopagus for beginning one of his works ('Concerning the Gods') with the words, "Respecting the gods, I am unable to know whether they exist or do not exist," was banished for atheism, and perished at sea. He was the author of a large number of works, all of which are lost. The two most important of them were the one already mentioned, and another entitled 'Truth.' One of the dialogues of Plato bears the title 'Protagoras,' and yields some information regarding his mode of teaching. His famous apophthegm, *ἄνθρωπος μέτρον* (man is the measure of all things) has become the eternal possession of philosophy and can never lose its significance. Man from his subjective impressions can, he said, decide what things are, and what things are not. Hence he taught that Science was impossible and Opinion everything. This was what in modern philosophy corresponds to Sensualism. For these views he was controverted by Socrates and the Socratic school. Consult: Lewes, 'History of Philosophy'; Herbst, 'Protagoras, Leben und Sophistik' (1832).

**Protection** is a term in political economy, employed to describe the policy of indirectly promoting the growth of national industries, either to secure the defensibility of the country in time of war, or to promote its general welfare, or both. It differs from Socialism in seeking this by indirect means, and with the minimum of interference with individual freedom, recognizing that the true function of government is to steer the ship of state in industrial matters, and not to propel it. It differs on the other side, from free trade, which excludes government from any kind of activity in the industrial sphere, and especially objects to any legislation which will have the effect of diverting capital and labor into channels in which they would not otherwise flow.

More than one way to this end has been used, such as the absolute prohibition of specified imports, premiums upon exports, bounties upon home production, and the retention of raw material. But the usual way has been to impose, upon the competing product from abroad, a duty sufficient to discourage its use and to make it unprofitable to the dealer. Such duties are either *ad valorem* or specific. The former are levied upon the value of the imported commodity, and are either directly or inversely proportional to that value. Thus the duties imposed by the British Corn Laws rose as the price of wheat fell, and the converse. Specific duties are those



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which tax the commodity by number, weight or bulk, irrespective of differences in value. For protective purposes there are preferable.

From the rise of national feeling in Europe, at the close of the Middle Ages, to the Congress of Vienna in 1815, all governments pursued the policy of protection to home industry. Among economic theorists a protest against this was begun by the French *Economistes* (Gournay, 1754; Quesnay, 1758; Turgot, 1766). It found its finest exposition and defense in their Scotch disciple, Adam Smith (1776), who contended that the interplay of self-interest is quite sufficient to secure the best industrial development, and that when every man is left to "do as he will with his own," he will do what is best for society. The antipathy of Napoleon I. to this theory, and the questionable means he employed to counteract it in his Continental System, seemed likely to give it a chance of being applied in the states represented at the Congress of Vienna. But a few years of actual experience satisfied the rulers and cabinets of the Continent that the path to national prosperity did not lie in that direction. They returned to protection, which England and France, indeed, never had abandoned, and which Germany made effective for the whole country through the Zollverein (1817).

It was in the United Kingdom, in 1846, after eight years of popular agitation by the Anti-Corn-Law League, that a European government first took steps to abandon Protection, and that after 510 years of it had lifted England out of the dire poverty of a merely agricultural country, into the first rank among manufacturing nations. And even she continued to protect her silk and glove industries against French competition, until the Cobden Treaty of 1860 agreed to the abolition of these duties.

In America the need of a national government, which could extend protection to the prostrate industries of the States, was one of the most powerful motives to the formation and adoption of the Constitution of 1787, which authorized Congress to impose duties on imports "to pay the debts and provide for the common defence and general welfare of the United States." The harsh experiences of the war for independence had shown the country the need of manufactures for the defense of the nation. It was on this ground that Washington repeatedly pressed for adequate legislation; and in this he was supported by his secretary of the treasury, Alexander Hamilton.

Duties were steadily adapted to this end, until the political revolution of 1801 brought Jefferson into office. From that time no advance in the direction of more adequate protection were made, although only the duty on salt was repealed, with the result that the country had a second salt-famine during the war of 1812-15. Its sufferings in this, and other industrial wants, effectually converted Jefferson from free trade, but it was not until 1824 that the country returned to an effective protective policy.

The South, however, found that its adhesion to slavery precluded it from entering upon manufactures, and now began to antagonize protection as an encroachment on the rights of the States, although her cotton-growing industry had been brought into existence and advanced to prosperity by a protective duty continued for

many years. Her threats of nullification led to the adoption of the tariff of 1833, which provided for the gradual reduction of all duties to a 20 per cent level by 1840. The general suspension of manufacturing through this reduction and the derangement of the currency brought about the severe depression of 1837-42, and caused another political revolution in the election of a Protectionist Whig to the presidency in 1840.

During the four years of the tariff of 1842 there was a great and general restoration of prosperity; but the influence of the example set by England, and the prospect of open markets in that country for western and southern products, brought about another change. The tariff of 1846 embodied no economic principle, but effected a large reduction of duties below the protective level. In 1857 these duties were farther reduced by one fourth, and another severe depression of industry helped to the election of Mr. Lincoln in 1860. Before he came into office the Morrill tariff had been passed by Congress and signed by President Buchanan.

This was done in view of the certainty that a civil war at home was impending, and that it might involve the country in hostilities with England and France. It was therefore felt necessary to put the country in the way of equipping itself for any emergency. The relation of home industry to national defense thus indicated, was amply shown in the distresses and disabilities of the Southern Confederacy, which solemnly committed itself to free trade in its Constitution, and was dependent upon its friends in Europe for military and other supplies. For over 30 years our country persisted in the policy of protection, with some unhappy experiments in the reduction of duties,—notably those on wool and woollens in 1883. The presence of a surplus of revenue in the national treasury was made the pretense for demanding "Tariff reform," meaning an advance toward free trade. In spite of partial victories, nothing was effected until after Mr. Cleveland's second election in 1892. The tariff of 1893 fell far short of what he and his friends wished, but it went as far beyond what the country would endure, and brought about a reaction and a return to Protection, which the country gives no sign of abandoning at an early date.

*The Reasons for Protection* are numerous and mutually supporting. (1) The necessity of varied industries for the national defense has been indicated already. It was again shown in the Boer war, in which a brave people were handicapped by their being a merely agricultural population, in conflict with a great manufacturing country. It may be illustrated, in the opposite way, in the next great European war which involves Great Britain, through that country's long neglect of her agriculture exposing her to the gravest perils. A single defeat of her navy may result in rendering it possible for an enemy to starve her people into submission. (2) The variety of industry, which Protection establishes, is not less necessary to defend the country from the perils of famine. A country which produces food only, is liable to famine and its consequent pestilences, whenever the rains are too scanty or too plentiful for the harvesting of the crops. Such a country has all its eggs in one basket, and should that fall, it has nothing to



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fall back upon. Ireland and India became famine countries through the destruction of their manufactures by English legislation and by English competition. They will remain such until they secure the independence which will enable them to enact the protection to their home industries they both desire. All the regions visited by famine in modern times — Persia, central Russia, northern China, northern Sweden, Asia Minor, and even some districts of our own country,—are merely agricultural communities. (3) Protection secures the general welfare of the producers of the country, by bringing each class into the neighborhood with the others, which supply its wants and demand its goods. It thus saves the cost of carrying products over land and sea to find a market, and bring back, at a like cost of carriage, whatever is taken in exchange. The railroads of this country save about \$5 a ton on having their worn rails converted into new, through not being obliged to send them to rolling-mills in Europe. The farmer gets more for his crop when he has the artisan close at hand to consume it, and obtains in greater abundance what the artisan produces, even if he has to pay a higher money-price for it. All this advantage is lost when a country keeps its farms on one continent and its workshops on another, and spends both strength and money in transportation which could be avoided. (4) The naturalization of varied industries by protection gives the people of the country greater liberty to choose the kind of work they prefer, and a finer opportunity to develop their natural capacities in improving old methods or inventing new ones. This has been especially true of America, whose people were taunted for their backwardness in invention before this became a manufacturing country. An English manufacturer declared we could not make so much as a mouse-trap for ourselves. American inventions have lightened the burden of toil for half mankind. They have made many staple articles, such as steel, cutlery, cottons and silks, cheaper to the whole world. The American character has been distinctly improved by emergence out of the stage, at which farming and shipping furnished almost the only employments, and has grown in manifoldness and energy. (5) The variety of industry, at which Protection aims, is highly useful in drawing the people of the country in closer relations, and thus contributing to the unity of will and understanding, which underlie national unity. It was by the trade between the English colonies that the fierce prejudices of our earliest time were overcome. It was through the development of foreign commerce at the expense of home trade that the Union was imperiled. As Mr. Carey showed Mr. Lincoln, our railroad lines ran only to the seashore, to facilitate exports and imports. They now run north and south as well. By the Zollverein and its fostering of home trade, Germany was helped to national unity. The English sneered at the notion that the Germans could "spin and weave themselves into national unity," but the result came. (6) By preventing adverse balances of trade, Protection guards the national supply of solid money from being drained out of the country. Money is "not a commodity like any other," as to whose incoming and outgoing we can afford to be indifferent. It is the means of organizing labor for the conquest of nature

and the production of wealth. And it is not indefinitely replaceable, as are many other commodities. To exchange it for hardwares and textiles is to exchange power itself for the products of power. Laveleye compares such an exchange with that between two parties of hunters, who should trade game for guns and ammunition, while at a distance from the basis of supply. Nor is it true, as some economists tell us, that the loss of gold and silver have no other effect than to lower prices in the country which exports them, and thus lead to a return of coin by purchasers from abroad. Prices are lowest in the countries which have the most money, because labor is organized there to the best advantage, and is thus made more productive. "Start a shilling in Thibet, and it will turn up in London." It goes to where it will buy more commodities, though less labor. Therefore is it true that the gold of the world tends constantly to the great centres of money and of manufacture, moving on the same lines with the commerce in food and raw materials. By refusing this unequal commerce, we have ceased to be a gold-exporting country, and have thus obtained that stock of money which enables us to organize labor on a great scale, and acquire industrial power.

*The Objections to Protection* are many in form, but they resolve themselves into a few. (1) It is charged that "protection is hostile to commerce. If we do not buy, we cannot sell. Thus we are deprived of the possibility of disposing of our surplus products." But with the single exception of England since 1846-60, all the great commercial nations have practised protection; and under that policy our own exports have reached a figure not equaled by any other country in the world, our rate of progress in this respect being rivaled only by protectionist Germany. In truth, nations buy of each other just what they must, and sell all they can, and means of payment are always found. (2) It is objected that "the interest of the consumer is that of society at large, while the interest of the producer is that of a class only. Free trade promotes the former, while protection seeks the latter. For the consumer is interested simply in getting what he uses as cheap as possible, and with this a protective duty must interfere." But "better than a low price for any article is a fair price," Mr. Lowell says. The times of especial cheapness are what we call "hard times," and even the free trader fails to recognize his own ideal in those times. Like other people he begins to talk of an "improvement in prices," meaning a rise. In considering the effect of protective duties upon prices it is necessary to look at both sides of the account. Nearly every one in the community has something to sell, and it is of small use to him to be able to buy at a low rate, if he must sell at a still lower. Ireland is a land of cheapness, but not to the advantage of its people, who cannot find a market for their labor. Nova Scotia is another country of low prices, and its people flock in thousands to Massachusetts, to seek employment at such wages as they never can earn at home, and to live in a comfort there denied them. The free trader fixes attention far too much on one side of the account, to the neglect of the other. Nor is the consumer, in the long run, obliged to pay higher prices because of protection. Mr. Greeley used to chal-



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lenge the free traders to mention a single article whose manufacture had been protected for 14 years, without falling in price below the point at which it has stood. All kinds of commodities in this country are cheaper to the consumer than they were before the enactment of the Morrill Tariff. The national consumption of all has increased far more rapidly than the increase of the population. (3) It is alleged that "Protection is but a method of forcing a hot-house growth of industries, which would have come to us naturally, when our density of population warranted the transition from farming to manufactures. The latter arise when there is a real need and demand for them, without any interference on the part of government." This statement is not supported by any historic instances of this natural growth. Every nation, which now possesses such industries, made its beginnings under Protection. Every great industry that is fighting for the markets of the world, was built up by protective duties. On the other hand, everyone admits that the want of manufactures is the root of the misery of Ireland and of India. The governmental commission to investigate the cause of Indian famines, reported, in 1885, that nothing but the diversion of a large part of the labor of the people to manufactures would put an end to them. The need of both countries is beyond question, for in both the density of population has passed the point at which people can live by the soil. But neither of them possesses the power of transforming mere need into effective *demand*, by native legislation. How long are they to wait for that "natural growth?" (4) Adam Smith's argument from the beneficial effects of what he called "natural liberty," supposes that "individual self-interest is enough to secure all the industrial growth that any country needs or should want. If everyone be left free to do as he will with his own, he will do what society needs to have done." Those who repeat this argument are never willing to apply it to other forms of the state's activity, which affect industry. They do not propose to have the merchants of each seaport keep its harbor in condition by their individual or even their united action. They dare not assert that individual self-interest has not inflicted deep and lasting injury of our country in the devastation of its forests, the destruction of its game, and especially the extirpation of insect-destroying birds. They sustain the government in making the coinage of money and the carrying of letters public monopolies, and punishing all who invade either. They have ceased to look to private self-interest for the maintenance of a school system adequate to our national need. They make all these exceptions to their own theory, and the protectionist adds one more. Adam Smith's principle, however, has great truth. It is the rule, and all these other things are the exception. The protectionist differs from the free trader in that he has no panacea or cure-all to offer to the public. He has only a specific for a single social defect, and he alleges in its favor that it interferes as little as possible with personal liberty. (5) It is objected that "protection favors the manufacturers at the expense of their laborers and of the farmers of the country." As for the laborers, protection does not set aside the law which Carey, Bastiat and Atkinson have shown to

govern the distribution of profits. The laborer's share of the joint-product of capital and labor constantly increases, while that of the capitalist constantly diminishes. Protection makes that joint-product greater with every expansion of industry, and thus secures to the workman a higher standard of living and a greater opportunity to save. Between 1860 and 1880, the wages of labor, measured in the power to purchase the staple commodities, more than doubled in this country. While free labor in America was once little if anything above the slave's level, as to the enjoyment of the necessities and comforts of life, it is now on the highest level that it ever has attained in history. The farmer is directly cared for in the tariff, being secured that great market for his produce which our manufacturing districts furnish him. From that market the protective tariff shuts out his Canadian competitor, in spite of the demand of our free traders, seconded by some short-sighted manufacturers, that we shall return to the reciprocity which existed from 1854 till 1867. The farmer is also benefited indirectly by having his market for produce brought into his neighborhood, thus making his exchanges more equal. As an English newspaper put this years ago, "when the western farmer in America had free trade, he gave a pound of butter for a pound of nails. But under protection he gets 14 pounds of nails for his pound of butter." (6) It is alleged that "protection favors the formation of trusts, and thus destroys that domestic competition, which the protectionist himself relies upon to secure reasonable prices." Yet a large number of our trusts, beginning with the Standard Oil Company, are almost independent of the tariff. Of the rest, very few have been able to secure such a control of production as to have the power to dictate prices; and of these several avoid attempting it. Their especial product is as cheap as before the trust was formed, their new gains coming from the saving of expenses. Others still are international trusts, of the sort that would be sure to arise if we abandoned protection. Nor are the countries which practise free trade characterized by unlimited competition among producers. Wherever the trades-union has obtained the control of the rate of wages and of the hours of labor, capitalists have been led to combine for mutual protection. They naturally think that they cannot afford to buy labor in a close market and sell their product in an open one. Unified control has come to be the rule in the great English industries, and they have improved upon our example by including the workingmen in their arrangements for adjusting prices and wages.

The general movement of American industry to better conditions under the protective policy is shown by some statistics of our national position at the beginning of our longest period of protection and the close of the 19th century:

	1860	1900
Population .....	31,443,321	76,304,799
Aggregate wealth ...	\$14,183,000,000	\$64,120,000,000
Share per capita.....	\$454	\$832
Exports .....	\$333,576,057	\$1,394,483,082
Imports .....	\$353,616,119	\$849,941,184
Wages .....	\$378,878,966	\$2,330,273,021
Wage earners .....	1,311,246	5,321,087
Average earnings ...	\$289	\$438

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**Protective Coloration.** See COLORATION, PROTECTIVE.

**Protector,** in the history of England, a person appointed to act as regent generally during the minority of the king. Those on whom it was conferred were the Earl of Pembroke, in 1216, during the minority of Henry III.; Humphrey, duke of Gloucester (1422-47), during the minority of Henry VI.; Richard, duke of York, February 1454 to February 1455, and November 1455 to February 1456; Richard, duke of Gloucester, in 1483, before the death of the young princes, his nephews, and his own accession to the throne; and the Duke of Somerset (January 1547 to October 1548), during the minority of Edward VI. On the 12th of December, 1653, the title of lord-protector was bestowed upon Cromwell, as head of the Commonwealth of England, by the council, composed mainly of his principal officers, which then held the chief power.

**Protectorate,** a term applied to the relationship existing between a stronger nation and a weaker one when the former undertakes to protect the latter from hostile invasion or other form of aggression and in consequence exercises more or less control over its domestic and foreign affairs. The term is also applied to the state thus protected. The relation between a protectorate and its protector is usually established by treaty, although sometimes it is the result of mere understanding only. At the present time most of the protectorates of the world are to be found in Asia and Africa and the islands of the Pacific Ocean. Notable examples of existing protectorates are Tunis in North Africa, under French protection, and North Borneo, Bechuanaland, Somaliland, British Central Africa, and British East Africa all under British protection. Germany and Italy also maintain

protectorates in Africa. Contrary to the general opinion the United States has from early times exercised similar control over weak nations in various parts of the world. One of these was Liberia on the west coast of Africa and founded by the American Colonization Society in 1820. It has been understood all along that no other nation would be permitted to annex it or interfere in its affairs. Likewise Hawaii for a short time occupied the position of a protectorate until its annexation to the United States in 1898. From 1882 to 1897 the United States was one of the three powers to exercise a protectorate over the Samoan Islands. Likewise from 1836 to 1845 it exercised a protectorate over the Republic of Texas. From 1846 to 1903 the United States as a result of treaty with Colombia exercised a quasi protection over the Isthmus of Panama for the purpose of insuring the neutrality of the Panama railroad. Partly as a result of American aid Panama seceded from Colombia in the latter year and virtually placed itself under the protection of the United States. The most perfect example of an American protectorate at the present time is that of the Republic of Cuba, which secured its independence of Spain in 1898 chiefly through the intervention of the United States and which upon demand of the American government inserted in its constitution a promise not to enter into foreign relations with any other country without the consent of the United States and accepted other conditions which materially impair its independence.

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**Proteids** (from "protein," q.v.), a large group of organic compounds, of which egg albumin may be taken as a typical example. They are mostly amorphous and indiffusible, and they possess a complicated chemical structure, whose nature is not yet understood. Gamgee describes the proteids, as a class, as follows: "Proteids are highly complex, and for the most part non-crystallizable compounds of carbon, hydrogen, nitrogen, oxygen, and sulphur, occurring in a solid viscous condition, or in solution, in nearly all the solids and liquids of the [animal] organism. The different members of the group present differences in physical, and to a certain extent in chemical, properties; they all possess, however, certain common chemical reactions, and are united by a close genetic relationship." Proteids occur in the vegetable kingdom, as well as in animals. They are built up, in plants, from simpler compounds; but the animal system is believed to be incapable of performing a synthesis of this kind, and the proteids that occur in the animal body are believed to be derived wholly by a modification of those that are taken into the system in the form of food. The proteids in the food are converted, by the action of such digestive ferments as pepsin and pancreatin, chiefly into soluble substances known as "peptones," and these, after absorption through the intestinal walls, are (in large measure) transformed into the proteids that normally occur in the muscles and other tissues of the animal. Some of the proteid portion of the food is believed, however, to be transformed, in the course of digestion and assimilation, into glycogen and fat. In the changes which are inseparably associated with the life of the animal, the proteids



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that are stored in the body (and especially those in the muscular and nervous systems) undergo a process of oxidation, or slow combustion, by which they are transformed into other compounds that are much less highly organized; the ultimate products of this oxidation being mainly water, carbon dioxid, and urea.

The proteids, as a class, are very similar to one another in their ultimate composition, so that Gerhardt believed them to consist mainly of one fundamental albumin-like substance, mingled, or perhaps chemically combined, with varying amounts of inorganic matter. This view is not in favor among the chemists of to-day, although it can hardly be said to be absolutely disproved. Analysis shows that the percentages of carbon, hydrogen, nitrogen, sulphur and oxygen in the various proteids are mostly confined within the following limits: Carbon, from 51.5 to 54.5 per cent; hydrogen, from 6.9 to 7.3 per cent; nitrogen, from 15.2 to 17.0 per cent; sulphur, from 0.3 to 2.0 per cent; and oxygen, from 20.9 to 23.5 per cent.

The proteids are mostly amorphous, although a few are known that are capable of crystallization. They are all insoluble in absolute alcohol, but many of them are soluble in water, or in dilute saline solutions. Dissolved proteids all rotate the plane of polarization of polarized light to the left, the extent of the rotation varying with the nature of the dissolved proteid. Dissolved proteids are not diffusible, as a rule, and mineral matters with which they may be mixed can therefore be removed by placing the solution in a vessel which is separated into two parts by a vertical porous membrane, pure water being placed in one compartment, while the solution to be dialyzed is placed in the other. The mineral salts will diffuse through the porous membrane, while the proteid remains in the compartment in which it was originally placed. By renewing the water in the second compartment from time to time, the dialysis may be caused to proceed until practically the last trace of mineral matter has been removed from the proteid. The peptones, however, are themselves diffusible, and the proteoses (or "albuminoses") are so to a lesser extent.

Many of the proteids that are soluble are precipitated from their solutions in a permanently insoluble condition by the action of heat, the substance which is thus thrown down being known as "coagulated proteid." The temperature at which heat-coagulation takes place varies with the nature of the proteid, and (to some slight extent) with the degree of acidity or alkalinity of the solvent from which they are thrown down. The fibrinogen of the blood, for example, coagulates at about 133° F.; while serum albumin and egg albumin coagulate at 162° F., and crystallin at 199° F. When a proteid is precipitated from solution by heat, the liquid from which it was thrown down almost invariably has its alkalinity increased, or its acidity diminished. Dry proteids may be brought into the "coagulated" condition by raising their temperature to 230° F.

Coagulated proteids are exceedingly insoluble, and in fact cannot be brought into solution at all except by the action of some agent which changes their chemical nature profoundly. Pepsin (in an acid medium) or pancreatin (in an alkaline medium) convert them into soluble peptones, when the experiment is performed at a

temperature not greatly different from that of the human body. A proteid which is precipitated from its solution by alcohol is not at first thrown into the "coagulated" condition, but passes into it gradually upon prolonged contact with the alcohol. When a solution of proteids is saturated with ammonium sulphate, all of its proteids are precipitated except the peptones; but the precipitate is not in the coagulated form, for it is capable of dissolving again, either in pure water or in a dilute saline solution. This reagent is used, in the laboratory, for estimating the amount of proteid in a given solution; the precipitate that it gives being removed by filtration; washed with a saturated solution of ammonium sulphate; heated to 230° to produce coagulation; and finally weighed, after the ammonium sulphate has been removed by thorough washing with pure water, and the precipitate has been dried. Many of the salts of the heavy metals (basic acetate of lead, for example), precipitate proteids from solution by forming, with them, an insoluble proteo-metallic compound. From this compound the metal may be subsequently removed by the action of sulphuretted hydrogen gas; the proteid then being set free in its original, soluble state.

Of the chemical reactions manifested by the proteids as a class, the following may be especially mentioned: (1) *The xanthoproteic reaction.* When nitric acid is added to a solution containing a proteid, the proteid is often (but not invariably) precipitated; and when the liquid is boiled, both the precipitate and the solvent turn yellow from the formation of xanthoproteic acid, the precipitate dissolving upon prolonged boiling, if the nitric acid is present in excess. The yellow color changes to an orange upon the addition of ammonia. (2) *Millon's reaction.* "Millon's reagent," which is one of the best tests for detecting the presence of a proteid, is prepared by dissolving mercury, by the aid of gentle heat, in an equal weight of nitric acid of specific gravity 1.4. When the metal has entirely dissolved, the solution is diluted with twice its bulk of water, and the abundant precipitate which comes down is allowed to subside. The clear liquid remaining is the reagent desired. Millon's reagent throws the proteids down in the form of a white precipitate; and both the precipitate and the solution become brick red upon boiling, though time is sometimes required before the coloration is complete. Solid proteids give this same reaction, when boiled with the test solution. Tyrosine and silk respond to it also.

The classification of the proteids is a difficult matter, and no scheme that has yet been proposed is free from objection. Halliburton's classification, which has been widely adopted, follows:

(1) *Albumins.*—Proteids which are soluble in water; which are not precipitated when their solutions are saturated with common salt, or with magnesium sulphate; and which are coagulated by heat. Egg albumin and the albumin of blood serum are the most important examples.

(2) *Globulins.*—Proteids which are insoluble in pure water, but which dissolve in dilute saline solutions, from which they are again precipitated in the uncoagulated state, when common salt or magnesium sulphate are added to saturation. Heat coagulates them. Myosin, fibrinogen, serum globulin and crystallin are important examples.



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(3) *Albuminates*.—Compounds of proteid bodies with metallic bases, or with acid or alkaline radicals. When a small quantity of dilute acetic or hydrochloric acid is added to an albumin or a globulin, the proteid gradually combines with the acid, forming a loosely-connected compound which is no longer coagulable by heat, and which is known as "acid albumin." Acid albumin is soluble in dilute acids or alkalies, but insoluble in a neutral menstruum. When the original proteid is treated with a small quantity of dilute alkali, it combines with the alkali to form "alkali albumin"; and this, like acid albumin, is soluble in weakly acid or alkaline media, but insoluble in a neutral one. Alkali albumin is likewise not coagulable by heat. The combinations here described may be taken as typical of the albuminates in a general way; but as the albuminates are doubtless very numerous, and as they have not yet been fully investigated, it must not be inferred that they will all possess the characteristics of ordinary acid and alkali albumins.

(4) *Proteoses*, or *Albuminoses*.—Proteids derived from the albumins or globulins or albuminates by the action of digestive ferments, such as pepsin and trypsin. They are intermediate between the original proteids and the peptones into which these original proteids are ultimately transformed by the digestive ferments. They are precipitated from solution by nitric acid, the precipitate dissolving upon application of heat. They are also somewhat diffusible, but not to the same extent as the peptones.

(5) *Peptones*.—Proteids which are formed by the prolonged action of digestive ferments upon other proteids. (Compare the "proteoses," in the preceding paragraph.) They are readily soluble in water, and are not precipitated by heat, nor by nitric acid. They are precipitated, however, by tannin, and by certain other reagents. The peptones are diffusible, and they play an exceedingly important part in digestion and assimilation. Peptones that are artificially prepared are commonly bitter, perhaps from the development of alkaloids or glucosides. Pure peptone has a meaty flavor.

(6) *Insoluble Proteids*.—This class includes those proteids which are markedly insoluble. It is hardly a logical division, because it includes many substances that have little in common save the one characteristic of extreme insolubility in all ordinary solvents. Fibrin, gluten, and coagulated egg albumin are examples.

**Protein** (Greek, "first"), a hypothetical substance whose existence is not now admitted, but which was formerly believed to be an essential part of albumin, casein, and other nitrogenous organic bodies. See PROTEIDS.

**Proteran'thus**. See GILLENIA.

**Protero'glypha**. See OPISTHOGLYPHA.

**Protesilaus**, prō-tēs-ī-lā'ūs, Greek hero, son of Iphiclus, king of Phylace, Thessaly. He led a band of Thessalian warriors against Troy and was the first of the Greeks to land on the Trojan coast, whereupon he was killed by Hector. Another tradition makes Achates slay him. He is famed in ancient story for the affection which existed between him and his wife Laodemia who, when she learned of his death, prayed that he might return to her for three hours. The prayer was granted and Hermes conducted Protesilaus to the upper world. At

the end of the three hours Laodemia died with her husband and returned with him to the lower regions. His tomb was near Eleus in the Thracian Chersonesus, a temple was erected to him there, and at Phylace a sanctuary was built in which funeral games were played in his honor. The story is told by Wordsworth in one of his most beautiful poems.

**Protest**, a solemn declaration of opinion, commonly against some act, particularly a formal and solemn declaration, in writing, of dissent from the proceedings of a legislative body, or a like declaration of dissent by a minority of any body against the proceedings of the majority. In commerce, a formal declaration, made by a notary public, under hand and seal, at the request of the payee or holder of a bill of exchange, for non-acceptance or non-payment of the same, protesting against the drawer and others concerned for the exchange, charges, damages, and interest. This protest is written on a copy of the bill of exchange, and notice is given to the drawer and endorsers of the same, by which they become liable to pay the amount of the bill, with charges, damages, and interest. (See BILL OF EXCHANGE.) A protest is also a writing, attested before a notary public, a justice of the peace, or a consul in foreign parts, drawn by a master of a vessel, stating the severity of a voyage by which the ship has suffered, and showing that the damage was not owing to the neglect or misconduct of the master.

**Protestant Episcopal Church, The**, the American branch of the Anglican Communion. The Church in America, though quite independent, is in full communion with the Church of England and inherits her ecclesiastical position. As the Preface to the Prayer Book states: "This Church is far from intending to depart from the Church of England in any essential point of doctrine, discipline or worship; or further than local circumstances require." To define her principles and position is to define Anglicanism, to interpret that movement in history known as the English Reformation.

In the beginning of the 16th century the Church of England was in full communion with the national churches of western Europe, acquiescing with them in the headship of the Church of Rome. In doctrine and discipline she had become identified with the prevailing type of Latin Christianity. By the end of the 17th century she had withdrawn from the Roman obedience and had gradually come to assume the position she maintains to-day. This period of transition constituted the Anglican Reformation. The status of the Church of England was unique. Positively, the change involved a reassertion of the principles of primitive Christianity and an assimilation of the newly-awakened tendencies of modern thought. Negatively, it involved the repudiation on the one hand of mediæval Roman Catholicism, on the other of Continental Protestantism. Anglicans believed that the change involved no breach in the continuity of the English Church. They maintained that in rejecting much that was Roman and mediæval, they had forfeited nothing essentially Catholic.

The American Church inheriting this position claims to be a branch of the primitive Catholic and Apostolic Church. At the same time she



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is frankly opportunist in adapting herself to the needs and conditions of modern life. In the sense of being not-Roman, she is Protestant. As maintaining that her continuity with the ancient Church is guaranteed by her possession of the Apostolic succession of bishops, she is Episcopal. She is Episcopal also in the sense of being not-Papal. This, perhaps, gives the rationale of her common legal title. Members of the Church are spoken of indifferently as Anglicans, Episcopalians or Churchmen.

The fundamental principles of Anglicanism as well as Anglican terms of inter-communion are indicated in what is known as the Chicago-Lambeth Quadrilateral. In 1886 a Commission on Christian Unity reported to a General Convention held at Chicago. The substance of their report was embodied in a Declaration of the House of Bishops. Two years later, this Declaration was, with slight modifications, adopted by the bishops of the whole Anglican Communion, meeting in conference at the Archbishop of Canterbury's palace in Lambeth. The wording of this Anglican Eirenicon, defining the essentials of the Christian faith, is as follows:

"1. The Holy Scriptures of the Old and New Testaments, as containing all things necessary to salvation, and as being the rule and ultimate standard of faith;

"2. The Apostles' Creed, as the Baptismal Symbol, and the Nicene Creed, as the sufficient statement of the Christian Faith;

"3. The two Sacraments, ordained by Christ Himself—Baptism and the Supper of the Lord—ministered with unfailing use of Christ's words of institution and of the elements ordained by Him;

"4. The Historic Episcopate locally adapted in the methods of its administration to the varying needs of the nations and peoples called of God into the Unity of His Church."

This Declaration may be taken as an official indication of the bases of the Anglican position.

It is the belief and hope of Anglicans that the position gives them good vantage-ground for promoting the cause of Christian unity. They have much in common with all bodies of Christians. While their attitude toward Roman Catholics is one of resolute protest, their quarrel is only with a mediæval Romanism by which they believe that the primitive Catholicism of the great Latin Communion has been obscured. Their position more nearly approximates that of Eastern Orthodox Catholicism—Greek Christianity—and that of the Old Catholics. Their relations with both these communions are those of friendly interest and intelligent sympathy, although there is no inter-communion nor immediate prospect of it. The many differences due to widely differing antecedents oppose difficulties to the adoption of a common platform. This, however, does not prevent many manifestations of present friendship and hope of closer relations in future. Recent years have seen a marked rapprochement between the Anglicans and the Russian Orthodox Communion.

On the other hand, the Anglican Church is in close sympathy with the life and aims of various bodies of Protestants. Her breach with the Christian past is not so great as theirs but she rejoices to feel that the fundamentals of her faith are the same as theirs, and that she is

at one with them in striving to adopt and apply Christianity to the needs of modern times. Since the appointment of a Commission on Christian Unity in 1856, there have been conferences with the Presbyterian General Assembly, the General Synods of Evangelical Lutherans of the North and the South, and the Provincial Council of the Moravians. These have contributed somewhat to a better mutual understanding. Some idea of the nature of the Anglican claim and hope is necessary at the outset for an appreciation of the details of Anglican history.

*The Church of England in the American Colonies.*—The Church of England came to America with the first English explorers and colonists. The first English service, so far as is known, was held in 1579 on the coast of California by the Rev. Francis (or Martin) Fletcher, ship's-chaplain to Sir Francis Drake. In 1607 an English clergyman was regularly established among the Virginia colonists at Jamestown. This missionary was the Rev. Robert Hunt, a man of simple piety and great zeal, who held daily services in the open air and on 21 June 1607 for the first time in America administered the Holy Communion. Virginia was a Church of England colony. Various missions were established as the colony grew. The clergy were most of them faithful missionary priests. Some, unfortunately, were men who had bad records at home, and whose lives tended to discredit the Church which they served. In the same year that Jamestown was settled, Prayer Book services were held also on St. George's Island, Maine. Within a short time there were English clergymen settled in Maryland, and before the end of the century, missionaries working in New Hampshire, South Carolina, Delaware, New York, New Jersey and Pennsylvania. In 1692, grants of land were made for Trinity Church, New York. Five years later, the Rev. William Vesey was established as rector of what has become the most important parish in the country.

In New England the Church of England fared badly. The Puritans of Massachusetts Bay had on leaving England professed unalterable attachment to their mother-church. They had, however, adopted a Calvinistic theology differing in various ways from the teaching of the Prayer Book. Shortly after reaching New England, they adopted also the ecclesiastical polity of the Pilgrims of Plymouth. In England, Puritans as well as Anglicans had done their best to suppress "Independents." Calvinistic Congregationalism became the "standing order" in Massachusetts and Connecticut. The use of the English Prayer Book was made a penal offense and Churchmen, so far as possible, were driven from the colonies. Among the more notable victims of Puritan intolerance were John Checkley, William Blackstone, the Browns of Salem and Samuel Maverick. Some took refuge in Rhode Island, others in colonies farther south.

The 18th century saw increased effort on the part of the Church of England to minister to the needs of colonists in America. Since 1634, colonial churches had been under the supervision of the Bishop of London. In 1696, Bishop Compton of London appointed as his "commissary" for Maryland, Dr. Thomas Bray. Dr. Bray's



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interest in American missions led to the formation of the Society for Promoting Christian Knowledge (S. P. C. K.) and of the Society for the Propagation of the Gospel in Foreign Parts (S. P. G.). This latter society was especially active in providing missionaries for America, and in furnishing them with means of support. The most notable of these missionaries were the Rev. George Keith and the Rev. John Talbot. They traversed the colonies from New Hampshire to North Carolina and sent to the S. P. G. full reports of the needs of America.

English clergy met with much opposition in New England. There was a special outcry against them owing to secessions from the Congregational ranks. In 1722, the President of Yale College, Dr. Timothy Cutler, and four tutors resigned their positions to embrace Episcopacy. One of these, Dr. Samuel Johnson of Stratford, became the most notable Churchman in Connecticut. One of the wisest and most far-seeing friends of America in England was Dr. George Berkeley, dean of Derry, afterward bishop of Cloyne. He wished to found a training-school for American missionaries. "Saint Paul's College" was to have been situated in—it being a conveniently central point—the Bermuda Islands. Dean Berkeley came to America and spent three years in Rhode Island. He was forced to abandon his project by failure to receive funds which had been promised by the English Parliament.

John and Charles Wesley for a time worked in Georgia in the early days of the colony. This was before any Methodist societies had separated from the English Church. Later Methodist preachers, especially George Whitefield, were vehement in denouncing the Anglican clergy and did much to disturb the S. P. G. missions. However, the work prospered despite draw-backs—greatest of which was the lack of bishops—and by 1775, there were about 300 parishes, ministered to by 250 clergymen. It is estimated that between 1607 and 1775 about 2,000 "Clerks in Holy Orders" of the English Church had, for longer or shorter periods, labored in America.

*Organization as an Independent Church.*—The outbreak of the War of the Revolution put an end to intercourse between colonial Churchmen and the authorities of the Church of England. Many of the clergy were Tories. These left the colonies for England and Nova Scotia. During the war, services were maintained in a few places, prayers for Congress being substituted for prayers for the King. The one man, whose influence did most to hold together scattered bands of Churchmen was Dr. William White of Christ Church and St. Peter's, Philadelphia. He was in close touch with the fathers of the commonwealth and was for many years chaplain of Congress. Immediately after the recognition of American independence, steps were taken to organize an independent American Church, and to establish new relations with the Church of England, which should recognize "the Change in our Situation from a Daughter- to a Sister-Church."

First to act—for themselves alone—were the clergy of Connecticut. They were convinced that the first step of all must be to obtain bishops. In 1783 a meeting was held at

Woodbury, at which a petition was addressed to English bishops to consecrate for America and a candidate was chosen for the episcopal office. The bishop-elect was Dr. Samuel Seabury, a native of Connecticut, an S. P. G. missionary in the colony of New York and recently a chaplain in the British army. He sailed to England and asked for consecration. This he was unable to obtain. The English bishops, as officers of a state-church, were unwilling to act without formal authorization by Parliament. This was not forthcoming. After waiting a year, Seabury, in compliance with instructions from Connecticut, transferred his application to the Episcopal Church of Scotland. The Scottish bishops willingly granted his request and he was consecrated in Aberdeen, 14 Nov. 1784. He signed a "concordate" with his consecrators, in which *inter alia* it was agreed that he should use his influence to introduce in America a Communion Office like the Scottish. This differs from the English one, being, in some ways, "more agreeable to the genuine Standards of Antiquity." Five years later, Bishop Seabury was enabled to keep this promise. His enduring monument is the complete form in the American Prayer Book of the Prayer of Consecration in the Eucharistic Office. Bishop Seabury lived until 1796. He was a noble man and a staunch Churchman. He was indefatigable in administering his diocese, but, partly owing to his "war-record," did not exercise great influence outside of Connecticut. It was not until a century after his death that his fellow-Churchmen fully appreciated the extent of their indebtedness to this first of all bishops in America.

In 1785, delegates from seven colonies south of Connecticut, laymen as well as clergymen, met in Convention in Philadelphia. Their most important acts were to arrange for triennial General Conventions, and to make a new application to the archbishops of England to consecrate bishops for America. There was some delay. The English bishops objected to proposed changes in the Prayer Book. Their objections were met by action of a convention held in Wilmington, Del., in 1786. Finally, on 4 Feb. 1787, English bishops in Lambeth Chapel consecrated Dr. William White to be bishop of Pennsylvania and Dr. Samuel Provoost to be bishop of New York. Four years later, Dr. James Madison, President of William and Mary College, was consecrated in England, bishop of Virginia. The four American bishops in 1792 joined in the consecration of Thomas John Claggett, as bishop of Maryland, through whom the joint succession from the bishops of England and Scotland has passed to every member of the American episcopate.

The bishops of the Church are its chief officers, but the "Constitution and Canons" adopted in 1789, provide that presbyters and laymen shall share their responsibility of administration. Each diocese has a Standing Committee, consisting of presbyters and laymen (in three dioceses, of clergy only) elected by the diocesan convention. This committee acts as a cabinet to the bishop. In case of vacancy in the episcopate, or sometimes during a bishop's absence or incapacity, the Standing Committee for canonical purposes becomes the "Ecclesiastical Authority" for the diocese.

Similarly, the House of Bishops is associated



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with a House of Deputies in General Convention. The lower House is composed of four clerical and four lay delegates (communicants) from each diocese and one clerical and one lay delegate from each missionary jurisdiction. Either House may originate legislation, but concurrent action is necessary to make it valid. The House of Bishops has a veto on the action of the lower House. All bishops are equal in rank. The senior by consecration acts as primate or "Presiding Bishop." All general disciplinary regulations are comprised in the Constitution and Canons of the General Convention. In addition to these, each diocese has its own Constitution and Canons.

A General Convention was held in 1789. Bishop Provoost and some delegates objected to the recognition of Bishop Seabury, but the objection was overcome by the influence of Bishop White. As Bishop Provoost was absent, Bishop Seabury and Bishop White constituted the first House of Bishops. Their chief work was the revision of the Prayer Book. All proposed changes emanated from the bishops and, with one exception, were ratified by the House of Deputies. The two bishops formed an effective combination. To quote an apt comment of Bishop John Williams: "For the results of that memorable Convention, in which so much was gained—may we not say so little lost?—we are indebted under the over-ruling wisdom of the Holy Spirit to the steadfast gentleness of Bishop White and the gentle steadfastness of Bishop Seabury."

The Prayer Book adopted in 1789 (to which a few additional offices were later added) continued in use for over a century. In 1892 a second revision was completed when the Prayer Book was given its present form. This Prayer Book, which contains all the public offices of the Church, is the best evidence of the doctrinal and ecclesiastical position of the Protestant Episcopal Church. Canons give regulations for practical administration, discipline and clerical education. They give a fair idea of the Church's methods of working. The Prayer Book alone can suggest the faith and spirit which constitute her life.

*History during the 19th Century.*—For 50 years the Episcopal Church was a small body. It could do little more than assert its right to exist in the face of hostile prejudice. It was suspected for its English antecedents and disliked for its assertion—distinct though timid—of ancient ecclesiastical principles in the midst of prevalent Protestantism. It was perforce apologetically apostolic. It was inevitable, however, that it should gain a firm footing in American life, when its representatives were such clergy as its first bishops and such laity as Washington, Jefferson, Hamilton, Franklin and two thirds of the signers of the Declaration of Independence. For 50 years the most conspicuous figure in the Church was that of Bishop White. His episcopate (1787–1836) was the most important the Church has seen. His wise and gentle guidance of his own people, his fairness and charity toward all others, did much to protect the Church in the critical period of its history.

There were other strong men in the House of Bishops. John Henry Hobart of New York (1775–1830) had the most forcible personality.

He was, as his epitaph states, "the able and intrepid Champion of the Church of God." He was enthusiastically loyal to the principles of his Church and saw no wisdom or charity in hesitating to avow them. "Evangelical Truth and Apostolic Order" was his motto. No Churchman of his time did so much to make explicit the principles of Anglican Catholicism.

Alexander Viets Griswold (1766–1843) of the Eastern Diocese (all New England except Connecticut) was influential in a different way. He possessed New England virtues, a serious piety, patient hardihood and frugality, and a great capacity for hard work. His faithful ministrations in all parts of his immense diocese did much to dispel Puritan superstition concerning Episcopacy and the episcopal order.

Philander Chase of New Hampshire (1775–1852), first bishop of Ohio, and later of Illinois, labored indefatigably as a missionary in many States. He was founder of Kenyon College and Bexley Hall, Gambier, Ohio, and Jubilee College, Peoria, Ill. For both of these he obtained funds in England. He was of an eccentric character, but a man of determination. His one aim was to spread the knowledge of his own two treasures, the Bible and the Prayer Book. These men were typical American Churchmen of the first half of the 19th century. Their work indicates very fairly the kind of work done by their fellow-Churchmen in all parts of the country.

*Parties.*—The work of the Church has been largely missionary; its clergy, men of affairs rather than theologians. It has produced no peculiar school of thought, but has reflected the theological developments of England and Germany. There have been, generally speaking, three types of Churchmen, known respectively as High Church, Low Church and Broad Church. Each of these has emphasized some one side of Church teaching and has not escaped the dangers of one-sided partisanship.

The Low Church represented the 18th century revival in the Church of England which took the form of Evangelicalism within the Church and Methodism without. The truths which it emphasized were the absolute dependence of the spiritual life on the person of Christ, the need of conversion, the reality of grace and purely instrumental character of "ordinances." The Atonement was the central fact in Evangelical theology. (Men of this school were also noted for promoting the cause of foreign missions.) The Evangelicals were dominant until the middle of the 19th century. They were strenuous in opposing High Church teaching as being thinly disguised "Popery."

High Church principles were brought to the fore by the Tractarian (Oxford) Movement which began in 1833. These were the assertion of the character of the Church as a divine society, the special sphere of the working of the Holy Spirit; of the character of sacraments as veritable means of grace; of the central place in Christian worship of the Holy Eucharist. Among the more obvious results of this movement were increased reverence and beauty in church services, increased parochial activity, especially among the poor; the revival of frequent Eucharists and (to some extent) of auricular confession. The later stages of the movement produced a party of Ritualists. They differed from



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the early Tractarians. Their ritual was largely in imitation of the Latin rite, whereas their predecessors copied a Laudian model; their ideals were mediæval rather than patristic. The early Tractarians sought to revive the teaching and spirit of the first four centuries, the ritualists to reproduce the picturesque externals of the 14th. Both sections of the party emphasized the "sacramental principle" in Christianity and made the Incarnation rather than the Atonement the central fact in their theology.

Parallel with the Oxford Movement was the development of what is variously described as the Liberal Theology or Latitudinarianism. The Broad Church platform is based on the fundamental truth of the Fatherhood of God. It is well described in words of its most distinguished American representative, Phillips Brooks. "The broader theology, which had its masters in England in such men as Dr. Arnold and the Rev. Frederick D. Maurice, has likewise had its clear and powerful effect upon the Episcopal Church. A lofty belief in man's spiritual possibilities, a large hope for man's eternal destinies, a desire for the careful and critical study of the Bible, and an earnest insistence on the comprehensive character of the Church of Christ—these are the characteristics of much of the most zealous pulpit teaching and parish life in these later days." Broad Churchmen desire to vindicate the rational character of Christianity, to develop its philosophic side, to bring formal statements of the faith into accord with modern knowledge and modern thought. They find themselves much in sympathy with the early theology of Alexandria and more or less opposed to the type of mind represented by Augustine.

There has been conflict between representatives of these several schools, not concerning positive principles but concerning their respective negations. Too often zeal for a half-truth has denied or disparaged another half-truth. In retrospect it seems easy to see that the special principles of the three schools are equally part of the Church's teaching. The difference between them is largely one of emphasis. They divide the Creed between them. The Church Catechism contains a question, "What dost thou chiefly learn by these articles of thy belief?" The answer is: "First, I learn to believe in God the Father, who hath made me and all the world; secondly, in God the Son, who hath redeemed me and all mankind; thirdly, in God the Holy Ghost, who sanctifieth me and all the people of God." This suggests a generalization which may characterize High, Low, and Broad Church. Each has emphasized one section of the Creed, and, at times, failed to do justice to the others. The Broad Church are concerned for the Fatherhood of God, the moral and philosophical basis of Christian truth. The Low Church are chiefly concerned to present Christ as Redeemer and the Centre of all their thought. The High Church have had to emphasize a neglected portion of the Creed, belief in the Holy Ghost, the Sanctifier, in Church and Sacraments as ordained means of union with Christ. The best men of the various schools have never been mere partisans. Party-lines are now less clearly defined. The tendency is to combine truths, to cultivate an all-round Churchmanship, which has more than one dimension.

*Controversy.*—For over 30 years, Churchmen

were more or less disturbed by discussions aroused by the Tractarian Movement. American Low Churchmen were strongly opposed to the "Oxford Divinity." The first important incident in the agitation was the "Carey ordination" in 1842. Arthur Carey, a graduate of the General Theological Seminary, who had accepted Tractarian principles, was, in consequence, subjected to a severe examination by the chaplains of the bishop of New York. They declined to recommend him for orders. The bishop, Dr. B. T. Onderdonk, himself examined the candidate, was satisfied with his answers, and proceeded to his ordination. This occasioned an outcry against the bishop, and was the signal for a series of disputes and campaigns of pamphlet warfare, in various parts of the country. In many instances, Low Church bishops objected to the liking of High Church clergy for "awkward chancel-arrangements" suggestive of High Eucharistic doctrine. Bishop McIlvaine of Ohio refused to consecrate a church until the altar was removed from the east wall. Bishop Eastburn of Massachusetts refused to visit a Boston church for confirmations because the clergy kneeled facing the altar, which was surmounted by a cross and candlesticks. These were typical examples. There were discussions over vested choirs, preaching in surplice, stained-glass windows, flowers on the altar, and similar details. There was also an effort made by Low Church partisans to discredit High Church doctrine by impugning the moral character of its leading champions. Partisan motives mingled with the laudable feeling that a bishop like the wife of Cæsar "must be above suspicion."

A revival of controversy followed the Civil War. At two successive General Conventions, 1868 and 1871, the main discussion concerned a "Canon of Ritual." Various proposals were made to forbid the use of ceremonies recently revived, and behind this was opposition to Tractarian teaching on the sacraments. In the convention of 1871, Dr. James De Koven of Racine College took a firm stand as champion of "the Real Presence" and challenged anyone to bring him to trial for erroneous doctrine. The challenge was not accepted. In 1875, however, because of his principles, the Church at large refused to confirm Dr. De Koven's election to the see of Illinois, as it had previously refused to confirm the election of Dean George F. Seymour. The Convention of 1874 passed a canon forbidding "ceremonies or practices not ordained or authorized in the Book of Common Prayer and setting forth or symbolizing erroneous or doubtful doctrines." The accompanying discussion indicates that the framers had especially in mind "the doctrine commonly known as Transubstantiation." In 1878, Dr. G. F. Seymour was elected bishop of Springfield. This time his election to the episcopate was confirmed by the Church. The event of his consecration marks the end of the effort to deny that High Church doctrine is in harmony with Anglican formularies. It marks also the end of a crusade against ritual as such, although the Church has consistently disapproved any attempt to supersede Anglican by Roman doctrine.

At the time of this later discussion occurred the secession of the "Reformed Episcopalians." The occasion of this was a controversy over



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Baptismal Regeneration. A number of Churchmen who held Zwinglian views of sacraments objected to the wording of the baptismal office. They found a leader in the assistant bishop of Kentucky, Dr. G. D. Cummins. He issued a call for a conference of all who wished to reform the Church. The convention adopted an expurgated Prayer Book and organized as a new sect. Bishop Cummins was deposed by the House of Bishops. He continued, however, to act as bishop and consecrated as a colleague, the Rev. C. E. Cheney, a deposed clergyman of the diocese of Illinois. Their following was never large and has now dwindled to insignificant proportions.

*The Church of the Confederacy.*—It is pleasant to turn to a striking episode in the Church's history where an unavoidable division was quickly and quietly healed. By the outbreak of the Civil War, Southern Churchmen were isolated from their Northern brethren. Their position was analogous to that of colonial Churchmen at the Revolution. There was this great difference that there were eleven organized dioceses, each with a bishop. These eleven dioceses eventually united to form the Protestant Episcopal Church of the Confederate States. For five years the Church of the Confederacy pursued its independent course. Bishop Polk of Louisiana, who had had a West Point education, assumed command of a Confederate army and was killed in battle. At the end of the War the Church was confronted with the difficult question of the relation of these severed parts. Some Northerners were anxious to take action which would have been very offensive to Southern susceptibilities. There were two specially difficult points, the precedent established by Bishop Polk and the case of Bishop Wilmer of Alabama, who had been consecrated during the War, without the consent of the Northern dioceses. Fortunately the wisdom of a few leaders, Hopkins of Vermont, Horatio Potter of New York, and others, guided all to a satisfactory conclusion. The Convention of 1862 had ignored the absence of Southern delegates. In 1865, the Southern bishops were urged to attend and "trust to the love and honor of their brethren." Two bishops and delegates from three dioceses responded. In the Convention of 1868, the South was fully represented. By exercise of tact and patience on both sides, Churchmen had succeeded in ignoring "the late unpleasantness."

*Christian Unity.*—As has been already noted, the Episcopal Church believes that she has a special mission to promote Church Unity. For 50 years there has been a standing Commission to consider this subject. The occasion of its appointment was the presentation at the Convention of 1853 of a "Memorial" signed by Dr. W. A. Muhlenberg and other well-known clergymen. This "Memorial" made a plea for greater liturgical freedom and a less stringency in conferring Holy Orders. It aimed at taking "an important step towards the effecting of a Church unity in the Protestant Christendom of our land." The first report of the Commission made valuable suggestions, but led to no immediate results. Important members of the Commission were Bishops George Burgess of Maine and Alonzo Potter of Pennsylvania. The discussion which ensued paved the way for sub-

sequent Prayer Book revision and conferences with representatives of other Christian bodies. Part of the aim of the "Memorial" was realized in 1898 by the passage of the "Huntington Amendment." This relaxes the obligation always to use the Prayer Book in public worship and recognizes the duty of bishops to provide special forms of service for special congregations and special occasions. Both "Memorial" and "Amendment" aim at making the Church freer for evangelistic work.

There is another side to this work for unity. Dr. Muhlenberg had in mind "the Protestant Christendom of our land." There is a larger Christendom than this which the Church may not forget. Something has been done to establish friendly relations with Eastern Orthodox and Old Catholics. Bishop Horatio Southgate in 1843 was accredited, as representing the Church, to the Patriarch of Constantinople; Dr. J. F. Young of New York (later bishop of Florida) in 1864, and Bishop Grafton of Fond du Lac, in 1903, have paid official visits to the Church in Russia. Bishop Whittingham of Maryland in 1872 attended the Old Catholic Conference in Cologne. Russian and Old Catholic bishops have on several occasions accepted the official courtesies of the American Church. Polish Old Catholics in America have made definite proposals of union. Another century may see some result from these small beginnings.

*Missions.*—The Episcopal Church has always been breaking ground in new fields. Her first duty was to extend her work in the Western States. Among the typical examples of the home missionaries were the Rt. Rev. Jackson Kemper, missionary bishop of the Northwest, and Dr. James Lloyd Breck. Dr. Breck with two friends founded Nashotah House in Wisconsin, as a training school for missionaries. Later he removed to Minnesota, organized work among Indians at Crow Wing, and laid foundations for Church institutions in Faribault. Bishop H. B. Whipple developed and completed his work. Still later Breck organized the "Associate Mission for the Pacific Coast." His last work was the founding of schools in Benicia, Cal. The first bishops in the Pacific States were William Ingraham Kip of California and Thomas Fielding Scott of Oregon and Washington. Most of the Western States contain one or more organized dioceses. There are still 16 missionary jurisdictions in the United States and four others in American possessions. Bishops have been recently sent to Alaska, Sandwich Islands, the Philippines, and Porto Rico.

There are six foreign missionary jurisdictions, Western Africa (Cape Palmas), Shanghai and Hankow in China, Tokyo and Kioto in Japan, and Cuba. Bishops have also been consecrated for independent churches in Haiti, Mexico, and Brazil. The direction of missionary work is entrusted to a Board of Missions with headquarters in New York. Contributions for missions of all kinds probably amount to a million dollars a year.

*Institutions.*—There are a number of Episcopalian theological schools. The General Theological Seminary in New York is a training school for the whole Church. It was founded in 1817, was removed for a time to New Haven,



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returned in 1820 to New York, and was shortly after established in Chelsea Square. It owes its present buildings to generous gifts of Dean Eugene Augustus Hoffman. Of other seminaries, the more important are the Episcopal Theological School, Cambridge, Mass., Berkeley Divinity School, Middletown, Conn., the Divinity School of Philadelphia, Seabury Divinity School in Faribault, and Nashotah House.

Trinity College, Hartford, Conn., Kenyon College, Gambier, Ohio, Hobart College, Geneva, N. Y., the University of the South, Sewanee, Tenn., and St. Stephen's College, Annandale, N. Y., are all Episcopalian institutions. Columbia University, New York, always has a Churchman for President and uses Church prayers in its chapel. Lehigh University, South Bethlehem, Pa., is by direction of its founder under Church auspices. There are many diocesan schools for boys and girls and special schools for negroes and Indians. Of the larger Church schools for boys may be mentioned St. Paul's School, Concord, N. H., Groton School, Groton, Mass., and Racine College, in Wisconsin. Churchmen have always been active in promoting charitable work. St. Luke's Hospital, New York, is a conspicuous example of their zeal. There are numerous organizations for the furthering of Church work and a number of religious orders for men and women.

The number of Churchmen is not large, but the rate of increase has been comparatively rapid. In 1800 there were 11 dioceses served by 7 bishops and 208 other clergy; in 1900, there were 86 dioceses served by 81 bishops and about 4,900 other clergy. The number of communicants was about 700,000, a number which implies about 3,000,000 adherents. The total number of clergy to the present time (1904) has been about 9,000, of whom 218 became bishops.

The materials for the history of the Protestant Episcopal Church are to be found in Journals of the General Convention, the memoirs of distinguished Churchmen, and collections of pamphlets in the libraries of Church institutions. Perry's 'History of the American Episcopal Church,' a collection of monographs, is the most complete formal history. There are smaller works by the Rt. Rev. Leighton Coleman, D.D., bishop of Delaware, the Rev. C. H. Tiffany, D.D., and the Rev. S. D. McConnell, D.D.

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**Protestantenverein**, prō-tēs-tän-ten-fě-rīn' (Protestant Association), a society founded at Frankfort on the Main in 1863 for the promotion of liberalism in the Protestant state churches of Germany. Its originators were notable clergymen, publicists and university professors. In 1863 the jealousies between Calvinists and Lutherans still persisted, though Calvinism and Lutheranism had 45 years previously been ostensibly reconciled in the constitution of the Prussian Evangelical Church. In all the Protestant state churches of Germany the authority of the prince, his ministers, or the clergy was supreme: the Protestantenverein demanded lay representation in the parochial and synodal administration of church affairs; further, they demanded the federation of the separate

established churches in one national church. The Protestant churches were obscurantist, creed-bound, and hostile to all free inquiry in matters affecting religious belief: the Protestantenverein held that "the attempt to limit the freedom of theological inquiry is a violation of the vital principle of Protestantism." And the association announced as one of its principal aims to arouse popular sentiment in Germany against the encroachments of clericalism and hierarchism in the Protestant churches and against the pretensions of the Papacy. The union was from the first viewed with jealousy by the governments and by the conservative majority in the several churches; and though before the law its members were under no disability, still, whether clergymen or university men, they found themselves effectually barred from pulpits and chairs in the seats of learning, or from advancement. All Germans who are Protestants and who are willing to promote the objects of the association are eligible to membership. Besides the general Protestantenverein, comprising its membership in all the German states, there are particular unions, one for northwestern Germany, one for Baden, one for Silesia, and so on. The meetings of the general body are biennial, those of the several states, annual. The May Laws or Falk Laws, designed to root out Roman Catholicity, and the reorganization of the Prussian state church in 1879, were fruits of the agitation carried on by the Protestantenverein. But after a few years political opportunism dictated to the government the policy of repealing the Falk Laws; and when, under the new system of lay representation in the church's councils, members of the general synod of the Prussian national church were to be chosen, only nine members of the Protestantenverein were elected, to 70 representatives of the most conservative orthodoxy. In 1880, the Protestantenverein had 26,000 members in 80 local associations.

**Protestantism**, the religious system and profession of Protestants. *The Name.*—Like most political and religious party designations, the name "Protestantism" was accidental in its origin and very inadequately expresses the nature of what it labels. In 1529 an edict of the Diet of Spires threatened the German Reformation with extinction. Five princes and 14 cities made formal protest against the validity of the edict and were jointly known as the protesting Estates, or Protestants. The name soon came to designate all who sided with the Reformation in Germany, and is now the common name of all Christian bodies in the West which refuse obedience to the Roman Catholic Church. The name has been unsatisfactory to many, especially in the Anglican and Lutheran Churches, because it is merely negative and polemical and does not do justice to the positive, evangelical character of Protestant Christianity. On the other hand it may be said that Protestantism had its historic origin in opposition to Roman Catholicism and that its nature and principles can be fully understood only when they are viewed in that contrast, so that the name has a measure of justification.

*The Historic Roots of Protestantism.*—Contrary to the popular conception, the roots of Protestantism run back far beyond Martin



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Luther. Its conscious life began with him. His powerful personality impressed itself on the movement. But he alone would be quite inadequate to explain it.

The age before the Reformation was a revolutionary age. The Holy Roman Empire was waning; the modern state was taking shape. The economic and social order was profoundly unsettled by the progress of capitalistic industry and commerce. The revival of learning had created new intellectual tastes and interests; scholasticism, a theology and philosophy revered with age, was put aside by younger minds as insipid and barbaric. The invention of printing made intercourse of mind with mind easy and education a common possession.

Amid so vast and general an upheaval it was impossible for the institutions of mediæval religion, which were so deeply intertwined with all the life of society, to remain unaffected. "Reform of the Church in head and members" was earnestly called for by many of the most eminent religious leaders of the century preceding the Reformation. In the great Reform Councils of the 15th century; in the national movements in England and Bohemia, which were led by Wyclif and Huss; in the efforts of the Franciscans and of the Waldenses and Cathari to restore the primitive simplicity of the Christian life; in the ridicule of poets and the doubt of theologians we trace a swelling tide of reformatory sentiment. There was an abundance of noble spiritual and moral life among the people and clergy; the incessant protests against the existing abuses are the most eloquent testimony to the moral vigor which was itself a product of mediæval religion. But evil is always slow to yield. What seemed intolerable exploitation and oppression to the mass of the people, was an indispensable source of income and a time-honored and lawful custom to powerful individuals and classes. Efforts for reform were again and again frustrated, and so the final explosion of the pent-up forces is historically comprehensible. Without this accumulated dissatisfaction of generations, Luther would have cried to deaf ears. Protestantism can be understood only against this background. It was not at the outset a demand for a change of doctrine, but a practical reformatory movement.

*The First Rapid Spread of Protestantism.*—On Hallowe'en of 1517 Luther posted his 95 Theses on Indulgences. They were a halting and uncertain protest against a practice which was endangering the spiritual integrity of the people. He expected to debate his theses with some university professor; instead of that Europe took up the debate. Within a fortnight those 95 sentences had echoed through Germany; within a month through Europe. The popular response gave Luther daring. From 1519 to 1523 he was the voice of a nation aroused and angry. His manifesto 'To the Christian Nobility of the German Nation' was a terrific enumeration of the social, political, and religious grievances of Germany. His 'Prelude on the Babylonian Captivity of the Christian Church' attacked those doctrines and practices of the Church which clustered about the seven sacraments. The Pope excommunicated him; Luther burned the Bull. The Diet of Worms demanded that he recant; he refused. The favor of his prince and various international complica-

tions combined to defend him. But back of all stood the protecting public sentiment of the nation.

In these earlier years of the Reformation the purpose was not to create a new Church, but to reform the one Church. As fast as the reformatory ideas spread and the resistance of civil and ecclesiastical authorities could be overcome, evangelical preaching was introduced. Almost simultaneously with the movement centring at Wittenberg, the Reformation had found a second focus in German Switzerland under the leadership of Zwingli. About 1525 a third and still more radical reformatory movement began to run through the lower classes of Germany, persecuted by all parties alike under the name of Anabaptism; a movement, the extent and religious power of which are only now coming to be appreciated. From 1536 onward Geneva under the leadership of Calvin's systematizing and organizing genius became the great spiritual centre of Protestantism for Switzerland, France, the Netherlands, Scotland and England. These rapid and almost simultaneous movements show that the Reformation was not an artificial contrivance of a few insurrectionary spirits, but the outcome of a great popular feeling and desire. But that the reformatory uprising finally ended in a permanent schism of the Church was not an absolutely necessary outcome of the situation. A less violent spirit on the part of the reform elements and less reluctance to grant the inevitable reforms on the part of the hierarchy before it was too late, might conceivably have averted that result. Historians will differ as to the apportionment of guilt.

For about half a century Protestantism on the whole advanced victoriously. It encountered the natural instinct of conservatism, the resistance of all classes that were interested in existing conditions, and the opposition of most governments, but it was not yet face to face with the full enthusiasm of religious conviction. At the end of 50 years it was firmly intrenched in Saxony, Hesse, Würtemberg and the Palatinate; in the most important cantons of Switzerland; in the northern Netherlands; in Denmark, Sweden, Prussia and Livonia. In another group of countries the issue was still in doubt. In France the Huguenots were an intelligent and powerful minority, able to wage wars and make treaties with the Crown. The Flemish Netherlands for a time went with the Dutch in revolt against Spanish and Roman Catholic domination, until the Treaty of Arras in 1579 cut them loose. In Bavaria, Poland and Hungary the people were largely Protestant and almost in control of the situation. In the Grand Duchy of Austria it is said that only a thirtieth part of the people remained faithful to the old Church. If the choice of religion had been left entirely to the common people, it is probable that most of the continent of Europe north of the Alps and Pyrenees and west of Russia would have become Protestant. In the British Islands the Reformation began in earnest with the return of Knox to Scotland in 1559 and the reign of Edward VI. in England (1547-53), and was destined to succeed. Ireland remained untouched by it. In Italy and Spain reformatory leanings remained confined to groups of educated people. The Reformation did not find the support of govern-



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ments, nor did it have time to become a popular movement. The Inquisition, reorganized in Italy by Caraffa, 1542, put an effective end to any movement that might have grown up. It is often assumed that only the Teutonic nations have a natural affinity for the Protestant type of Christianity, because the Latin nations failed to embrace it in the 16th century. But their failure to do so was hardly due to natural predilections. The theory can not be said to have had a fair test at that time.

*The Roman Catholic Reaction Against Protestantism.*—In the middle of the 16th century the tide turned on the continent of Europe. Those countries in which the issue had remained in doubt, were wrested from the grasp of Protestantism and restored to the Catholic Church, and no further important territorial gain was made. This remarkable change was largely due to the rallying of the spiritual forces of Catholicism on the one side, and to the weakening of the spiritual forces of Protestantism on the other.

Many eminent men who remained loyal to the Roman Church and held its doctrines to be infallible and irreformable, had yet recognized the justice of many of the complaints about practical abuses, and hoped by reform of the Church from within to conciliate the Protestants and if possible heal the schism. This party was now overborne by another which also desired reform, but at the same time advocated uncompromising insistence on the sole authority of the Roman Church. The Council of Trent (1545-63) gave an authoritative definition of those doctrines which had been assailed by Protestantism and henceforth there could be no doubt what the Catholic faith was. A new monasticism arose, of which the Jesuit Order was the finest type, which flung itself with splendid zeal into the service of the needy, the conversion of the heathen, and the conflict with heresy. Protestant leaders had made a powerful appeal to the intellect through preaching and writing. The Jesuits met them on their own ground. The combination of Protestantism with Humanism had made the Protestant schools the attractive seats of learning. The Jesuits now took higher education under their care and especially succeeded in molding the young men of the upper classes. The people were urged to a more frequent use of the confessional and this furnished an effective means of counteracting Protestant leanings wherever they came to light in the thought of a penitent. Its peril had not been without effect on the Church. Abuses which had long been the sorrow of its earnest men were stopped. With Paul IV. a succession of popes began, very different from those of the previous century, and as earnest and austere as some of the greatest popes of the Middle Ages.

Under such leadership and with such renewed self-assurance and enthusiasm the Catholic Church of the second half of the 16th century was a far more formidable adversary than Protestantism had hitherto found it. To this was added the immense political power still left to it, which it now used with a new determination and unity of purpose. If the majority of any people were Protestants and the rulers of a nation were Catholic, force lay with the latter and that prevailed. Protestant historians

hold that if the conflict had been intellectual and spiritual only, the outcome would have been different.

While Roman Catholicism had rallied its forces the spiritual force of Protestantism had declined. The first group of heroic leaders was thinning in numbers, and its successors were not equal to them. The athletic vigor and joy of a newly found faith had waned. The contest for great truths often degenerated into a wrangle over points of doctrine. Protestantism was split into two camps, the Lutheran and Reformed, and these spent some of their strength against each other. The Religious Peace of Augsburg in 1555 had granted religious autonomy to the Lutheran estates of Germany. From this assured position they could look on with indifference while Calvinistic Protestantism was fighting for its life in France and Holland. Protestantism lacked the international organization and centralized direction of Roman Catholicism. Popular sympathy for the persecuted brethren abroad was ineffective unless the political interests of the princes happened to work in the same direction. It had no such mobile corps of soldiers as the religious orders supplied to Roman Catholicism. The strength of Protestantism lies in its appeal to individual conviction and its capacity to set free the initiative of the individual. But in Lutheran countries ecclesiastical government was vested in the princes and the theologians and not at all in the people. In the Calvinistic churches there was more popular participation, and this resulted in stricter church discipline, sterner morality, and immense tenacity and power of resistance. But even they did not fully evoke the power of devotion, of sacrifice and moral vigor latent in the plain people whose spontaneous cooperation would have made the Protestant nations invincible.

From the middle of the 16th century for a hundred years the conflict between Roman Catholicism and Protestantism forms the substance of European history. This duel found its outward expression in the great "wars of religion." In France the Huguenot wars ran with intervals from 1562 to 1598 and ended with the Edict of Nantes, which recognized the civil equality of Protestants, but conceded only a limited right of worship. The war between Roman Catholic Spain and the Netherlands extended with intervals from 1568 to 1648 and the Thirty Years' war in Germany from 1618 to 1648. When the wars closed, Protestantism had lost the debatable ground: France, Belgium, Bavaria, Austria, Bohemia, Poland. But it was not beaten out of the field; it held Scandinavia, northern Germany, the Dutch Republic, the Protestant cantons of Switzerland, Scotland and England. And now the religious impulse and enthusiasm of Roman Catholicism in turn had spent themselves, just as the first aggressiveness of Protestantism had formerly ebbed. The ancient jealousy between the House of Hapsburg and France once more proved stronger than the religious interest. Protestant Germany was saved in the Thirty Years' war by the alliance of Gustavus Adolphus, the champion of Protestantism, and Richelieu, the head of Roman Catholic France. Europe stopped in sheer exhaustion, and in the Peace of Westphalia, 24 Oct. 1648, the old and new faiths agreed to tolerate each other and live side by side. The ancient con-



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ception of the outward unity of the Church and of the necessary uniformity of worship within each nation, was surrendered. Henceforth the religious life of the Western world was to run in two channels, but not without profound influence of each on the other.

*Protestantism in Great Britain.*—England, in its comparative isolation from the rest of Europe, ran a course of its own. Its real Reformation only began when the wars of religion closed on the Continent. The English Reformation, indeed, was not, at first, a great popular movement, and consequently lacked such leaders as are born in the travail of a whole nation. The repudiation of papal supremacy under Henry VIII. (1531) was scarcely due to reformatory leanings. Under Edward VI. (1547–53) the ideas of the Reformation began to make real progress, but they were still promoted from above and encountered the resistance of the people. The persecutions under Mary (1553–8) first kindled that hatred of popery which became part of English traditions. Under Elizabeth (1558–1603) England was slowly and moderately Protestantized. By natural tastes the queen did not lean to innovations, but the denial of her legitimacy and her right to the throne by Pope Paul IV. allied her self-interest with what Protestant convictions she had. The country followed her. Of 9,400 Roman Catholic priests only 189 refused the oath of supremacy. By 1570 the influence of the Roman Catholic Reaction began to make itself felt in England. Priests of the new zeal came to England as emissaries. English Protestants saw their brethren on the Continent crushed, their own country threatened by Spain under Philip II., the life of their queen in constant danger. A fearful spiritual tension was created. A bull of Pius V. deposed Elizabeth and forbade Englishmen under penalty of excommunication to obey her. When an English monarch demanded the oath of allegiance from English subjects, Paul V. forbade them to take it under the same penalty. This identified Roman Catholicism with treason and forced Roman Catholics into a terrible dilemma. The severe persecutions endured by them were at least ostensibly directed against their treason, and not against their religious belief.

The Reformation in England had wrought its changes with great moderation. The Thirty-Nine Articles embody the Calvinistic theology prevalent at the time of their adoption (1563 and 1571), but the hierarchical organization of the clergy inherited from Roman Catholicism had been retained, and the forms of worship modified with a gentle hand. During the 17th century a more strenuous Protestantism gained ground. English Calvinism became Puritanism. A thorough purging of the doctrine, constitution and worship of the Church was demanded. The Presbyterian party sought to conform the Church of England to the Scottish and other Calvinistic churches. The Independents were still more radical. They were opposed to established churches, held that each congregation should have the right to govern itself, and favored a large measure of religious liberty. Radicalism in religion linked itself quite naturally with a corresponding democracy in civil affairs. During the Civil War and the Commonwealth (1649–60) control passed successively to the more radical parties. The reform outran the

sentiment of the nation. An inevitable reaction followed. But though Puritanism failed outwardly, it had transformed England. Since the Commonwealth, England has had a Protestant soul. The efforts of James II. to introduce Roman Catholicism once more ended in the Revolution of 1688. A century later the Roman Catholics of England numbered only about 65,000. The bold Protestantism of the Independents of the Commonwealth was too far ahead of its time to stand, but it was prophetic of the future. The political and social ideals of that uprising have slowly been realized during the last 250 years, and the development of church and religion has tended in the same direction.

*Later History of Protestantism.*—Since 1648 there has been no serious change in the territorial base of Protestantism and Roman Catholicism in Europe. Each has held what it then had. In Italy, Spain, Portugal and Belgium the number of Protestants is very slight. On the other hand, in Denmark, Sweden and Norway Roman Catholics number only a few thousands. In spite of the decimation suffered by Protestants in France after the Revocation of the Edict of Nantes (1685), they have again grown considerably in numbers and are important through their intellectual and moral influence. In Austria they numbered in 1900 about 494,000 or 1.9 per cent of the population, and in Hungary 3,703,888 or 19.4 per cent. Of recent years there has risen in Austria a mass movement away from Roman Catholicism, the *Los-von-Rom Bewegung*, the final importance of which can not yet be foreseen. Switzerland in 1900 had 1,918,197 Protestants and 1,383,135 Roman Catholics. Germany had 35,231,104 Protestants and 20,327,104 Roman Catholics, and the percentage had scarcely changed from 1880 to 1900. The Netherlands had 1,790,161 Roman Catholics in 1899 in a population of 5,104,137. In Ireland Protestants numbered in 1901 25.8 per cent of the population of 4,458,775. According to the official Roman Catholic statistics of the Congregation *de Propaganda Fide* for 1898 the Roman Catholic population of England and Wales was 1,362,489 out of a population of 32,000,000, and in Scotland 373,500 out of 4,400,000. In 1900, 4 per cent of the marriages in England and 10.24 per cent of those in Scotland were celebrated according to Roman Catholic ritual. The great increase of Roman Catholics in England during the 19th century and in Scotland during recent years, has been due mainly to Irish immigration. The conversions in England have been more important in character than number. The countries of South and Central America are almost wholly Roman Catholic and swell the Roman Catholic total. Canada, in a population of 5,371,315 in 1901, had 3,141,715 Protestants. About 65 per cent of the Roman Catholics are massed in the Province of Quebec. The religious statistics of the census of 1900 for the United States have not yet been published. The official Roman Catholic statistics for 1898 gave the Roman Catholic communicants as 9,479,250, but the term "communicant" is more inclusive in the Roman Catholic Church than in most Protestant bodies. The number of Roman Catholics in the United States has increased immensely during the 19th century, partly through the acquisition of new possessions in the Southwest, but mainly through Roman Catholic immigration from Ireland and



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Germany formerly and more recently from Canada, Italy and Austria, and the natural increase of these immigrants.

*The Distinctive Characteristics of Protestantism.*—Protestantism is not a single organized body. There is no central authority able to define its positions. The various Protestant churches have realized the genius of Protestantism in the most varying stages of clearness. Scarcely anything can be asserted about Protestantism as a whole which would not be contradicted by the history of some Protestant body or of all Protestant bodies at some stage of their existence. Its origins furnish no clear expression of it, for the stream carried away a heavy sediment from the banks among which it rose. Luther, for instance, was in most respects a very mediæval man. Protestantism is a historical movement, a tendency. It has gone through a gradual process of self-purification and has come to clearer consciousness of itself. These qualifications must be borne in mind in considering the following enumeration of the more important characteristics of Protestantism:

1. Protestantism is a simplification of religion. Instead of many external religious performances, it calls for one thing: faith. Faith in that sense is the formula for an attitude of the soul toward God, for the innermost life of loving obedience. That faith justifies, and the externals of religion have value only in so far as they express or strengthen that relation.

2. This simplification of religion involves a simplification of church worship. The Reformation involved a critical scrutiny of the inherited forms of worship and the elimination of all that seemed to the Reformers contrary to the Bible or repugnant to their religious feeling. In their recoil they often went to the other extreme of making worship bare. But even where Protestant worship is most ornate, it is simpler than the liturgical splendor of the Greek or Roman Church.

3. In consequence of the characteristics just mentioned, the visible organization of the Church occupies a smaller space in the spiritual horizon of Protestants than of Greek or Roman Catholics. For Roman Catholics the hierarchy of the Church is the sole channel through which the infallible teaching of Christianity and the saving grace of the sacraments must flow. The relation of the individual to God depends largely on his relation to the Church. For a Protestant his relation to the Church depends on his relation to God. Protestantism sends men to the Bible for truth and to God direct for saving grace. Consequently Protestantism is less essentially churchly. Church attendance is less a true gauge of religious life in Protestant churches.

4. Thorough-going Protestantism recognizes no essential difference between clergy and laity. It holds, at least in theory, to the universal priesthood of believers, that is, to the direct and equal access of every believing soul to God. The clergy have grown less important and laymen have become more important in the worship and government of the Protestant churches.

5. As a consequence of these convictions and in historical reaction against the hierarchical structure of the mediæval church, Protestantism in varying degrees has tended to democratize

church government. The Church of England retained the episcopacy inherited from the past. The Calvinistic Churches developed a kind of aristocracy in presbyterial government. The bodies with congregational organization have self-government like that of the New England town-meeting. As an indirect result radical Protestantism has had a marked affinity for civil democracy and has made for popular liberty.

6. Protestantism to-day has accepted the principle of religious liberty and freedom of conscience. In the 16th and 17th centuries it followed inherited theories and was at times more tyrannous over the individual reason and conscience than mediæval Catholicism had been. But the respect for individual conviction has become steadily greater. There is probably no Protestant body to-day that would not repudiate the use of force in punishing heresy or in enforcing religious conformity. By granting liberty and demanding individual conviction, it has powerfully developed the sense of personal worth, the claim of a man to his own mind, and that capacity of initiative which is one of the causes for national efficiency. This has also been a chief cause for the development of science, for freedom is the life-breath of all higher intellectual work.

7. In one aspect Protestantism was an effort to emancipate the human mind and soul from the bondage of inherited doctrines and institutions. It was compelled to challenge and scrutinize the claims of ancient authorities. Consequently it developed the critical conscience. It has given fairly free course to historical science and undergoes a continuous self-purification by it. The Protestant exaltation of the Bible was originally a part of this desire to get beyond all late, and possibly doubtful, authorities, and to find out from the original documents what Christianity really means. It was a quest for unadulterated Christianity.

8. Protestantism is comparatively unfettered by its past and therefore free to advance. Protestant bodies make no claim to infallibility in their past beliefs and utterances, and therefore they can change their creed and confess that their past practices were wrong. If, for instance, a Protestant body in a speculative period of theology, has implied in its creed that some babes may be eternally lost, it can eliminate that from its creed, and such an action will be no confession of weakness, but an evidence of growing light. If Calvin secured the burning of Servetus and Melancthon praised it, their religious descendants can erect an expiatory monument to the memory of the heretic. Thus Protestantism has the same power as the individual, of rising by putting its dead past under foot.

9. Protestantism has abandoned ascetic morality. Throughout the Middle Ages it was held that the perfect life was one of poverty, of abstinence from married life, and of obedience to ecclesiastical superiors, and that he who followed these "counsels of perfection" did more than God required of him and earned merit. Protestantism denies that man can ever do more than God requires, and that ascetic morality is higher at all. It holds that God is best served within the natural human relations.

*Bibliography.*—On the History of Prot-



## PROTEUS

*estantism.*—The general Church Histories of Gieseler, Möhler, Hase, Schaff (Vols. VI. and VII.), Sheldon, and Alzog (Catholic). *On the History of the Reformation:* Fisher, 'History of the Reformation'; Häusser, 'Period of the Reformation'; each in compact form and excellent. D'Aubigné, 'History of the Reformation,' is very widely read, but has strong Protestant bias. Archbishop Spalding, 'History of the Protestant Reformation,' is an equally vigorous Catholic reply to it. Janssen, 'Geschichte des deutschen Volkes,' Vols. II. and III., give a celebrated Catholic account, charged with unfairness. Ranke, 'History of the Reformation in Germany,' 3 vols., is the work of a very great historian. Köstlin and Michelet give good biographies of Luther. Wace and Buchheim, 'First Principles of the Reformation,' gives a translation of three fundamental early writings of Luther. See also bibliography under LUTHER. Seeböhm's 'Era of the Protestant Reformation' is a brief and simple account of the times. The English Reformation is described in Green, 'History of the English People'; Froude, 'History of England'; Burnet, 'History of the Reformation'; Blunt, 'Reformation of the Church of England'; Stoughton, 'Ecclesiastical History of England.' The following works, though dealing with special sections of history, all bear on the general struggle of Protestantism and Catholicism: Ranke, 'History of the Popes in the 16th and 17th Centuries,' 3 vols.; Macaulay's famous 'Essay on Ranke'; Robertson, 'Charles V.'; Prescott, 'Philip II.'; Freitag, 'Bilder aus der deutschen Vergangenheit,' Vol. II.; Froude, 'The Council of Trent'; Symonds, 'The Catholic Reaction'; Motley, 'Rise of the Dutch Republic'; 'History of the United Netherlands'; and 'Life and Death of John of Barneveld.'

*On the Doctrine and Principle of Protestantism.*—Schaff, 'The Creeds of Christendom,' 3 vols., gives in the third volume the most important Protestant creeds, and in the first volume a historical introduction to them. Volume II. gives the Catholic creeds. J. A. Möhler, 'Symbolism, or an Exposition of the Doctrinal Differences between Catholics and Protestants'; and Hase, 'Handbuch der protestantischen Polemik,' are the best polemical handbooks, the one Catholic, the other Protestant. Schenkel, 'Das Wesen des Protestantismus'; Orr, 'The Progress of Dogma'; Schaff, 'Christ and Christianity,' two essays on 'Protestantism and Romanism,' and on 'The Principles of the Reformation'; Kahn, 'Die Prinzipien des Protestantismus,' are all discussions on the essential principles. I. A. Dörner, 'History of Protestant Theology,' 2 vols., is a solid history of theological thought. Harnack, 'What is Christianity?' in its second part gives a brilliant sketch of Greek and Roman Catholicism and of Protestantism.

*On the Moral and Political Effects of Protestantism.*—Janssen, 'Geschichte des deutschen Volkes'; Dollinger, 'Die Reformation,' 3 vols., a collection of contemporary testimony to the destructive effects of the Reformation; Pastor, 'Geschichte der Päpste'; Balmes, 'Protestantism and Catholicity compared in their Effects on the Civilization of Europe'; are four important works by Catholic authors. Balmes was a Spanish priest and a cordial champion of the Inquisition. On the Protestant side, de

Laveleye, 'Protestantism and Catholicism in their Bearing upon the Liberty and Prosperity of Nations'; Guizot, 'History of Civilization in Europe,' Lecture 12; Charles Beard (Hibbert Lectures), 'The Reformation of the 16th Century in its Relation to Modern Thought and Knowledge'; Buckle, 'History of Civilization'; Heeren, 'The Political Consequences of the Reformation'; Freeman, 'National Prosperity and the Reformation,' in Historical Essays, 4th Series; Froude, 'Short Studies,' Vols. I. and II., essays on 'The Influence of the Reformation on the Scottish Character' and on 'Calvinism.' In his later years Dollinger, the learned Catholic historian of the 19th century, came to view Protestantism somewhat differently; see his lectures on 'The Reunion of the Christian Churches'; 'The History of Religious Freedom' in his Historical and Literary Essays; 'Upon the Political and Intellectual Development of Spain' in his 'Studies in European History.'

*On the Present Status of Protestantism.*—The annual issues of 'The Statesman's Year-Book' give statistics and facts on the religion of the various countries of the world. The Census Report for 1900 will give the latest facts about the United States. Carroll, 'The Religious Forces of the United States,' is a thoroughly informed manual. 'Les Œuvres du Protestantisme Français au XIX. Siècle' is a sumptuous illustrated account of present French Protestantism. 'Der Protestantismus am Ende des Neunzehnten Jahrhunderts in Wort und Bild,' 2 vols., edited by C. Werckshagen, is a splendid illustrated account of the history and present power of Protestantism, in 50 essays by very competent scholars.

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**Proteus**, prō'tūs or prō'tē-ūs, in Greek mythology, according to Homer (whose account is the one chiefly identified with the name, "the old man of the sea"), a subject of Poseidon (the sea god), gifted with the power of prophecy, who pastured the seal herds of Amphitrite upon the shore of the island of Pharos near the mouth of the Nile. He is represented as of great age and able to change himself instantly into any form he might wish. To compel him to prophesy it was necessary to steal craftily upon him and hold him so that he might not escape whatever form he took. Menelaus, as told in the *Odyssey*, succeeded in doing this even though Proteus became in turn fire and water. Allusions to Proteus refer to his power of assuming many forms, as in the adjective, protean. Herodotus relates that Proteus as king of Egypt entertained Paris and Helen, but giving Paris a phantom in her stead, kept Helen with him and afterward restored her to her husband Menelaus.

**Proteus**, a remarkable genus of urodele Amphibians allied to the axolotls, sirens, etc., and often called "mud-puppies." The gills in these are retained throughout the entire lifetime of the animals, in addition to the lungs with which they are also latterly provided. These animals are found only in the waters of certain subterranean caves in central and southern Europe. The animal itself is about 12 inches long. Its body is elongated, slender, and somewhat cylindrical, and averages about one inch or three



## PROTEUS ANIMALCULE — PROTOPLASM

quarters of an inch in diameter. It is of a pale flesh tint — the absence of color being the necessary result of its non-exposure to light. The tail is broad and compressed. The limbs are weak, the front legs possessing three and the hinder limbs only two toes. Three pairs of bright red or scarlet branchiæ or gills project from the branchial clefts on each side of the neck. Two series of small teeth exist in the upper and in the lower jaw. The eyes are rudimentary and completely covered by the skin. The proteus is eminently aquatic in its habits, and in dry seasons, or when the water of the caves becomes dried up, is said to bury itself in the mud. For the development of this group see EMBRYOLOGY.

**Proteus Animalcule.** See AMŒBA.

**Protevangelium,** prō - tē - vān - jēl'ī - ūm (Gk. "the first gospel"), term applied to the passage in the Old Testament, Genesis iii. 15, in which theologians see the first announcement of the coming of a Messiah.

**Prothero,** prōth'er-ō, **George Walter,** English historical writer: b. Wiltshire 14 Oct. 1848. He was educated at Eton, Oxford, and the University of Bonn, was university lecturer in history and tutor of Kings College 1876-94, and professor of history at the University of Edinburgh 1894-9. He is editor of 'The Quarterly Review' and has published 'Life and Times of Simon de Montfort' (1877); 'Memoir of Henry Bradshaw' (1889); 'British History Reader' (1898); etc.

**Prothero, Rowland Edmund,** English author, brother of G. W. Prothero (q.v.): b. Clifton-on-Teme 6 Sept. 1851. He was educated at Marlborough and Oxford and was editor of 'The Quarterly Review' 1894-9. He is the author of 'Pioneers and Progress of English Farming' (1887); 'Life and Correspondence of Dean Stanley' (1893); and has edited the 'Letters of Edward Gibbon' (1896); 'Letters and Journals of Lord Byron' (1898-1901); etc.

**Prothonotary,** in Pennsylvania, and a few other States, the name given the judge of the orphans' court. (See COURT, PROBATE.) Formerly the term was applied to certain functionaries connected with the papal court who receive the last wills of cardinals, make informations and proceedings necessary for the canonization of saints, etc.

**Protis'ta,** a group-name introduced by Haeckel to include the simplest forms of life, and hence probably the first to appear on the earth. It has failed of general acceptance, and its members are divided between the protozoans and the unicellular plants.

**Protoamœba.** See MONER.

**Pro'tocol,** in diplomacy, the minutes or rough draft of an instrument or transaction; the original copy of a treaty, despatch, or other document; a document serving as the preliminary to diplomatic negotiations; a diplomatic document or minute of proceedings, signed by the representatives of friendly powers in order to secure certain political ends peacefully; a convention not subject to the formalities of ratification. By a *protocol* concluded and signed 12 Aug. 1898, by William R. Day, secretary of state of the United States, and Jules Cambon, ambassador extraordinary and plenipotentiary of the republic of France, at Washington, re-

spectively representing for that purpose the government of the United States and the government of Spain, the United States and Spain agreed upon the terms on which negotiations for the establishment of peace between the two countries should be undertaken. Following the signing of this peace protocol, President McKinley issued a proclamation suspending hostilities.

**Protogenes,** prō-tōj'ē-nēz, Greek painter, contemporary with Apelles: b. Caunus on the borders of Caria. He lived about 350 B.C. He was one of the first of Greek realists in painting. Several masterpieces of his are mentioned, in one of which a hound was represented panting, and with foam on his mouth. Pliny relates that for a long time the painter failed in the execution of the foam; but at last, in a fit of anger, threw against the picture the sponge which he used in painting, and thus accidentally produced a natural representation of it. This picture saved the city of Rhodes when it was besieged by Demetrius Poliorcetes, who refrained from making his attack on the weakest part of the city where the picture was placed. Protogenes is said to have lived in comparative obscurity at Rhodes till the 50th year of his age, when his merits were made known to his fellow-citizens through a visit of Apelles (q.v.). Apelles offered Protogenes an enormous sum for each of his works, which the painter himself had been in the habit of selling for very insignificant sums. The Rhodians now wished to buy back the pictures from Apelles, in order that they might keep them among themselves, but Apelles refused to part with them except for an advance. Protogenes subsequently went to Athens, where he executed one of his finest pictures in the Propylæa. In the time of Cicero it was still in that city, but Vespasian carried it to Rome, and placed it in the Temple of Peace, in which it was burned under Commodus.

**Protohip'pus; Protorohippus;** genera of early fossil ancestors of the horse. See HORSE, EVOLUTION OF.

**Pro'tophytes.** See FUNGI.

**Pro'toplasm,** the elementary or primitive organic compound of an albuminous nature, which enters into the composition of organized tissues of all kinds. The term is more especially used to denote the substance — indistinguishable from the primitive base of the tissues in higher forms — of which the bodies of the lowest animals (*Protozoa*) and plants (*Protophyta*) are wholly composed. But no appreciable difference, either chemical or microscopical, is to be perceived between the protoplasm of these lower forms of life and that out of which the tissues of the highest animals are elaborated. This protoplasm, therefore, enters into the intimate composition and formation of animal and plant tissues of every kind. It forms the indispensable medium, as it were, and at first sight, for the presence and manifestation of vitality. The tissues of the highest plant or animal form may be considered simply as consisting of elaborated protoplasm, equally as the body of the lower animalcule or plant consists of that substance in a more primitive and undifferentiated state.

In its chemical composition protoplasm exhibits carbon, hydrogen, oxygen, and nitrogen united to form one of a group of proximate



## PROTOTHERIA — PROUDFIT

compounds to which Mulder gave the name of "proteine" compounds. See ANATOMY.

**Protothe'ria**, a division or subclass of mammals including the *Monotremata* and with more less certainty some fossil forms grouped as *Protodonta* and *Multituberculata*. In the living forms their most marked peculiarities are the fact that they have but a single opening for the digestive tract and the urogenital system; and that they are oviparous. The sutures of the skull are obliterated, and while in the young there are peculiar teeth with many tubercles upon the crown, these are lost in the adult, the jaws being furnished with horny plates. Similarities in the teeth lead the fossil forms to be associated here. The only living examples are the duckbill and scaly ant-eaters (*Echidna*). The marsupials are sometimes known as *Meta-theria*, and all other mammals as *Eutheria*; but the latter term is more scientifically made to include all mammals except the monotremes. Consult Beddard, 'Mammalia' (1901).

**Protozo'a**, a phylum or branch of the animal kingdom set off from all other branches which together constitute the *Metazoa*, and distinguished by the simplicity of organization. The animal consists of but a single cell or a colony of simple cells. The group manifests gradual transitions at several points from such forms as are distinctively animal organisms to those which are as clearly plants. And on the other hand, certain higher forms show the first stages in differentiation among the cells of the colony which mark the advance to the metazoön organism.

The *Protozoa* manifest a physiological complexity as striking as the structural simplicity, in that all the functions of higher organisms are here discharged by the single cell. In the place of the tissues and organs of the higher animals, one finds differentiations within the single cell which are related to special functions and hence analogous to organs. These are denominated cell-organs, or organellæ, and include locomotor structures such as pseudopodia, flagella and cilia, protective coverings of a permanent character such as shells, shields, or spines, or temporary, as cysts formed at the reproductive period or in times of stress in the environment. Of this type are further the mouth and anal openings with highly modified attachments of various sort relative to the ingestion of food or extrusion of waste, the sucking tubes of the *Suctoria*, the digestive, excretory and contractile vacuoles, the means of attachment developed in parasitic forms, and many other structures similarly connected with special functions.

Some years ago it was held that certain *Protozoa*, the *Monera* of Haeckel, were without any nuclear structures. This view has not been confirmed by later investigations. The simple protozoan is uninuclear; the multinuclear condition is evidence of a colonial organism or of a phase in reproduction. In one group, however, two types of nuclei coexist, and are known as the sexual and the somatic nucleus, or micronucleus and macronucleus.

Simple or multiple division is the ordinary type of reproduction and occurs either in the free or in the encysted condition. Two types of reproduction may alternate in the life cycle of a given form and so-called sexual processes

have recently been demonstrated in various groups. In these there occurs the fusion of similar individuals (isogametes) or of dissimilar (macro- and microgametes), or a temporary union (conjugation) of two individuals, accompanied by an exchange of nuclear matter. There exists a close parallel between these phenomena and those of maturation and fertilization in the metazoan egg-cell.

The phylum consists of four well defined classes, namely: (1) *Sarcodina*, with the subclasses *Rhizopoda*, *Heliozoa*, *Radiolaria*, and *Mycetozoa*; (2) *Mastigophora*, with the subclasses *Flagellata*, *Dinoflagellata* and *Cystoflagellata*; (3) *Sporozoa* with the subclasses *Teliosporidia* and *Neosporidia*; (4) *Infusoria*, with the subclasses *Ciliata* and *Suctoria*.

Recent investigations have demonstrated the responsibility of various species of *Protozoa* in the production of serious diseases among man and the domesticated animals. Thus malaria is caused by a form (*Plasmodium malariae*) parasitic in the red blood-corpuscles, tropical dysentery is produced by *Entamæba histolytica*, and Texas fever of cattle is due to *Piroplasma bigeminum*. Surra in the Philippines, the tsetse fly disease in Africa, and other maladies of domestic animals are known to fall in the same category, while in man, smallpox, yellow fever, scarlet fever, spotted fever, dengue and other diseases less thoroughly investigated, are believed to be due to protozoan parasites. Consult Lankester, 'A Treatise in Zoölogy' Part I. (London 1903).

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**Protrac'tor**, an instrument for laying down and measuring angles on paper, and by which the use of the line of chords is superseded. It is of various forms — semicircular, rectangular, or circular.

**Proud, Robert**, American historian: b. Yorkshire 10 May 1728; d. Philadelphia, Pa., 7 July 1813. He came to America in 1759 and settled in Pennsylvania where he engaged as teacher of Latin and Greek in a Friends' Academy in Philadelphia. During the American Revolution he remained loyal to the crown, firmly convinced that the future of the new country would be ruined by the success of the American arms, and it was during the progress of the war that his work of greatest importance 'The History of Pennsylvania' (1797-8) was written. The work is of much value as containing original material and important information, but the narrative is not well sustained. Consult Thomson, 'Life and Character of Robert Proud' in 'Memoirs of the Historical Society of Pennsylvania' (Vol. I. 1826; 1864).

**Proud Flesh.** See GRANULATION TISSUE.

**Proud'fit, David Law** ("PELEG ARKWRIGHT"), American author: b. Newburgh, N. Y., 27 Oct. 1842; d. 1897. He enlisted in the Union army as a private in 1862, was commissioned lieutenant-colonel of colored troops and served through the war. He afterward entered business, became interested in pneumatic tube experiments and later was president of the Meteor Dispatch Company. His publications include: 'Love among the Gamins' (1877); 'Mask and Domino' (1888); etc.



## PROUDHON—PROUT

**Proudhon**, proo'dôn, **Pierre Joseph**, French philosophical anarchist: b. Besançon, France, 15 July 1809; d. Paris 19 Jan. 1865. He studied at the University of Besançon, but left without completing his course there because compelled to find some means of self support. He then learned printing and in 1837 became partner in developing a new typographical process. He had continued his education by improving every opportunity for study; and in 1838 published a philological treatise, 'Essai de Grammaire Générale,' for which the Academy of Besançon conferred on him a pension which yielded an income of 1,500 francs for three years. Political economy now became his chief study, and in 1840 appeared his famous work 'Qu'est-ce que la Propriété?' ('What is Property?'), to which question the first page of the treatise contains the answer, "C'est le Vol" ("It is theft"). This first treatise was followed in 1841 and 1842 by two pamphlets in the same strain, the second of which, 'Avertissement aux Propriétaires,' led to his prosecution and trial for his revolutionary opinions, resulting in an acquittal. In 1843 Proudhon undertook the management of a system of transports on the Rhone and Saone. But he still continued to write. In that year appeared his treatise 'De la Création de l'Ordre dans l'Humanité,' a proposed system of political organization; and in 1846 'Système des Contradictions Economiques.' After the revolution of February 1848, he began the publication of a journal at Paris called 'Le Représentant du Peuple,' which, however, was speedily suppressed. But he had by this time acquired so much popularity that he was elected the representative of the Seine in the Assembly. Here however, he had little success, and again turned to writing and journalism. He published several pamphlets, and started three journals in succession, 'Le Peuple,' 'La Voix du Peuple,' and 'Le Peuple de 1850.' He was frequently fined for his statement of his radical theories, but the fines were paid for him by subscription. In 1849 he attempted to found a bank under the name of the "Banque du Peuple" with the object of abolishing interest and finally putting an end to capital. This project failed, and he fled to Geneva to escape imprisonment for violation of the press laws, but returning in June 1849, was imprisoned for three years. On his release in 1852 he went to Belgium, where he continued to write, and in 1860 under an amnesty returned to Paris, where he lived in retirement till his death. His publications in addition to those already mentioned include: 'Confessions d'un Revolutionnaire' (1849); 'Actes de la Révolution' (1849); 'Intérêt et Principal' (1849); 'Gratuité du Crédit' (1850), the last two a résumé of discussions he had had with Bastiat on the subject of interest; 'La Révolution Sociale Démontrée par le Coup d'Etat' (1852); 'Manuel de Spéculateur à la Bourse' (1856); 'De la Justice dans la Révolution et dans l'Eglise' (1858); 'La Guerre et la Paix' (1860); 'Théorie de l'Impôt' (1861); 'Les Majorats Littéraires' (1862). Several works of his have also been published posthumously, among them 'De la Capacité Politique des Classes Ouvrières' (1865); 'Théorie de la Propriété' (1865).

He was the first to formulate the doctrines of

philosophical anarchism; he maintained that property was unjustifiable, that labor only should give just claim to share in the product of labor, and that consequently rent and interest should not exist. He thus far agreed with the socialist doctrine of value, but he was neither a socialist nor a communist; because the state depended upon and protected property he claimed that the state must be destroyed; and that the proper basis of society was a voluntary contract between individuals. Consult: Sainte Beuve, 'Proudhon, sa Vie et Correspondance' (1875); Diel, 'P. J. Proudhon, seine Lehre und sein Leben' (1888-96); Desjardins, 'Pierre Joseph Proudhon' (1896); Mulberger, 'P. J. Proudhon, Leben und Werke' (1899).

**Proustite**, or **Ruby Silver**, the most beautiful silver mineral and one of the most important ores of silver. It occurs in scalenohedrons, or, less commonly, in prismatic crystals, also massive. Its lustre is brilliant adamantine, typical color cochineal-red, but changing to nearly black on exposure to light, losing simultaneously much of its transparency. Chemically, it is silver sulpharsenite, the silver percentage being 65.4. In the rich silver mines of Chile it is one of the chief ores and magnificent crystallized specimens worth thousands of dollars have been taken out. The royal Saxon mines are also celebrated for their ruby silver, and it occurs as an ore in many European, Mexican, Colorado and Nevada silver mines.

**Prout**, prow, **Ebenezer**, English composer and writer on musical theory: b. Oundle, Northamptonshire, 1 March 1835. He was educated at University College, London, and from 1860 till 1884 was a professor at the Crystal Palace School, and in 1876-82 professor at the National Training School for Music. He is a professor of harmony and composition in the Royal Academy of Music and the Guildhall School of Music, and since 1894 has occupied the chair of music in Dublin University. His compositions include cantatas, concertos, quartets, symphonies, etc., among the first named being 'Hereward' (1878); 'Alfred' (1881); 'Red Cross Knight' (1886); and 'Damon and Phintias' (1888). Among his theoretical works are the following: 'Instrumentation' (1876); 'Harmony' (1889); 'Counterpoint' (1890); 'Double Counterpoint and Canon' (1891); 'Fugue' (1892); 'Musical Form' (1893); 'Applied Forms' (1895); 'The Orchestra' (1898-9).

**Prout, Father**. See MAHONY, FRANCIS SYLVESTER.

**Prout, Samuel**, English painter: b. Plymouth 17 Sept. 1783; d. Camberwell 10 Feb. 1852. He early manifested a turn for drawing, but the only lessons he received were from a drawing-master in his native town. In 1801 he made the acquaintance of Britton, the architectural antiquary, who employed him in visiting the rural districts to make sketches, which were engraved in the 'Beauties of England.' In 1818 he visited Normandy, returning with many striking water-color drawings, whose merits placed him at the head of this department of art. He was especially happy in depicting monuments of mediæval architecture throughout France, Germany, and Italy, and also directed his attention to lithography, pub-



lishing several collections of lithographed sketches. He was a great water-color painter, in the English sense of the term, and relied altogether upon wash tones, whose depth was determined by the degree to which the white paper on which they were laid was permitted to appear. The principal features of his buildings he marked with strong lines and deep shadows, but his main characteristics are breadth, freedom of handling, and power of coloring. His industry was great and his pictures were eagerly sought for. In 1868 his 'Nuremberg' (21 x 28 in.) was sold for \$5,010. He is the author of 'Hints on Light and Shadow' and the 'Young Student's Drawing Book.'

**Provancher, Leon**, Canadian naturalist: b. Besancour, Quebec, 10 March 1820. To devote himself exclusively to the pursuit of botany and kindred studies, he retired from the Catholic priesthood. He established 'Le Naturalist Canadien' in 1868, and published 'Elementary Treatise on Botany' (1858); 'Canadian Plant Life' (1865); 'From Quebec to Jerusalem' (1882); 'Short History of Canada' (1887).

**Provençal** (prō-vōñ-säl) **Language and Literature.** A curious natural feature of Dalmatia is the number of rivers which come up suddenly from underground, or burst full-grown from the bases of the hills, and seek the sea with a force and velocity of current all the more impressive from the mystery of their origin. Just so the poetry of the Troubadours leaps abruptly, in full volume, out of the murk of the unlettered ages, and spreads itself abroad in a laughing flood of which the superficial sparkle may sometimes deceive concerning the strength of the undercurrent passion on which it is upborne.

*Gai Saber* — the Gay Science — was the name bestowed by these gushing singers themselves upon their newly discovered art of verse-making; and the epithet was perfectly descriptive. To the serious, disciplined, and systematic 20th century mind, there is something incongruous, not to say indecent, in the association of science and joy. Whatever else the science may be, in whose sign we are supposed to conquer, it is not gay. But the Troubadour did not even know the difference between science and art. His era in the life of modern Europe corresponds exactly with the *insouciant* season when "a young man's fancy lightly turns to thoughts of love." The Troubadour was palpitating, moreover, with the two masterful enthusiasms of his time: the religious enthusiasm of the Crusades, and the high-flown sentiments and noble chimeras of the lately formulated code of chivalry.

Seizing the instrument nearest to his hand, — a supple and still growing offshoot from the imperishable root of Latin speech, — he shaped his pipe, fashioned his stops, and blew his amorous blast; and overcome by amazement at the delightful result, was fain loudly to proclaim himself the happy *finder* (troubaire) of the verbal music he had achieved, rather than its *maker* or poet.

*Lengua Romana*, or *Romans*, was what he called his own language. To Dante, in the beginning of the 14th century, it was Provençal as distinguished from the *lengua materna*, or Italian; and Provençal it is, to this day, loosely

called. But it was spoken in substantially the same form, far outside the fluctuating limits of mediæval Provence; and one of the Troubadours themselves — Raimon Vidal — has in fact defined its limits very explicitly. "The only true language of poetry," he says, "is that of Limousin, Provence, Auvergne, and Quercy; . . . and every man born and brought up in those countries speaks the natural and right speech."

The time at which the troubadour minstrelsy flourished is as distinctly marked as its locality. Two hundred years, from the last decade of the 11th century to the last of the 13th, comprise it all. Fifty years for its rise, a hundred for its most exuberant period, fifty more for its decline, — and the brief but picturesque and exciting story is all told. The love of man for woman is its perpetual and almost exclusive theme. The special form of the tender passion to which the troubadour tuned his lay was, however, the love of chivalry; theoretically a selfless and spiritual sentiment, having even a touch about it of religious exaltation. It involved the absolute devotion of life, wit, and prowess to the service of a formally chosen lady-love; and was as much a part of the sacramental obligations of a full-made knight as the service of God and of his feudal seigneur. The art in which this love found expression was thus essentially an aristocratic one; reserved for the practice of those who were either *élite* by birth and fortune, or ennobled by the possession of rare poetic gifts. Marriage was no part of its aim, and was never once, in the case of any well-known troubadour, its dénouement. The minstrel's lady was quite regularly the wife of another man; often of his feudal lord or sovereign ruler. The scope for tragedy and crime afforded by so fantastic a relation is obvious, and history has plenty to tell of the calamities which attended it in particular cases. Yet the austere ideal was never totally eclipsed; and that it survived the final disappearance of the troubadour as a court-minstrel and titular lover, we have abundant proof in the mystic lauds addressed by Dante to Beatrice and by Petrarch to Laura.

For the rest, the precocious perfection of form exhibited by some of the earliest troubadour songs which we possess, is not quite as miraculous as at first sight it appears. The main points in the mechanism of troubadour verse, both in its earlier and simpler, and in its later and highly elaborate developments, are two: strong tonic accents — mostly iambic, though sometimes of trochaic lines — and terminal rhymes. By these features it is radically distinguished from the quantitative measures of classic Greece and Rome; and in these respects it has furnished the model for almost all modern European poetry. But the rustic and popular poetry of the Latin race had been, from the first, a poetry of accent: and the tradition of it had been handed down through the early hymns of the Christian Church, and the rude staves and ballads trolled from town to town and from castle to castle during the Dark Ages, by the *joculatores* or *jongleurs*; those vagrant mimes and minstrels who played so large a part afterward, in diffusing and popularizing the more refined compositions of the troubadours. Rhyme, on the other hand, was very probably borrowed immediately from that Arabian verse in which it is so lavishly employed, during the long sojourn of the Saracens in southern Europe.



## PROVENÇAL LANGUAGE AND LITERATURE

It seems a curious freak of philological fate whereby a literature so juvenile and impulsive as that of the troubadours, so destitute of connected thought, and at the same time so instinct with emotions, should have become—largely by virtue of its important historical position midway between the written word of ancient Rome and that of modern France—a favorite and hard-trodden field for dry research, grammatical quibbling, and controversy on technical points. But so it is. Every sigh of the troubadour minstrel has been analyzed, and every trill conjugated. Yet when all has been said and read, the reader's appreciation of this unique body of song will have to depend rather more upon personal divination and temperamental sympathy than upon any laboriously acquired skill in interpretation. Even for the name and lineage of many of the most famous and successful *finders*, as well as for the incidents of their lives, we are mainly dependent upon two sets of brief biographies, compiled by nameless monks, one in the 12th and one in the 14th century. Of these cloistered authors, the earlier was no doubt contemporary with a certain number of his subjects; but we may safely conclude that they both adorned their facts, to some extent, with fancy and with fable. In selecting, out of a hundred or two of these romantic lives, a few as typical of all, we may think ourselves fortunate if, as in the case of the name that heads all the lists, the poet be a sufficiently exalted personage to have had a place in general history, and to have borne a part in the leading events of his time.

William IX., Count of Poitiers and Duke of Aquitaine, born in 1071, succeeded in his 15th year to the sovereignty of a region comprising, besides Gascony and the southern half of Aquitaine, Limousin, Berry, and Auvergne. Almost alone among the great lords of southern France, he resisted the call of Raymond of Toulouse to the first Crusade in 1095; but when in the last year of the century the great news arrived of the capture of Jerusalem, and an appeal was made for the reinforcement of the small garrison left in the Holy Land, William was overborne, and prepared, though still reluctantly, to go. His amours had been numerous, and he had already written love songs,—many of which are licentious to a degree, though some few reflect in sweet and simple strains the most refined ideals of chivalry. On the eve of his departure for the East, early in 1101, he composed a farewell to Provence, being haunted by a sad presentiment that he should see that fair land no more. His foreboding was not realized. He lived until 1127, and made ruthless war in his later years upon his young and defenseless neighbor, Alphonse Jourdain of Toulouse, for the sovereignty of that province. Alphonse was a son of the heroic Raymond, the leader of the first Crusade, born in the Holy Land and baptized in the Jordan,—whence his surname. A daughter of his was distinguished by the tuneful homage of a troubadour named Guiraud le Roux, of knightly rank but poor, who had taken service at Alphonse's court. This Guiraud is remarkable as being the only troubadour on record who loved but one woman; and there is a quality about his whimsical and subtle but always irreproachable verses which reminds one a little of the Elizabethan lyric.

William IX. of Poitiers was succeeded by his

son William X.; and he in turn was the father of one of the most illustrious women of her age, a great patroness of the troubadours, and past-mistress of all that nebulous lore which was made the absurd matter of solemn discussion and adjudication in the so-called Courts of Love. This was no other than Eleanor, Princess of Aquitaine and Duchess of Normandy, first married to Louis VII. of France, then divorced and married to Henry II. of England. She was already married to Henry, who was 10 years her junior; but she had not yet visited England when she welcomed and installed as her formal worshipper at the Norman court one of the most famous and prolific of all the troubadours, a true poet, though a light and inconstant lover, Bernard of Ventadour. Very humbly born, Bernard's exquisite talent was early discovered by his master, Ebles III. of Ventadour, who is described in the old chronicles as having "loved, even to old age, the songs of alacrity." Ebles not only educated the boy, but permitted and even encouraged him, for a long time, to *afficher* himself as the adorer of his own youthful second wife, Adelaide of Montpellier. The day came, however, when the youth's homage was suddenly discovered to have passed the proper ceremonial bounds; and he was abruptly dismissed, to take new service in Normandy. It is next to impossible to separate, in his remains, the songs of the two periods: Adelaide or Eleanor, it is all virtually one. The limpid stream of babbling minstrelsy flows on for some 40 years, always dulcet and delicate, sometimes lightly pathetic, but reflecting indifferently the image of either lady. Within the long period of Bernard's placid ascendancy were comprised the rapid and fiery careers of two men of a very different stamp,—the most tragical figures in all the miscellaneous choir.

Jaufré Rudel, the Prince of Blaya, fell in love with a certain Countess of Tripoli on the mere rumor of her charms; assumed the cross for the sole and sacrilegious purpose of meeting her; fell ill upon the voyage, and on his arrival was recovered from a death-like trance by his lady's embrace, only to die almost immediately in her arms.

The horrible story of William of Cabestaing would seem quite beyond belief were it not given circumstantially, and with very slight variations, by an unusual number of writers. An accomplished cavalier, William won such favor in the eyes of the Lady Margarida, wife of Raymond of Roussillon, that he aroused the savage jealousy of the latter, who slew him, and then cut out his heart, which he ordered cooked and seasoned and set before his wife. The hapless lady partook of it; then, on being brutally told the ghastly truth, swore that she would never eat again, sprang past her husband, leaped from an open window, and perished. Both Raymond and William were vassals of Alphonse II. of Aragon, himself a troubadour, and a great patron of the art. He had Raymond arrested, and caused him to die in prison; while the tomb of the lovers before the door of the church at Perpignan was long a place of pious resort for the pilgrims of passion in those parts.

A different and less melodramatic interest attaches to the names of the two Arnauts,—Arnaut Daniel and Arnaut de Maroill: of whom the former, as we know from Canto xxvi. of the



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'Purgatorio,' spoke in Provençal to Dante when he met him in the shades; while the latter is mentioned by Petrarch in a canzone as "the less famous Arnaut." The distinction seems a strange one: for while the verses of the former are chiefly remarkable for an extraordinary artificiality and complexity of rhythm, the latter, who had vowed his devotions to a certain lovely Viscountess of Béziers, was the author of some of the most exquisitely tender bits of Provençal song which we possess. The laborious verbal conceits and metrical intricacies of Dante's Arnaut were imitated with great ingenuity, and even exaggerated, by Raimon de Miraval, who fought in the Albigensian war; during which so many of the local poets and their patrons fell, that a whole civilization seemed to perish with them. That cruel contest may be held to mark the beginning of the end of the Provençal school of song.

The name of a woman, the Countess Die, who also, like the royal Eleanor, presided over a Court of Love, remains attached to one plaintive lament much admired in its day; and another woman, though unnamed, was the author of the most artless and impassioned of all the peculiar class of poems known as *albas* or morning-songs.

Another very beautiful *alba* was written by Guiraut de Borneil, of whom it is said by his ancient biographer that he composed the first true *chanson*, all previous poets having made *verses* only. He won a weightier kind of renown by the virile force and fire of his *sirventes*,—didactic or satiric pieces,—in which he mourned the accumulated misfortunes of his country, or lashed the crimes and vices of the men who had brought her to the verge of ruin.

Contemporary with Guiraut was another intrepid censor of the corruptions of his time, Peire Cardinal; of whom we have a satire beginning with the burning words, "Who desires to hear a *sirventes* woven of grief and embroidered with anger? I have spun it already and I can make its warp and woof!" Both these brave men died not far from the year 1230, and the course of Provençal literature after their day is one of steady deterioration.

The Provençal language has been revived within the last 50 years as a literary instrument, a society having been formed in 1854 and organized in 1876 with the object of attempting "to bring together and to encourage those who by their writings preserve the language of the land of Oc, and also those scholars and artists who study and work in the interests of this region." Joseph Roumanille (q.v.) first conceived the idea of preserving and perfecting the dialect of his own region (Avignon) and in 1852 edited a collection of Provençal poems by many authors. Frederic Mistral (q.v.), a man of powerful poetic genius, has devoted life-long labors to the cause. The society soon after its organization in 1876 largely increased in numbers. Its members called themselves *Félibres* (Book makers) and included among the charter members Joseph Roumanille; Frederic Mistral; Theodore Aubanel; Eugene Garcin; Anselme Mathieu; Paul Giéra; and Alphonse Tavan. The club disseminated their views by means of an annual, '*Arnsana Prouvenceau*' (which at present reaches a circulation of many thousands), and through it the public became ripe for the appreciation of Mistral's first long poem,

'Mierio,' published in 1859 and received in the literary circles of Paris with great applause. The movement spread to Spain and the Catalan poet and patriot Victor Balaguer received an ovation on his visit to Avignon in 1867. The Provençal of the *Félibres* is by no means the language of the Troubadours, but is based upon the dialect or patois of Saint Rémy, which was not derived from the Limousin dialect of the Troubadours. The language of Mistral, while rich in vocabulary, and full of local Provençal terms, is an artificial language, formed by rejecting all terms due to the influence of French and the French Academy and utilizing the tongue of the poet's native home. What makes the work of the *Félibres* live and prevail is the sheer superiority of its literary quality. Consult: Rutherford, 'Troubadours' (1873); Preston, 'Troubadours and Trouvères' (1876); Huffer, 'Troubadours' (1878); Meyer, 'Provençal Literature' in the 'Encyclopedia Britannica' (9th ed.); Diez, 'Leben und Werke der Troubadours' (2d ed. by Bartsch, 1883); Rowbotham, 'The Troubadours and Courts of Love' (1895); Farnell, 'Lives of the Troubadours'; Jourdain, 'Histoire des Félibres.' For those who wish to study the Provençal texts in the original, the most convenient collection is Karl Appel's 'Chrestomathie' (Leipsic, 1895).

HARRIET WATERS PRESTON.

**Provence**, *prō-vāns*, an old province of southeastern France, bounded by Piedmont, the Mediterranean, Languedoc, Venaissin, and Dauphiné, and including what is now the departments of Bouches-du-Rhône, Var, Basses Alpes, and, in part, Vaucluse, and Alpes Maritimes. Lesser ranges of the Alps, called the Alpines and in the south the Maures break up the country. The principal rivers are the Var, Durance, and Rhone; the last river has a great marshy delta. Climate and soil vary greatly, from the damp, changeable, rather sterile, and stony north to the south with its ideally mild air, its culture of bees and silkworms, and its produce of olive-oil, wine, mulberries, oranges, citrons, and all southern fruits. There is good sheep-grazing, but other livestock is less successful. The inhabitants of the Provence preserve to a large degree southern characteristics quite foreign to the northern Frenchmen, and keep a language and literature of their own, nearly as much akin to the Spanish and Italian as to the French. (See PROVENÇAL LANGUAGE AND LITERATURE.)

*History*.—There are traces in Provence, as in the polished stones found in the Grotte de la Masque and elsewhere, the tumuli, and dolmens of Draguignan, Pontève and la Blaque, and the lake dwellings of the mouth of the Var, of a civilization as early as the middle of the Stone Age. The Iberians held sway here until the 5th century B.C., when they were finally displaced by the Ligures. Greek and Phœnician colonies, notably Marseilles (q.v.) had been founded here at least as early as this. The Greek city of Marseilles by its repeated appeals to Rome for help against the Ligures, first in 155 B.C., effected the introduction of Roman influence, and in 124 B.C. Marcus Fulvius, proconsul, and Gaius Sextius Calvinus, consul, destroyed the capital of the Saluvii and founded (123 B.C.) on its site the city of Aquæ Sextiæ (modern Aix). Victories over other tribes in the next few years gave all the country between



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the Cevennes and the Alps to Rome. A Roman province, *Provincia par excellence*, or Gallia Transalpina (or Narbonensis, from its capital Narbo, modern Narbonne), arose, was threatened 15 years later by the invasion of the Cimbri and Teutones, and was racked by the civil war between Cæsar and Pompey, in which Massilia (Marseilles) siding with the Senate was captured and crushed by Cæsar in 49 B.C. The amphitheatre of Fréjus, the theatres of Arles, Fréjus, and Orange, the triumphal arches of Orange, Cavaillon, and Carpentras, the temple of Augustus and Livia at Vienne, and the splendid Roman roads through southern France, are remains of the glory of Provence in the first four Christian centuries, when Arles was a great commercial centre and one of the residential cities of Constantine, and when Autun and Marseilles were great university towns, Marseilles being the seat of a Greek college and a medical school.

The Visigoths entered Provence in the beginning of the 5th century, and about 470 Eurich captured Arles and made it his capital. The Ostrogoths held Provence from 510 to 536, receiving it as the price of their protection against the Franks, but losing it after a quarter of a century to the growing Frankish empire. In the 9th century Provence was twice a kingdom, and from 934 to 1113 was ruled by the counts of Arles (or of Provence), descendants of Boson, whose line failing in 1113 the county went to Berengar of Barcelona. His claim was contested by the Count of Toulouse, who in 1125 by treaty secured Valence, Die, Orange, and Venaissin; what had been retained by Berengar went to Aragon in 1162, the Count of Barcelona having come to that crown in 1137. In 1246, Beatrice, daughter of Raimond Berengar IV., the last of the male line, married Louis of Anjou, and Provence was a possession of the House of Anjou until 1481, when it was willed to Louis XI. of France and lost its separate significance politically.

Consult: Oddo, 'La Provence: Histoire, Usages, Coutumes, Idiomes, etc.' (1902); Castanier, 'Histoire de la Provence dans l'Antiquité' (1893-6); and Marchand, article 'Provence' in 'La Grande Encyclopédie.'

**Proverbial Philosophy**, a once popular didactic work by Martin Farquhar Tupper, published 1838-67. It is a series of poems in blank verse, dealing with almost every emotion and condition of life. The book contains many wise sayings, but is for the most part merely padded commonplace.

**Proverbs, Book of**, a portion of the Old Testament. *Date and Authorship*.—The book of Proverbs is the subject of much discussion in reference to date and authorship. The old view that king Solomon was the author of nearly or quite the whole of the book has been generally abandoned. Two classes of views are widely held at the present day. One is that all of the book, or all but the last two chapters, was written and compiled before the Babylonian exile. The amount attributed to Solomon varies, but is in any case an appreciable quantity, forming the kernel of the whole. The other view is that both writing and compilation are to be dated long after the exile, no part having been written by Solomon. The completion of the work of compiling is assigned to various dates from about 350 to 180

B.C., the whole composition of the book being supposed to cover not more than a century. There is a growing tendency toward the second view, which is held by most of the very recent writers on the book.

*Arguments for Late Date*.—The chief argument in favor of the late date of the book is from language, that is, the occurrence of a considerable number of words found elsewhere only in late Hebrew, and of words borrowed from the Aramaic. But the number of words which can with certainty be assigned to these two classes is much smaller than is often claimed. Historical indications also urged for the same conclusion are that the book makes no mention of polygamy and idolatry, which were common before the exile, and that it assumes the existence of a distinct class of sages, known as wise men, who are hardly mentioned in the historical and prophetic books before the exile, nor are any results of their activity apparent. These are arguments from silence, and therefore must be used with great caution. The resemblance to the apocryphal book of Ecclesiasticus, which is also urged, has little bearing on the question, in view of the well-known habit of the author of Ecclesiasticus of borrowing from other books.

*Arguments for Early Date*.—In favor of the early date, the chief argument is the thought of the book. The oft-repeated teaching of the book concerning the problem of God's government of the world is this: the good will prosper, the wicked will be punished, in this life. This is generally acknowledged to be the pre-exilic doctrine, while that of the exile and after the exile is quite different. The adherents of the late date are obliged to suppose that the pre-exilic doctrine had persisted long after the exile, in face of the teaching then current that the wicked prosper and the righteous suffer. Further, the frequent allusions to a king harmonize only with the early date. Many passages speak of him as the promoter of justice, and none refer to him as a foreigner. After the exile the sovereignty of Palestine was in the hands of foreigners, with little justice in their administration. The syntax of the book, also, is of the classical, earlier, type. The titles in chapter i. 1; x. 1, and xxv. 1, which attribute portions of the book to Solomon represent at any rate a tradition, and should be given some weight. The preponderance of evidence seems in favor of the earlier date.

*Divisions of the Book*.—As ordinarily viewed, although with some variation, there are eight different portions into which the book is divided, each of which is a separate compilation. These divisions, in the chronological order usually, but not invariably, assigned to them, are as follows: Chapter x. 1, to chapter xxii. 16, containing the title in chapter x. 1, "The proverbs of Solomon." Chapter xxii. 17, to chapter xxiv. 22, called in chapter xxii. 17, "the words of the wise." Chapter xxiv. 23-34, a similar collection, of which it is said in chapter xxiv. 23, "These also are sayings of the wise." Chapters xxv.-xxix., headed by the statement in chapter xxv. 1, "These also are proverbs of Solomon which the men of Hezekiah king of Judah copied out," which division, however, some regard as older than chapter x. 1; xxii. 16. Chapters i.-ix., a connected discourse in praise of wisdom, in the form of advice to a son or



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scholar. Chapter xxx., with the title in chapter xxx. 1, "The words of Agur the son of Jakeh." Chapter xxxi. 1-9, described in chapter xxxi. 1, as the words probably should be translated, as "The words of Lemuel king of Massa." Chapter xxxi. 10-31, an anonymous alphabetic poem or acrostic in praise of the ideal housewife. The first division was probably compiled somewhat after the time of Solomon, the fourth is traditionally assigned to the time of Hezekiah, while the last three divisions probably belong soon after the exile. There are no indications of precise date for the other divisions, but on the view adopted all of them are to be regarded as pre-exilic.

*Solomonic Authorship.*—That the first and fourth divisions are not entirely the work of Solomon is indicated chiefly by the fact that there are many repetitions of proverbs partly the same, and by the further fact that some are not written from his standpoint, especially the utterances concerning the king. On the other hand, there seems to be no sufficient reason for denying that he is the author of many of them. There is no evidence, however, that Solomon wrote down his own proverbs, 1 Kings iv. 32, does not mention Solomon as *writing* proverbs, but as *speaking* them.

*Literary Characteristics.*—The Hebrew word for proverb (*mashal*) probably meant originally a *comparison*, and then was broadened to apply to any sententious saying, because often containing a comparison. The proverbs of this book do not bear in general the stamp of long popular use, but rather of the reflection of individuals. The whole book is written in what is called, from the Hebrew standpoint, poetry; for the most part gnomic, although the lyric form is also found, especially in chapters i.-ix. Like Hebrew poetry generally, parallelism of the members of a verse is the most prominent characteristic. Antithesis is found especially in chapters x.-xv. Each verse expresses usually an independent thought, except in chapters i.-ix. and chapters xxx.-xxxi., where connected discourse is found. Brevity and sententiousness of statement are implied in the very nature of a proverb, while simile, metaphor, and paradox are common. An extended personification of wisdom is found in the eighth chapter.

*Purpose.*—Although Proverbs has several authors and compilers, and much of it is disconnected in form, yet a marked degree of unity pervades the whole. The book confirms the statement of purpose in chapter i. 1-6, that it is intended to teach wisdom to men, especially to the young and inexperienced, but also to those who already have some knowledge of wisdom. Wisdom, however, is a comprehensive term, it includes all that is desirable in character, folly all that is undesirable. Its foundation is religious, it consists fundamentally in a right relation to God, "the fear of Jehovah is the beginning of wisdom" (chapter ix. 10). But all that pertains to humanity is included in the scope of wisdom, so that the book touches all phases of human life. Observation of the customs and habits of men, and conclusions therefrom, have a prominent place.

*Relation to Philosophy.*—Wisdom is thus practical rather than speculative. To speak of the book as philosophical, as some have done, is, therefore, misleading. The book, it is true, iden-

tifies virtue with knowledge. But this is done, not from a philosophical standpoint, but from a religious and practical one. For the practical purpose of the writers, men are divided into two classes, those who know the right and do it, and those who are ignorant of it and do not do it. The other class, always so common, consisting of those who know the truth and do it not, is simply ignored. The speculative element is wanting in the book. The teachings concerning wisdom often suggest philosophical speculations concerning the greatest good, but they are always religious, not philosophical.

*Ethical Teaching.*—The ethical teaching of the book is on a high plane. Ceremonial is occasionally alluded to, but the sages agree with the prophets that the external act has no value without an inner reality. When revenge is forbidden, chapter xx. 22, and chapter xxiv. 29, and kind treatment of enemies is enjoined, chapter xxv. 21, the standard approaches closely to that of the New Testament.

*Bibliography.*—Cheyne, 'Job and Solomon'; Davison, 'The Wisdom Literature of the Old Testament'; Frankenberg, 'Die Sprüche' (in Hand-Kommentar zum alten Testament); Horton, 'The Book of Proverbs' (in Expositor's Bible); Kent, 'The Wise Men of Ancient Israel'; Nowack, 'Proverbs' (in Hastings' Dictionary of the Bible); Perowne, 'The Book of Proverbs' (in Cambridge Bible); Strack, 'Die Sprüche Salomos' (in Kurzgefasstes Kommentar); Toy, 'A Critical and Exegetical Commentary on the Book of Proverbs' (in International Critical Commentary); and 'Proverbs' (in 'Encyclopedia Biblica'); Wildeboer, 'Die Sprüche' (in Kurzes Hand-Kommentar zum alten Testament); Zöckler, 'The Proverbs of Solomon' (in Lange's Commentary).

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**Providence, R. I.**, the county-seat of the county of the same name and the capital and largest city of the State, is situated at the head of what is called Providence River, a tidal arm of Narragansett Bay. It is 35 miles north from the open ocean, about 20 west from Fall River, 40 southwest of Boston and 157 northeast of New York. It covers an irregular area of 146 square miles. The early settlement was on the river at the mouth of two small streams, and for nearly 200 years it grew in an easterly direction, many of its finest residences being erected on the high hill overlooking the Providence River, this hill or ridge about 200 feet high dividing the valley of the two streams from that of the Blackstone or Seekonk, a river of some size. Later on the settlements began to extend in a westerly direction over low and rolling ground, and to-day the West Side, as it is called, is the most densely populated section of the city; though within the past few years a movement has again set in toward the east, a large area having been built up in that part of the city adjacent to and running west from the Seekonk.

*Climate and Health.*—Situated near the sea the city has a rather humid climate with a considerable range of temperature, but the weather is neither as hot in summer nor as cold in winter as in places farther inland. The prevailing winds in summer are from the southwest and



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1. Market Square, 1844.

2. Market Square, 1903.







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in winter from the northeast or northwest. The city is more healthful than many large manufacturing cities and has been noticeably free from epidemics of serious diseases. The death rate in 1902 was 18.75 per 1,000 and in 1903 21.05.

*Commerce and Manufactures.*—In 1681 Providence was the most compact settlement of the colony of which it was a recognized centre; but its commercial growth for the ensuing hundred years was not as rapid as that of Newport, which, on account of its geographical position, was better adapted for the maritime trade of the East Indies, China, and the western coast of Africa.

Providence, however, eventually became considerable of a seaport town, and for many years the wealth of the city was mainly derived from its commerce of the seas. With the growth in size of the freighters of the coastwise and trans-Atlantic trade, and a proportionate lack of increased facilities for accommodating these larger vessels, Providence began about 1840 to lose its prestige in the shipping world, until finally its foreign maritime trade entirely disappeared. It can hardly look for its return, until the city, State or private owners of water front privileges, provide suitable accommodations for the handling of that trade, which by reason of the natural advantages of a magnificent harbor, easily entered, it should enjoy.

Chief among the advantages of Providence as a centre of industry, commerce, and trade, are those pertaining to its geographical position, it being the natural outlet of southern New England, and the sources of supply and distribution which are the natural outcome thereof.

Though its reputation as a shipping port has gone, to-day Providence is one of the great industrial centres of the United States, noted for the variety of its manufactured products, the greatness of its industries, the skilled workmanship of its artisans, and for the invention of those numberless ingenious accessories of modern life which have become necessities in this age of luxury. Preeminent among the varied industries of the city is the manufacture of jewelry with its allied interests, such as chasers, electroplaters, gilders, engravers, colorers, enamelers, die-sinkers, etc., approximating a total of 250 establishments, engaged in a manufacturing industry whose products are distributed alike among the civilized and uncivilized nations of the earth. The value of the products of these establishments in 1812 amounted to \$100,000; increasing in 1900 to \$12,719,124, or 27.4 per cent of the entire value of the production of all the manufacturing establishments in Providence.

Allied to the jewelry manufacture is the manufacture of silverware. It was an apprentice of the founder of the jewelry industry who began the manufacture of silverware in Providence, and founded what is now one of the largest establishments in this line of manufacture in the world. There were eight establishments engaged in this industry in 1900, located in Providence, with a capital of \$5,127,714, an increase over 1890 of \$2,125,482, or 70.8 per cent. These establishments gave employment to 1,540 wage-earners, to whom \$978,198 was paid in wages, and their product was valued at \$3,834,408, an increase of \$1,324,539 since 1890, or 52.8 per cent.

The refining of gold and silver sweepings is closely dependent upon the two industries just described. Until 1850 the material used in this industry was allowed to go to waste. There are

now 10 establishments engaged in this industry in Providence, with an invested capital of \$505,957, and a product valued at \$3,484,454.

Chief among the great corporations which claim this city as their home, are those of B. B. & R. Knight, operating nearly 500,000 spindles, largest in the world in the productive cotton goods line; the Gorham Manufacturing Company, manufacturers of gold, silver, and bronze works of art; the Brown & Sharpe Manufacturing Company, manufacturers of every class of fine tools and machinery, and the American Screw Company, established in 1838, said to be capable of supplying the world with the commodity it manufactures.

In 1839 the manufacture of files was begun in Providence, but it was to the invention by a local mechanic in 1864 of machinery for this manufacture, that the present importance of this industry in the city is due. The product of the industry in 1900 amounted to \$1,033,838, the Nicholson File Company, the largest corporation of its kind in existence, representing practically the entire output of files and rasps in Rhode Island. Here is also located the New England Butt Company, manufacturers of machinery for insulating electrical wires and cables, single, double, and triple braiders, cabling, stranding, winding, and polishing machinery, and cable covering braiders; the Rhode Island Tool Company, makers of high-grade bolts and nuts; the Rhode Island branch of the American Locomotive Company; the Corliss plant of the American and British Manufacturing Company, the original home of the Corliss engine which won the admiration of the industrial world at the Centennial in Philadelphia in 1876; a plant in which to-day is also manufactured the Diesel oil engine; the Providence Belting Company, manufacturers of leather belting; the Davol Rubber Company, established in 1874, manufacturers of fine goods in hard and soft rubber; the Providence Machine Company, manufacturers of improved cotton and worsted roving machines; the Almy Water Tube Boiler Company, makers of Almy Patent Sectional Water Tube Boilers; The Builders Iron Foundry; the Barstow Stove Company; the Queen Dyeing Company, with a world-wide reputation for its fast blacks; the American Ship Windlass Company, and scores of other manufacturing plants smaller in size.

The total capital invested in the manufacturing of woolen fabrics in the city of Providence approximates \$15,000,000, the number of wage-earners employed being about 8,500; the value of annual products being approximately \$16,000,000.

In cotton fabrics and other textiles, the total capital invested is a little more than \$2,000,000, the average number of wage-earners employed being about 1,700; wages amounting to \$452,182; the value of annual product being approximately \$2,250,000.

In connection with textile products, there are in Providence a number of plants producing textile mill machinery and metal mill supplies, with a total capital invested of nearly \$1,500,000, employing something over 1,000 hands, whose annual wages amount to \$500,000; the value of annual product being approximately \$1,500,000.

The financial strength of the city is concentrated in its manufacturing as has been shown. There are, however, other industries and enter-



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prises of the highest importance, notably wood-working and lumber, including furniture, iron foundries, drug and dyewood mills, bleachers and dye-houses, boiler-makers, box makers, and brass founders, gas, steam, and water fittings, patent medicine manufactories, stove founders, assayers and refiners and the extensive trade in cotton and wool, groceries, dry-goods, hardware, clothing, etc., which is carried on with great success and employs an army of workers.

In 1790 there were made in the households of Rhode Island 30,000 yards of woollen cloth, 25,265 yards of linen, and 5,858 yards of cotton; but the introduction of power spinning marked the commencement of a period of change in manufacturing from the old handicraft system to the modern factory system, the first introduction of this factory system being applied to the making of cotton yarns in the year 1790. From this time on manufacturing establishments began to increase in number, until about 1840 when Providence began to enjoy that wide reputation in the manufacturing world which gradually increased, until to-day the number of her manufacturing establishments is about 1,950; capital invested about \$84,000,000; average number of wage-earners 45,000; total wages about \$20,000,000; gross value of products about \$88,500,000.

In 1900 the census office reported that the percentage of population in Providence increased from 37.9 per cent in 1880 to 41 per cent in 1900, while the percentage of the number of establishments decreased from 54.6 per cent in 1800 to 46.1 per cent in 1900. The products of the city formed 40.9 per cent of the total in 1880, this percentage increasing to 61.4 per cent in 1890 and decreasing to 42.4 per cent in 1900.

These percentages indicate that the tendency has been to a wider distribution of manufactures, decreasing the percentage in the principal cities.

The commercial growth of the city for the past 50 years has not been phenomenal, but it has been a healthy advancement in capital invested, and in value of products, reflecting the solidity of the business interests here centred. The perpetuity of the high standing of the manufacturing and commercial interests of Providence is unquestionable, and the continued growth of this city, its trade and commerce founded upon sound business principles is assured, as is the high position it occupies in the financial world.

*Banks.*—Steadily the trend of banking interests is making toward the absorption of the smaller institutions by the larger, in Providence as in other large cities.

To-day (1904) the Providence Clearing House numbers 21 banks and trust companies, whereas when the clearing-house was established there were 34.

The Providence bank clearings for 1903, amounting to \$354,165,000, were the largest ever recorded.

There are in Providence 15 national banks, 2 state banks, and 6 trust companies, with an aggregate capital invested amounting to \$12,561,000. There are four savings banks in Providence whose combined deposits aggregate \$45,000,000, the deposits of the national and state banks and trusts amounting to \$87,500,000.

Soon after its passage in 1864, most of the state banks of Rhode Island availed themselves of the provisions of the Act of Congress, by which they became known as national banks. Within the last 50 years many private banking

houses have been established in Providence, that have exerted considerable influence in financial circles.

The first savings bank established in this city, the Providence Institution for Savings, was incorporated in 1819, the oldest bank being the Providence National, chartered in 1791; the next oldest bank after the Providence Institution for Savings, being the People's Savings Bank.

*Population.*—The population of the city in 1902 was 181,000. In 1900 out of a total population of 175,597 there were 55,853 persons of foreign birth and 101,585 of foreign parentage. A majority of those of foreign birth came from the United Kingdom. The 101,585 persons of foreign parentage included 42,791 of Irish, 13,481 of English, 8,808 of Italian, and 6,000 of French Canadian parentage. The growth of the population since 1800 is shown by the following figures: (1800) 7,614; (1820) 11,767; (1840) 23,171; (1860) 50,666; (1880) 104,857; (1890) 132,146. In June 1890 a part of the town of Johnson was annexed to the city of Providence, thereby increasing the population approximately 8,500.

A manufacturing city is seldom a city of home-owners, and Providence is no exception. In the population of 175,597 in 1900 there were 38,516 families, and of these but 4,087 families owned their homes free, while 29,696 families lived in hired homes.

*Schools and Colleges.*—On the ridge in the eastern side of the city stand the buildings of Brown University. Some of the quaint brick dormitories are over 100 years old, while the fine gymnasium and science laboratories were built but recently. (See BROWN UNIVERSITY.) Near by is the school for boys and girls founded by the Society of Friends in 1818. Other educational institutions in the city are the State normal school and the Rhode Island School of Design. The city has 100 public day schools as follows: 4 high schools, including a manual training school, 15 grammar, and 78 common schools, 8 schools for individual work, and 3 schools for backward children. The total number of teachers is 866, and at the last census there were 34,281 pupils. There are 18 evening schools and 24 kindergarten schools. The total number of children of school age, 5 years to 21 years, in 1900 was 47,928, of whom 40,090 were native- and 7,838 foreign-born; of these 26,416 were attending schools. The number of illiterate persons among those of native white parentage is very small, being but 180 in 1900; in that year the total number of illiterates was 10,029, of whom 8,607 were foreign born.

*Clubs.*—A number of clubs include in their membership the leading business and professional men of the city. The more prominent clubs are the Hope, Union, University, Central, West Side, Squantum, and Pomham. The two latter have elegant club-houses on the shores of the bay, some miles below Providence, and have numbered some famous men among their guests.

*Chief Buildings.*—By far the most imposing structure in the city is the new State House, a massively proportioned building, built of white marble with a large central dome. It was occupied first in 1900. The city-hall, a heavy granite structure; the county court-house; the public library; the English high school buildings; and the Roman Catholic cathedral of Saint



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Peter and Saint Paul are also worthy of note. The new union railway station, while not imposing, is commodious, pleasing in outline, and remarkably well designed. Of modern office buildings Providence has comparatively few for a city of its size, chiefly because its great manufacturing firms have offices at their works. There are, however, a number of commodious, substantial office buildings of modern construction, chief among which are the Bannigan Building, the Industrial Trust Building, the Union Trust Building, Butler Exchange, the Francis Building, the Studley Building, the Swarts Building, the Providence Washington Building, the Vaughan Building, the Lauderdale Building, Mercantile Block, the Tierney Building, the Equitable Building, the Barton Block, the Merchants Bank Building, the National Exchange Bank Building, the Lederer Building, and the Fletcher Building; other buildings of note are the Y. M. C. A. Building, the Manufacturers' Building, the Athenæum, the Public Library, and four of the largest department stores in New England, equaling any in metropolitan cities, namely, The Boston Store, Shepard's, O'Gorman's, and the Outlet. The Arcade, an old structure, was famous in its early days. In Exchange Square, fronting the railway station, stand the Soldiers' and Sailors' Monument, the handsome Bajnotti fountain, and an excellent equestrian statue of Gen. Ambrose E. Burnside. In Cathedral Square stands the Doyle Monument, erected in memory of the late Thomas A. Doyle, for 18 years mayor of the city of Providence; a man who, in his day, did more than any other individual to broaden and strengthen the commercial interests of the community of which he was the figure-head.

*Hospitals and Charitable Institutions.*—One of the first hospitals for insane persons established in this country, the Butler Hospital for the Insane, stands in beautiful grounds in the eastern part of the city on the Seekonk River. Other hospitals and asylums are the Rhode Island Hospital, the Rhode Island Homœopathic Hospital, the Dexter Asylum for Poor, Saint Joseph's Hospital, and the State Institution for the Deaf.

*Libraries.*—One of the first public libraries in America is now represented by the Providence Athenæum which has some 62,000 volumes. The Public Library contains some 90,000 volumes housed in a handsome building recently erected. Other libraries in the city are the library of Brown University and those of the Rhode Island Historical Society, the Rhode Island Medical Society, and the Young Men's Christian Association.

*Churches.*—Providence is the seat of an Episcopal and of a Roman Catholic bishop. The Roman Catholic cathedral of Saint Peter and Saint Paul is perhaps the most imposing church building in the city. Grace Church, almost cathedral in its interior decorations and arrangement, is known as the Bishop's Church of the Episcopal Diocese. The First Baptist Church associated from a religious point of view with Brown University since Revolutionary days, is an imposing reminder of the architecture of the period in which it was designed by Sir Christopher Wren. Saint John's Church, on North Main Street, is one of the oldest Episco-

pal churches in New England, and the Beneficent Congregational Church, more commonly known as "The Round Top Church," on Weybosset Street, has long been associated with the religious life of Providence. Other churches whose edifices are both imposing and attractive are, the Church of the Mediator and the First Universalist, the Union Congregational, the Central Congregational, the Central Baptist, the First Congregational, the Trinity Methodist Episcopal, All Saints' Memorial, and Saint Stephen's Episcopal. The total number of religious buildings, churches, chapels, and missions in the city is 128, 110 of these being of various Protestant denominations and 18 Roman Catholic.

*Parks.*—There are altogether 18 parks in the city, having a total area of 530 acres. Of these Roger Williams Park is the largest, covering 103 acres. It contains a pretty little lake, children's play-grounds, a bronze statue of Roger Williams, and for its size is one of the most attractive city parks in this country.

*Streets.*—There are 235 miles of streets, of which 189 miles are covered with broken stone or gravel, 31 with granite blocks, 5 with cobblestones, and 5 with asphalt.

*Government.*—The mayor is elected annually. A board of aldermen and a common council form the legislative. Most administrative officers are elected by the council, as are three park commissioners, the license and fire commissioners. The commissioner of public works is appointed by the mayor. The police force is under the direction of a police commissioner appointed by the State legislature.

*Finance.*—The assessed valuation of the city in 1902 was \$197,873,000, of which \$154,711,860 was real estate. The tax rate is \$16.50 per \$1,000. The city expenses now amount to about \$3,465,000 annually, of which \$740,000 is spent on schools, \$640,000 for the interest on the city debt; \$370,000 on the police department; and \$355,000 on the fire department. The city obtains its water supply from the Pawtuxet River; the system cost \$7,100,000 and includes 333 miles of distributing mains. The sewage of the city is emptied into Providence River some distance below the city, and there are in the city 192 miles of sewers. At the precipitation plant just north of Fields Point, the sewerage of the entire city is gathered into immense basins or tanks, where it is filtered, clarified, and emptied into the river a considerable distance below the point. This plant is of modern construction, and is considered one of the best in the country, having been erected by engineers of national reputation after a careful study of surrounding conditions.

*Public Utilities.*—The water, sewage and park systems of Providence have already been noticed. The local electric railway system is one of the best in the United States, and branches out into every accessible part of the adjoining towns. The Union Railway Company and the Providence Tramway Company have practically a monopoly of the streets used for transporting passengers and freight by electric-propelled cars. Their exclusive franchise lasts for 20 years from 1891, the conditions being the payment of a franchise tax not exceeding 5 per cent on gross earnings, and the maintenance of a portion of the streets which they occupy. The Providence Gas Company has an exclusive right for the



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same period to supply illuminating and heating gas within the city limits. It pays a franchise tax of 3 per cent on gross earnings, after paying 8 per cent on capital stock, and making reasonable provision for maintenance and extension. If there is still a balance it is to be applied to reduction of the price of gas. The Narragansett Electric Lighting Company has an exclusive right for 20 years from 1892 for the supply of electric light in the city, the franchise tax not being less than 3, nor exceeding 5 per cent, this being determined each five years by arbitration.

*History.*—Providence was founded by that great apostle of religious liberty for the New World, Roger Williams, who arrived from England in Massachusetts Bay Colony in February 1631. He was well received by the Puritans, as a "godly minister," but because of his boldness in announcing his views regarding the power of magistrates in religious matters he was forced to seek refuge with the Pilgrims at Plymouth. Subsequently he went to Salem, where his convictions regarding religious freedom incurred the displeasure of the general court, and in January 1636 he was ordered to return to England; he refused and fled into the wilderness. Accompanied by five other men from Salem he had no fixed abode for weeks, but in June 1636 he began a settlement at a point a little north of the present site of Saint John's Church in Providence. Williams obtained a grant to lands covering what is now that part of Rhode Island west of Narragansett Bay, from the Indians, the earliest deed on record being a memorandum dated 24 March 1637. In 1640 articles of agreement were adopted by the settlers as the basis of the town government, all affairs being regulated by a monthly town meeting. A royal charter was obtained in 1644 uniting various settlements about the bay, as "Providence Plantations in the Narragansett Bay in New England." Providence being on the mainland and more exposed to the attacks of Indians, grew less rapidly than Newport on the island of Rhode Island, and in 1676 was nearly deserted. Less favorably situated for shipping than Newport, Providence grew but slowly; in 1730 the population of Providence, which included four settlements, was 3,916. In 1750 the population of Newport was twice that of Providence, and in 1774 the population of the town of Providence proper was but 4,321, though by this time the population of Providence County was greater than that of Newport County.

The first notice of a school house in the town records appears in 1752. A charter for a college was granted in 1764, and Providence County raising the most money, the first building was erected at Providence in 1770. This was the beginning of Brown University. Providence was one of the first towns in America to have a public library, a set of books having been bought by subscription before 1754 by a company formed for that purpose. During the whole of the 18th century Providence was a quiet community, where people lived simply with few amusements. The first theatrical performance was given by an English company in 1762.

The first fire engine was purchased about 1755. The first advertisement of a regular stage line to Boston appears 1767; the stage made weekly trips. The first public market-house was erected in 1773.

In the disputes with England that preceded the outbreak of the Revolution, Providence took a considerable part. The first overt act of resistance to England was the destruction of the armed schooner *Gaspee* in 1772. During the Revolution Newport was occupied by the British from 1776 to 1779, and the commerce of Providence was almost cut off by the British fleet, though a number of privateers hailing from Providence preyed on English commerce.

After the Revolution commerce slowly moved again, trade being with Europe, China, and Central and South American ports. In 1801 a fire destroyed property valued at \$300,000, and in 1815 a great gale wrecked many vessels and did damage to the amount of \$1,000,000. From this time on the growth of Providence was steady if not rapid, the population about doubling every 20 years. Government by town meeting proving inadequate to meet the public needs, a city charter was adopted in 1831. The history of Providence during the 19th century is largely that of industrial progress in this country, and reference to the great manufacturing establishments of the city is made elsewhere.

*Bibliography.*—Bayles, 'History of Providence County' (1891); Greene, 'The Providence Plantations for Two Hundred and Fifty Years' (1886); for early history a brief historical sketch in Vol. XVIII. of the Tenth United States Census. The 'Early Records of the Town of Providence' has been published in 15 volumes (1892-9).

GEORGE H. WEBB,

*Secretary Chamber of Commerce.*

**Providence, Sisters of**, a religious order of the Roman Catholic Church, founded in France, according to some accounts in 1806, to others in 1820 (*Sœurs de la Charité de la Providence*), by Pastor Dujarrié in the parish of Ruilé, diocese of Le Mans (department of Sarthe). It gradually extended beyond this parish, and was authorized in 1826. A colony from Ruilé opened the first institute of the order in the United States on 22 Oct. 1840 at Saint Mary's, near Terre Haute, Vigo County, Ind. Establishments are conducted by the order in the archdioceses of Baltimore, Boston, and Chicago, and in the dioceses of Fort Wayne, Grand Rapids, Indianapolis, and Omaha. In 1904 the order had charge of 67 parochial schools and 20 academies for higher education. In 1904 there were 45 establishments of the order, the mother-house being at Saint Mary's, Vigo County, Ind.; and 800 members.

**Providence Plantations.** See RHODE ISLAND, *History*.

**Province**, is a territory, section or district of a nation or government. Among the Romans a province was a district of conquered country, governed by a proconsul or proprætor. The first Roman province was Sicily, 241 B.C. From the time of Augustus they were divided into the senatorial provinces, and the imperial provinces. The latter comprised those which were most exposed to hostile inroads, and the administration of which was left entirely to the emperor under the pretense of sparing the senate and people the trouble of managing them, but in reality to keep the army in his own hands. Under the empire the provinces were much better governed than they had been under the republic. One reason of this was that the em-



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perors were more disposed to pay regard to the complaints of the provinces than the republican courts had been, for the latter were largely composed of men who had themselves profited, or who hoped to profit, by the same kind of maladministration with which the governors were charged, and were therefore always willing if possible to connive at such offenses. In addition to this the provincial governors under the empire received fixed salaries, which lessened the temptation to resort to illegal exactions to indemnify themselves for the expenses that they necessarily incurred in soliciting the office that was an indispensable condition of their governorship.

In modern times the term has been applied to colonies or to dependent countries at a distance, or to the different divisions of a kingdom itself. The name has sometimes been retained by independent states. Thus, the Republic of Holland, after it had thrown off the Spanish yoke, was called the United Provinces; and the Argentine Republic used to be called the United Provinces of La Plata. In the canon law the term is applied to the jurisdiction of an archbishop. In the Roman Catholic Church it is also given to the territorial divisions of an ecclesiastical order such as the Franciscans, as well as to those of the Propaganda.

**Province House**, a brick mansion in Washington Street, Boston, Mass., built in 1679, and occupied by numerous colonial governors. It was burned in 1864.

**Prov'incetown**, Mass., town, Barnstable County; at the extremity of Cape Cod, on Cape Cod Bay and on the New York, New Haven & Hartford railroad. It was in the harbor of Provincetown that the Mayflower anchored in 1620 before going to Plymouth (q.v.), and that the Pilgrims prepared the compact by which their colony was to be governed. The town was not settled till 1680 and was incorporated in 1727. It has a large harbor, deep and well sheltered; it was formerly an important whaling town, but this industry has greatly declined. Its cod and mackerel fisheries are now its leading industries and there are several wholesale fish houses; it also contains oil factories, and small vessels and fishermen's boats are built. It has also been growing in popularity as a summer resort, and contains several hotels. It has a public library and a public high school. Pop. (1890) 4,642; (1900) 4,247.

**Provo** (prō'vō) **City**, Utah, county-seat of Utah County; on the Provo River, and on the Oregon Short Line and the Rio Grande Western R.R.'s; about 45 miles south of Salt Lake City. It was settled in 1849, and in 1851 was chartered as a city. It is in a region in which the principal occupations are agriculture, stock-raising, and cultivation of fruit. The chief manufactures are flour, lumber, tin and iron roofing, woolen goods, and canned fruit. There is a large trade in farm products, live-stock, fruit, lumber, and in the importing of groceries and textiles. The place is visited by many tourists on account of the Provo Cañon, Utah Lake, and Bridal Veil Falls in the vicinity. It has the State Insane Asylum and a Mormon tabernacle. It is the seat of the Brigham Young Academy (Mormon). Pop. (1890) 5,159; (1900) 6,185.

**Provoost**, prō-vō', **Samuel**, American Protestant Episcopal bishop: b. New York 11 March 1742; d. there 6 Sept. 1815. He was graduated at King's College (now Columbia) in 1758, went to England to prepare for ordination, studied at Cambridge University, and was ordained deacon and priest in 1766. Returning to America, he became rector of Trinity Church, New York, the second of four successive rectors who were raised to the episcopate. Throughout the Revolution he took a firm stand in favor of the liberty of the colonies, and was chaplain to Congress in 1785 as well as to the United States Senate in 1789. After presiding at the general convention held in Wilmington in 1786 (the absent Seabury being the only bishop in America), he set sail for England in company with William White to receive Episcopal consecration. A special act of Parliament having been passed empowering the archbishops of Canterbury and York "to consecrate to the office of a Bishop persons being subjects or citizens of countries out of His Majesty's dominions," Provoost and White were consecrated by these prelates and the bishops of Bath and Wells and Peterborough in the chapel of Lambeth Palace, 4 Feb. 1787. Bishop Provoost resigned his see in 1801, but the House of Bishops declined to receive his resignation, giving consent, however, to the consecration of Dr. Benjamin Moore as assistant bishop. He was buried in Trinity churchyard.

**Prov'ost**, one who is set over others; one who is appointed to superintend or preside over something; the principal, head, or chief of certain establishments or bodies; applied to (1) a jailer; the keeper of a prison; (2) the heads or principals of several colleges in the English universities of Oxford and Cambridge; the principal of the University of Dublin.

**Provost-marshal**, in military affairs, an officer who takes cognizance of offenses against discipline, orders the arrest and the punishment of deserters and other offenders according to the sentence of a court-martial, and maintains order generally. See COURT-MARTIAL; MILITARY LAW.

**Proxy**, the agency of one person who acts as substitute for another. In Great Britain every member of the House of Lords was formerly permitted, on obtaining a nominal license from the crown, to appoint another lord of Parliament his proxy to vote for him in his absence. Only a spiritual lord could be proxy for a spiritual lord, and a temporal for a temporal lord, and no peer could hold more than two proxies at the same time. Proxies were never used in judicial business, or in committees of the House, nor could a proxy sign a protest. The practice of admitting proxies was discontinued in 1867. Shareholders in joint-stock companies may vote by proxy.

**Prud'hommes**, **Conseils de**, kōn-sā-ē dè prū-dōm, courts of conciliation in France for deciding small disputes between workmen and employers. The first councils called by this name in Paris were formed in 1296 in the reign of Philippe le Bel, when 24 *prud'hommes* were appointed to assist the provost of the merchants in settling disputes between merchants and manufacturers at the fairs and markets. After the revolution of 1848, at which period 75 towns



had conseils de prud'hommes, the whole legislation on this subject was revised. All the patrons and workers of industrial establishments within the circle of jurisdiction of the council of prud'hommes were made eligible as electors. In June 1853 a law was passed which, with some modifications, is still in force. The patrons and the workmen are formed into separate electoral colleges, for the latter including managers and foremen, each to elect an equal number of prud'hommes. The general council, besides the president and vice-president, is composed of an equal number of patrons and workers. The jurisdiction of the councils is summary and without appeal for sums under 200 francs; above that sum an appeal lies to the tribunals of commerce. The presidents and vice-presidents of the conseils de prud'hommes are appointed by the executive power, and need not belong to either of the classes from which the other members are chosen. The number of conseils de prud'hommes is now about 140.

**Prud'den, Theophil Mitchell**, American physician and author: b. Middlebury, Conn., 7 July 1849. He was graduated from the Sheffield Scientific School, Yale, in 1872. Besides contributing to the scientific literature of bacteria and their influence in disease, he has written entertainingly on these and other scientific topics for the general public. He is professor of pathology in the College of Physicians and Surgeons, New York. Among his writings are: 'Manual of Normal Histology;' 'Handbook of Pathological Anatomy and Histology' (1885), with F. Delafield; 'Story of the Bacteria' (1899); 'Dust and its Danger'; 'Water and Ice Supplies' (1891).

**Prudentius**, proo-dĕn'shĭ-ŭs, **Aurelius Publius Clemens**, Christian hymn writer: b. Spain, probably at Saragossa, about 350; d. 410. He practised the profession of an advocate, and afterward became a functionary of the government. From a life of pleasure and worldliness he was reclaimed by his conversion to Christianity, retired to a cloister in his 57th year, and there spent the remainder of his life. It was during these latter years that he wrote the religious poems which have made his reputation as the greatest Christian poet of the 4th and 5th centuries in the Latin Church. This was the golden age of Latin patristic letters, and his contemporaries included Ambrose, Jerome, and Augustine. It is quite evident that he was a profound student of classic latinity, for he shows a complete mastery of the epic and lyric metres of Roman literature, and at the same time these poetical works are purely Christian, full of devotional feeling and theological lore. His 'Liber Cathemerinon' consists of 12 religious poems for daily use; while 'Psychomachia' is an allegorical description of the struggle between good and evil in the human soul. 'Peri Stephanon' is a metrical martyrology. Consult Glover, 'Life and Letters in the Fourth Century' (1901).

**Prud'hon, Pierre**, pĕ-ār prŭ-dôn, French painter: b. Cluny, Saône-et-Loire, 4 April 1758; d. Paris 16 Feb. 1823. He received his first instruction in his art at Dijon under Desvoges and in 1782 he took himself to Rome and formed his style on that of the 16th century masters, especially Correggio. He returned to Paris in 1769 and painted portraits, gaining with diffi-

culty his living under the Terror. He gradually made himself known, although his misfortunes had been early aggravated by a marriage undertaken under circumstances of great imprudence; and in 1800 he became famous by his timely picture 'Truth Descending from Heaven.' In 1808 appeared in the Salon his 'Psyche Carried off by Zephyrus' and 'Crime Pursued by Justice and Divine Vengeance.' From this time his position was assured. His importance in the history of French art history lies in the fact that he indicated a revolt from the cold classicalism of David, introduced freer and bolder pictorial effects than had so far obtained in French art, and utilized the emotional and sentimental resources which lie in the skilful distribution of light and shade in a picture. Consult: Clement, 'Prudhon, sa Vie et ses Œuvres' (1880); Gauthiez, 'Pierre Paul Prudhon' (1886).

**Prue and I**, a work by George William Curtis, first published in 1856. It is a series of sketches or meditations showing the enjoyment to be derived from even the most commonplace existence. The papers are supposed to be written by an old bookkeeper, who strolls down the street at dinner-time, and without envy watches the diners-out. But whatever the genial old bookkeeper is thinking or relating, his heart is full of his Prue, and from beginning to end it is always "Prue and I."

**Prune**, the dried fruit of certain varieties of plums, extensively cultivated in the Danubian principalities, France, and Italy, in Europe, and in recent years introduced into California, Oregon, and Washington, in the United States; a product of great commercial importance and nutritious qualities. Any variety of plum having the requisite percentage of sugar, plenty of solids and, when cured, will keep for a long time without deterioration, is suitable for making prunes. France produces annually 80,000,000 pounds of prunes of deservedly high reputation for size, perfect curing, and attractive manner of packing.

Prune growing was introduced into California in 1856, from scions imported from France, and in 1863 prunes were for the first time publicly exhibited as a California product. The first large orchard was planted in 1870, yet in 1903 the number of trees in the State was estimated at 2,000,000. Attempts have been made to cultivate the prune in other parts of the United States, but without success, owing to the absence of requisite conditions for curing. Cultivation has been successfully extended to Australia and South America, and these countries will ultimately prove formidable competitors in the trade. In California where the wet and dry seasons are absolutely defined, and from May until October rains are infrequent, never exceeding a fraction of an inch in volume, exist the best natural conditions for perfect curing of the prune. The fruit is not picked until perfectly ripe. It is then passed through a grader which separates the different sizes in order to secure uniformity in drying, as small fruit will dry in a shorter time than a larger grade. Next it is dipped into a weak solution of boiling lye to take off the bloom and facilitate curing. Sometimes the outer skin is punctured by needles so that the surplus moisture in the fruit may more readily escape. In large establishments an end-



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less-chain machine is employed in dipping, but where it is done by hand, a wire dipper is used; and the fruit is again washed in fresh water after the process to clean off the lye. After spreading upon wire-netting trays, the fruit is taken to the field and exposed to the sun's heat until properly cured. The summer days in California are invariably hot, and the green fruit, after exposure to the sun's rays for 6 to 10 days, depending upon size, is thoroughly dried. (In eastern Europe it is customary to cook the green fruit partly before exposing it to the sun.) In countries where periods of dry weather are liable to be interrupted, evaporators are used in extracting the moisture of the fruit, the trays being introduced into a chamber in which the temperature is raised to 140° to 180°, and where they remain from 12 to 48 hours. To understand the exact amount of time necessary to perfectly cure the fruit is essential, as if this matter is ill-judged an inferior quality of product results. When sufficiently cured, the fruit is taken from the trays to bins, where it is allowed to "sweat" for two or three weeks, after which it is ready to be regraded and marketed. Grades are indicated by the number of prunes to the pound, according to the size; 30 to 40 to the pound represents the highest grade, whence the size falls to 120 or 130, the smallest. Before final packing the prunes are "processed" by dipping into a hot solution of water with glycerine or fruit syrup, which not only adds to the beauty and polish of the fruit, but extirpates insect germs that may be present. Producers seldom introduce a substance in the process mixture for increasing weight. In shipping, sacks are employed when a buyer intends to pack for his own trade, but the larger quantity is packed into boxes of stated dimensions at the place of shipment. French methods are also practised in packing higher grades in fancy boxes with attractive linings. In quantity the States of California, Oregon, and Washington produce a larger amount than all foreign countries put together, the output of the three States for 1903 aggregating fully 200,000,000 pounds. Large quantities of the better sort of American fruit are imported into Europe, where they rank equally with the finest brands of France.

Orchards of large size are found in various parts of California. They require careful cultivation (see PLUM), and frequent pruning, besides occasional irrigation. The nomenclature of the prune-making plum is large and abounds in synonyms. The following varieties are most favored in the Western States: Green Gage, Yellow Egg, German Prune, Hungarian, Robe de Sargeant, Bulgarian, Tragedy, Golden Champion, Willamette, Pacific, Tenant, Steptoe, St. Martins Quesche, Brignolle, Dalle de Hongrie, Giant, and others. Consult: Bailey, 'Cyclopedia of American Horticulture,' titles 'Prune'; 'Plum'; 'California'; and 'Evaporation of Fruits' (New York 1900-2).

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**Prunel'la**, a kind of woolen stuff of which clergymen's gowns were once made, and which is still used for the uppers of ladies' boots and shoes.

**Pruning**, the removal of parts of plants in order to economize and divert energy in desired directions. Fundamentally the various

objects for which plants are pruned are: (1) training, in which the limbs are started and disposed as desired; (2) pruning proper; (3) trimming or the shaping to some artificial form. The first is of prime importance in the early years of orchard fruits, but is of smaller and smaller application as the subjects dealt with are shorter-lived or less tree-like. The second is important, as a rule, during the whole life of the plant, in many cases, especially of trees commencing when the plants are set. The third is usually of small importance, at least in America, being employed mainly with such ornamental subjects as hedges, topiary specimens, and dwarf trees.

Popular opinion concerning the practice has changed within recent years. Formerly it was against pruning upon the ground that the plants suffered, and that the practice was unnatural. But nature is an inexorable pruner, as the straight limbless trunks of forest trees, and the dead twigs and branches of trees left to themselves sufficiently show. The horticulturist improves upon nature in doing his work intelligently, not only with respect to what shall be removed, and when, but how it can be best done, so as to enhance the healing of the wound. The practice is essential to successful orchard-fruit culture, and to a greater or less extent with other plants. With woody plants that have been grown in nurseries it is necessary to cut back the tops to approximate a balance between the top and roots which latter have been necessarily reduced in digging. The usual practice in this matter is to remove at least one half of each branch that is to remain, and to cut off all the others. Many orchardists trim off all the limbs, and some leave nothing but a switch or even a stub, claiming that they can then form the head of the tree where they desire, and that the tree more quickly recuperates than if a larger proportion of top is left. Certain it is that in practice the trees untrimmed at transplanting time generally suffer severely.

Among the principal objects sought in the pruning of fruit-trees the following may be mentioned: To divert plant-food from wood production into fruit formation and development of improved specimens; to keep, not to force, the tree in bearing condition, which is secured by regular annual attention and not by intermittent neglect and butchery; to prevent the excessive production of wood which is usually at the expense of fruit production and ordinarily is a sequence of excessive pruning; to keep the tree within manageable limits so as to facilitate cultivation, spraying, and harvesting; and to admit light and air to the tops so that the fruit may be well colored.

Before any pruning is done, however, it is essential to know the exact manner in which the trees or shrubs bear their fruits, for unless this is understood the operator may be working against his own interests and injuring the tree at the same time. For instance, apples and pears bear their fruits upon gnarly twigs called spurs, the plum and cherry usually upon spurs, but sometimes also on the axial growths; the peach bears usually upon the axial growth of the previous season, but also to some extent upon spurs which live only two or three years as a rule; the quince bears upon terminal shoots of the present season; the grape upon shoots of



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the current season; the raspberry and blackberry usually upon shoots of the previous season, the shoots dying after production; and the currant and gooseberry upon wood one or more years old. Further advantage may be taken of the method of fruit production in preventing the necessity of thinning, the fruit-buds being removed by the cutting out of the fruit-bearing wood.

In the pruning of ornamental subjects the same principles apply. Except for removing straggling, unsightly, or unnecessary growths, the pruning has mainly to do with flower production. Flowering shrubs and trees may be divided into two groups; those which produce their flowers from buds which were matured during the previous season; and those whose buds are developed during the current year. The one rule that will apply to these subjects is: Prune after flowering. If members of the first group are pruned during the winter they will generally suffer severe loss of flower buds; members of the other group, however, should be pruned, preferably, in early spring about the time that growth starts. Properly done and at the right time the production of bloom should be greatly enhanced with each group.

There is considerable difference of opinion as to when subjects should be pruned, but if wounds are properly made; that is, close to the main stem without leaving any stub, and if the large ones are protected from decay during the healing process, they may be pruned at any time, preferably, perhaps, just before the season of most active growth when the object is wood, and after this period if the object is fruit. Trees grown as cordons, espaliers, etc., require the greatest skill, but these practices are largely matters of training and are of rare application in the United States.

Consult: Bailey, 'Cyclopedia of American Horticulture' (New York 1900-2), 'Pruning Book' (New York 1900-2).

**Prunus**, a genus of shrubs and small fruit-trees of the rose family, about 75 of which are widely distributed, especially in the north temperate zone, and include many leading fruits of the world and many species of ornamental value. They have alternate leaves; solitary or clustered, pink or white flowers which appear usually in spring; and drupaceous fruits containing one hard-stoned seed. The number of varieties and hybrids is legion; they include weeping, double-flowered, variegated-leaved, and diversely colored subjects, besides the host of varieties cultivated for their fruits. Their range of hardiness varies with the species, some being hardy in the cold north and plains States, others tender even at the latitude of New York. The most important members of the genus are treated under their own titles, as ALMOND; APRICOT; CHERRY; NECTARINE; PEACH; PLUM; PRUNE; SLOE.

**Pruri'tus**, itching, a symptom of various skin diseases. It may occur independently of any structural alteration of the skin, as a neurosis. It may involve the skin of the entire body or be limited to a particular region, such as the anus, scrotum, or vulva. The sensation is described as prickling, burning, or crawling. It is very annoying when slight, and may be so severe as to destroy all sense of comfort. Excitement and overheating, even the warmth

of the bed at night, cause at times troublesome exacerbations. The etiology of this affection is frequently obscure. Impaired general health and a neurotic tendency are predisposing causes. Pruritus senilis is a distressing form occurring in advanced age, and is due to degeneration of the skin. Pruritus hiemalis (winter itch) is peculiar to cold weather. Other causes are the change from light to heavy under-clothing; ingestion of certain drugs, as opium; sometimes hepatic and renal disease; and the circulation in the blood of abnormal biliary constituents, as in jaundice, and of other abnormal material in diabetes. Localized pruritus frequently depends upon a venous congestion of the part; thus pruritus ani is invariably aggravated by constipation and obstruction of the portal circulation; and in pruritus vulvæ, uterine engorgement and pregnancy are exciting causes. Worms not infrequently produce itching of the anus and of the nose, the latter being a reflex condition. The almost constant scratching caused by a persistent localized pruritus is likely to produce eczema.

In treatment the general health is to be improved by hygienic measures; sometimes an entire change of diet, scene, etc., is necessary. Internal medication should be left to the physician. Local remedies are palliative, only relieving the discomfort until the cause of the itching is removed. Among the palliatives are carbolic acid, borax, soda, starch, chloroform in powder, liniments, solutions, and ointments.

**Prussia** (German *Preussen*), a kingdom comprising the greater part of North Germany, and constituting the empire state of Germany (q.v.), its king, by the constitution of 1871, being emperor of Germany. The kingdom extends from lat. 49° 6' to 55° 35' N., and lon. 5° 50' to 22° 15' E. It is bounded south by Alsace-Lorraine, Bavaria, Saxony, Bohemia, and Austrian Silesia; west by Luxemburg, the Netherlands, and Belgium; north by the North Sea, Denmark and the Baltic; northeast and east by Russia. The length of Prussia is 700 miles from east to west, and breadth 470 miles north to south. It is divided into the following provinces:

PROVINCES	Area Eng. sq. miles	Pop. 1900
East Prussia (Ostpreussen).....	14,284	1,996,626
West Prussia (Westpreussen)....	9,859	1,563,658
Berlin, City of.....	25	1,888,848
Brandenburg .....	15,382	3,108,554
Pomerania (Pommern).....	11,630	1,634,832
Posen .....	11,186	1,887,275
Silesia (Schlesien).....	15,568	4,668,857
Saxony (Sachsen).....	9,751	2,832,616
Schleswig-Holstein .....	7,338	1,387,968
Hanover (Hannover).....	14,870	2,590,931
Westphalia (Westfalen).....	7,803	3,187,777
Hesse-Nassau .....	6,062	1,897,981
Rhine (Rheinland).....	10,423	5,759,798
Hohenzollern .....	441	66,780
Total.....	134,622	34,472,509

The small island of Helgoland transferred by Great Britain to Germany in 1890, belongs to the government of Schleswig-Holstein.

**Topography**.—Prussia is naturally divided into two great sections, the larger belonging to the great European plain, and the other in the



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southwest belonging to the German plateau. The eastern provinces form a level district of over 50,000 square miles, intersected by a few inconsiderable hill chains, the highest elevations of which do not exceed 700 feet. The southwestern boundary of Silesia is formed by the Riesengebirge, or Giant Mountains (average elevation 4,100 feet, highest peak, 4,929 feet), and their continuations, the Iser Ridge and the Lusatian Mountains. The northern part of the province of Saxony, which extends from the river Elbe to the Werra, is almost a perfect level, interrupted only by inconsiderable hills and an isolated elevation of 1,086 feet, the Petersberg, near Halle. The southern portion to the southwest of the river Saale is intersected by projecting spurs of the Harz Mountains (highest elevation, the Brocken or Blocksberg, 3,506 feet), and the Thuringian forest (highest elevation the Dolmar, 2,184 feet). The western provinces contain the northwestern group of the mountain system of Germany, its numerous ridges having as many distinct names. The more important are: on the right bank of the Rhine, the Weser Hills, including the picturesque gap known under the name of Porta Westphalica, the Teutoburg Forest (the battle ground of the Germans and Romans), the Rothhaar Hills, the Sauerland Hills, the Seven Mountains (Siebengebirge), and Westerwald (2,000 feet); on the left bank of the Rhine, the Hundsrück (3,000 feet), Hohe Veen, and Eifel (1,600 feet). The Hohenzollern principalities are intersected by the Rauhe Alp. The coast line of Prussia on the Baltic and North seas has a length of over 1,000 miles. The sea being shallow near the coast, and full of shifting sand banks, there are few good harbors; the best are Helgoland, Kiel, Stralsund, Colberg, and Dantzic. Beside the open bays of Bodden, Putziger Wyck, Prorer Wyck, and Tromper Wyck, there are several extensive lagoons or haffs, separated from the open sea by narrow strips of land or strings of islands. Of these lagoons the Great and Little Haff, whose head is formed by the embouchure of the Oder River, the Frisches Haff, which receives the waters of the Nogat River, and the Kurisches Haff, are the most extensive.

*Hydrography.*—All the river systems of Prussia belong to the basins of the Baltic and North Seas. The principal rivers in the eastern section are the Memel, Vistula with its tributaries the Drewenz, Ossa, Brahe, and Mottlau, Oder with its tributaries the Oppa, Ohlau, Bartsch, Bober, Neisse, and Warta, and Elbe with its tributaries the Saale and Havel with Spree. Independent of these are a number of coast rivers, namely, the Dange, Pregal, Elbing, Leba, Lupow, Stolpe, Wipper, Persante, Rega, Ucker, Ihna, Peene, and Recknitz, nearly all of them navigable for some distance. The western section is watered by parts of the river systems of the Werra, Ems, and Rhine. The Rhine flows through Prussian territory a distance of 185 miles, receiving on the right bank eight tributaries, namely, the Lahn, Wied, Sieg, Wupper, Ruhr, Lippe, Berkel, and Vechte; and on its left bank the Nahe, Moselle, and Ahr. Beside its rivers Prussia has a large number of artificial water courses, the Vistula and Oder being connected by the Bromberg canal, the Oder and Spree by the Müllrose canal, the Havel and Elbe

by the Plaue Canal, and the Baltic and North Seas by the Kaiser Wilhelm Canal. Other canals connect small adjacent river systems in the western provinces. Of lakes Prussia contains an immense number, especially in the level northeastern section; but none of them are important either for their extent or as affording facilities for commerce. The largest lake in the province of Prussia, Spirding, covers an area of only 37 square miles. The province of Saxony contains a small salt lake in the vicinity of Halle, the Röblinger See. In the Rhenish province the Laacher Lake, an old crater, nearly 8,000 feet square and over 200 feet deep, fed by 40 springs, is renowned in legendary lore. The total number of lakes covering not less than 200 acres each is 389, and their total area 750 square miles, the aggregate area of all other lakes being 700 square miles. There are large swamps on the lower course of the Ems, Havel, Oder, Warta, and Netz rivers, attempts to drain which have been fairly successful especially in the case of the great Bourtanger Moor since 1870.

*Geology.*—Tertiary strata prevail over almost the whole of the level portion of Prussia. In the mountainous districts of the eastern and southern parts of the state the loftier summits are composed of granite, gneiss, mica schist, porphyry, diorite, etc. Secondary formations, composed of mountain limestone and the various strata of the Carboniferous system, occur in Silesia, chiefly in two localities in Upper Silesia along the frontiers of Cracow and Russian Poland, and among the mountains in the county of Glatz, and toward the Riesengebirge. Chalk and its accompanying beds occur in many different localities, more especially on the north side of the Harz, and in Silesia, both in its higher districts and on the frontiers of Poland. Prussia has a great variety and abundance of mineral wealth. Of nearly 110,000,000 tons of coal mined in Germany in 1900 Prussia produced almost 102,000,000, and she contributed 34 million tons of lignite to the total amount of 40 million tons for the empire. Her production of iron ore for that year (4¼ million tons) was nearly a quarter of the total for all Germany, and her output of pig-iron (5¾ million tons) was more than two thirds of the production of the whole empire. About a half of the zinc production of the world comes from Prussia, her total for 1900 being 155,760 tons, and most German lead and copper are of Prussian origin. Cobalt, nickel, and other metals are found and worked in smaller quantities, and pyrites is obtained from Westphalia. Other valuable mineral productions are rock-salt and salts of potassium, magnesium, mineral oils, and peat.

*Climate.*—Within the same ranges of latitude, and at nearly equal heights above the sea-level, the climate of the western is superior to that of the eastern division of the state. The mean annual temperature is about 1 degree higher, the winter is milder, and the summer cooler, and the range of the thermometer is accordingly confined within narrower limits. The fall of rain, however, is greater, averaging 20 inches in the west and only 15 inches in Silesia and the eastern provinces. This, however, cannot be considered a disadvantage, as the larger quantity of the western is by no means in excess, and only tends to make vegetation more luxuriant.



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*Forestry, etc.*—The best afforested districts are Frankfurt, Potsdam, Liegnitz, Marienwerder, Cassel, Königsberg, Oppeln, and Posen. Sylvicultural knowledge and practice have made great strides in recent times. The fisheries form an important source of revenue. For further details, and for *Flora*, and *Fauna*, see GERMANY.

*Agriculture, etc.*—The system of agriculture generally pursued, though much improved in modern times, is still very defective. The land is much subdivided, especially in the more populous districts, small farms of three and four acres being the most common holding. The soil includes all varieties, from light sands to the most obdurate clays, but has been subdivided into the three classes of wheat land, light loams of middling quality, and sandy or stony land. On the first soil, as its name indicates, wheat is the prevailing crop, and alternates chiefly with hay and beans. Rye and oats are both much more extensively grown and used than wheat; barley is of smaller importance, alike in the area occupied and the annual produce. Like the rest of Germany, Prussia now imports a considerable quantity of wheat and other cereals. Another important crop, the culture of which is more or less extensive in every district, is that of potatoes. Of these a great proportion are consumed by distilleries in the manufacture of a coarse kind of spirit. Beet-root, for the production of sugar has for years been a very important crop. Hemp and flax are also extensively cultivated, more especially the former, which furnishes large supplies for the home manufactures, though much has to be imported. Much tobacco is also raised. Oil plants are important objects of culture, particularly linseed, which forms an important article of export from Eastern Prussia, while large exports of clover and other seeds take place from Brandenburg and the Rhenish province. To the latter province the culture of the vine is chiefly confined. The largest space occupied by vineyards is in the governments of Coblenz and Treves. The culture, on a smaller scale, is carried on in the governments of Cologne and Aix-la-Chapelle, and also in Saxony, Brandenburg, Posen, and Silesia. The breeds of domestic animals are being improved, and much has been done by the government, more especially in the case of horses, by the establishment of breeding studs in different localities, and on a general system.

*Commerce.*—The principal exports of Prussia are grain, flax, hemp, linseed, oil-cake, flour, sugar, timber, cement, linen and linen yarn, spirits, earthenware, chemicals, wool, woollen cloth, hosiery, iron, and zinc; the principal imports, coal and coke, chemicals, cotton and cotton twist, stone and building materials, iron and ironware, petroleum, grain, tea, oil and turpentine, raw hides, wine, herrings, salt, etc. The Zollverein or Customs Union, by giving a free interchange of communication between the different states belonging to it, makes it difficult to specify the exact amount of trade which each state possesses, but there cannot be a doubt that that of Prussia is very extensive.

*Manufactures.*—These have made great progress, and are generally diffused over all the provinces. Certain localities, however, form distinctive manufacturing centres, such as the large towns, the valleys of the Rhine basin, the districts of Aix-la-Chapelle, Düsseldorf, Arns-

berg, the south of Hanover, southwest Saxony, Lusatia, etc. Manufacturing industries (including the building trades) give employment to over 12,000,000 persons. The chief textile manufactures are those of linens, cottons, and woollens. Silesia, Brandenburg, and Westphalia are the provinces in which the linen industry is chiefly developed. The cotton manufacture has its chief seat on the Rhine, particularly in the neighborhood of Düsseldorf and Elberfeld-Barmen, but is also carried on to a considerable extent in Westphalia and Hanover, in Silesia, particularly in the government of Breslau, and also in the province of Brandenburg. The woollen manufacture has its chief seats in Brandenburg and the Rhenish province. Silk and velvet are made in the Rhine Valley, as also at Berlin. The number of persons employed in the textile industries is about 430,000. The manufactures in metal employ over 500,000 persons. In iron and steel ware the first place belongs to the Rhine province and the Westphalian government of Arnsberg. Among particular localities may be specified Essen, for the celebrated steel works of Krupp, where gigantic cannon are made; Solingen for its fine saws and tools; Aix-la-Chapelle and Burtscheid, Altena and Iserlohn for needles and pins; Remscheid and Hagen for locks and various similar kinds of hardware. Berlin has long been famed for its fine castings, many of which, whether as articles of ornament or utility, are unsurpassed. In connection with these may be mentioned type-founding, which, as well as printing, forms an important branch of industry in Berlin. The leather manufacture is important, and includes, besides ordinary leather, the finer varieties and parchment. Pottery in all its varieties forms an important industry. For porcelain and the finer kinds of ware Berlin and St. Martin, near Treves, are the most celebrated localities; excellent stoneware of a more common description is made extensively in the south of the province of Saxony, in Liegnitz, and in the Rhenish province. Common pottery is made in all the provinces, more especially in those of the east and centre. One of its most celebrated localities is Bunzlau. Glass does not rank high as a Prussian manufacture. The principal localities are the governments of Treves, Minden, and Oppeln. The most important paper-mills are in Silesia, Saxony, and Westphalia. Other manufactures carried on to such an extent as to be of national importance, are beet-root sugar, chocolate, chicory, chemical products, and tobacco. Of these the first is very important, being carried on chiefly in the provinces of Saxony, Hanover, and Silesia. The tobacco industry is also important, and is carried on in extensive factories in the Rhenish province, in Brandenburg and Saxony. The last manufactures deserving of notice are beer and spirits, the consumption of which is immense. The greatest number of distilleries is in the Rhine province, though Silesia has also a very large number. Of the breweries the Rhine province has above one fourth. Sparkling wines are made near Coblenz and elsewhere.

*Communications.*—Both from the nature of the country and the number of navigable streams which intersect it, Prussia has great natural facilities, which have been greatly extended by roads, canals, and railways. Prussia had, 15



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April 1901, 19,088 English miles of railway belonging to or administered by the state, and 1,436 miles owned and administered by private companies, making a total of 20,524 miles. The whole of the railways of Prussia will eventually become national property. The principal ports of Prussia are Memel, Pillau, Königsberg, Dantzic, Colberg, Swinemünde, Stettin, Wolgast, Stralsund, Kiel, and Flensburg on the Baltic; and Altona, Hamburg, Geestemünde, Leer, and Emden on the North Sea. The merchant navy of Prussia in 1900 consisted of 2,074 vessels of 270,304 tons register, of which 513, of 191,412 tons register, were steamers. Among the foreign vessels which trade to Prussian ports the tonnage of Great Britain is about one third more than that of any other nation. The second place is occupied by the Dutch, and the third by the Danes. In some of the ports shipbuilding is carried on with activity. Stettin builds about one third of the whole.

*Coins, Weights, and Measures.* See GERMANY.

*Government.*—Prussia is a monarchy hereditary in the male line, and from the absence of recognized constitutional checks was, previously to the European revolutionary movement in 1848, in theory absolute. The present constitution was mostly framed by the government, with the aid of the constituent assembly, in 1849, and proclaimed 31 Jan. 1850. It has been modified by royal decrees, of which no fewer than 16 were issued between April 1851 and May 1888. The sovereignty at present belongs to the house of Hohenzollern. The king, whose functions are both executive and legislative, attains majority at the age of 18. He is assisted by a council of ministers appointed by royal decree. A representative assembly composed of two chambers shares the legislative authority with the king. The consent of the king and of both chambers is necessary to all laws. Financial projects and estimates are first submitted to the lower chamber, and must either be accepted without amendment or rejected by the higher. Each branch of the legislature has the right of proposing laws. The upper chamber or House of Lords (*Herrenhaus*) is composed of princes of the blood of the reigning and former sovereign families of full age; about 100 heads of noble families, and over 200 other members, comprising great functionaries of the kingdom, representatives of towns, corporations, and universities, etc., nominated for life by the king. The second chamber or House of Deputies (*Haus der Abgeordneten*), since the enlargement of the kingdom, consists of 433 members. The primary qualification of electors is based on taxation, and is the same as for municipal elections. The primary electors are divided into three classes, according to the amount of their taxation. The first division consists of those who pay the highest taxation, the second who pay the medium, and the third of those who pay the lowest amounts; and the numbers in each division are determined by the total amount of taxation, which is equally distributed between the three divisions. The indirect electors (*Urwähler*) elect the direct electors (*Wahlmänner*), who choose the representatives. The deputies are chosen for three years, and the new members must be elected within six months of the dissolution of the chamber.

The chambers are regularly convoked each November. Members accepting office must be re-elected. Members of the second chamber receive 20 marks (\$5) a day, acceptance of which is obligatory. A legal majority of members must be present when a resolution is decided on.

Prussia is represented in the Imperial Bundesrath by 17 members and in the Imperial Reichstag by 236.

*Finance.*—The estimates of public revenue and expenditure submitted by the government to the chambers are now always made to balance each other, but the actual expenditure has in recent years usually been under the revenue, and sometimes there has been a very considerable surplus. The revenue and expenditure for the year 1901–2 were each estimated at an amount equal to \$662,250,000. The total debt by the budget of 1901–2 was \$1,650,950,000. A certain part of the debt has been incurred for the construction of railways, and is a profit-bearing investment. The state railways yield a very considerable proportion of the total annual revenue.

*Ethnology.*—The greater part of the people are Germans, but in several quarters the Lithuanian and Slavonian stocks preponderate. In the northeast corner of the monarchy, between the Deine, Angerap, Goldapp, Pregel, and the Inster and Memel, Lithuanian is spoken, read, written, and taught. The Slavs, chiefly Poles, Czechs, and Wends, occupy the south parts of Gumbinnen, Königsberg, and Marienwerder, the greater part of Posen, and no inconsiderable part of Silesia. French are found chiefly in the west part of the monarchy, but partly also in the province of Brandenburg, where they are descendants of the French Protestants who found an asylum here from the tyranny of Louis XIV.

*Population.*—As given in the table of provinces the population in 1900 was 34,479,509, of whom 16,971,425 were males, and 17,501,084 females, or 103.12 females per 100 males. The average density of the population is about 256 to the English square mile. The Rhine province (*Rheinland*) is the most densely peopled, while Pomerania and East Prussia have the smallest population per square mile. Almost every province showed an increase in 1900 over the population of 1895, the only exception being East Prussia. The urban population in 1895 was 12,954,591, showing an increase since 1890 at the rate of 1.84 per cent per annum. The increase in the rural population was only .89 per cent per annum. Berlin is the capital and the largest city, others being Breslau, Cologne, Frankfort, Hanover, Magdeburg, and Düsseldorf.

For *Education, Religion, Judiciary, and Local Government*, see GERMANY.

*History.*—The kingdom of Prussia, which, in the second half of the 19th century, and before the re-formation of the German Empire, possessed the most powerful organization and wielded the greatest and most compact military strength of any state in Europe, dates only from the beginning of the 18th century. The antecedent history of the growth of this state into a kingdom is divided, by the natural order of the circumstances from which it is derived, into two branches. The more important of these follows the rise of the Electorate of Branden-



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burg, which formed the nucleus of the future kingdom, and contained the principle of unity and the germs of vital organization which directed its growth. The other and less important branch relates to the province of Prussia, which incidentally gave its name to the kingdom, and which in one direction determined its external relations.

During the southern migration of the Teutonic races on the decline of the Roman Empire, the northern part of Germany as far west as the Elbe, and including the modern Brandenburg, was occupied by people of Slavic race. When the divided empire of Charlemagne made way in the 9th century for a German kingdom, military marches (q.v.) were established for the defense of the frontiers. Brandenburg, which had been conquered by Charlemagne in 789, was erected into a margraviate by Henry I. (the Fowler), king of Germany, in 926. Otto I. founded the bishoprics of Brandenburg and Havelburg. Albert the Bear, who received Brandenburg as a fief from the Emperor Lothair (1134), conquered the Slavonian Wends, and took in 1157 the title of Margrave of Brandenburg. He also held the dignity of arch-chamberlain of the empire, which conferred the electoral dignity. He began the colonization of the country with German immigrants, which was continued under his successors. His dynasty continued to bear rule till 1320, and during this period German civilization was gradually extended in Pomerania, Saxony, Brandenburg, and Silesia. After its extinction there followed a period of anarchy. Brandenburg fell as a lapsed fief to the empire, and Louis of Bavaria gave it to his son. It continued in the Bavarian house for three successive electorates or reigns, and during this period it was named as one of the principalities to which the electorate was restricted by the Golden Bull (1356). It was subsequently ceded to the house of Luxemburg, and Charles IV., the first imperial representative of this house, gave it successively to his sons Wenceslas (1373) and Sigismund (1378). Sigismund sold the New March to the Teutonic knights in 1402, and twice mortgaged the Electoral March for his debts. On the second occasion, after he had become emperor, he received from Frederick, the burgrave of Nuremberg, a loan of 400,000 gold florins, for which the latter held Brandenburg in pawn for some years. The emperor then formally agreed to cede the electorate in liquidation of his debt, and Frederick, to whom the exchange was acceptable, was duly invested in it at the Diet of Constance in 1417, two years after John Huss had been burned by the decree of the council assembled at the same place.

The burgrave who had acquired the electoral dignity in this manner was the descendant of Conrad of Hohenzollern, a cadet of a Swabian house, who had received in 1200 the appointment of imperial burgrave of Nuremberg, which had become hereditary in his family. The elder branch of the family continued to hold a small territory surrounding the ancestral castle of Hohenzollern, of which they traced their lordship back to the time of Charlemagne, till 1851, when they ceded it to Prussia, and were recognized as princes of the blood.

The territory which Frederick had acquired had relapsed under its imperial rulers into a

condition of disorder and lawlessness. The feudal nobility had made themselves nearly independent and had covered the country with their strongholds, which were little better than the abodes of robbers. Frederick protected the towns from their depredations, and gradually reduced their castles. Before his purchase of the electorate he had acquired two small territories in Franconia, Ansbach and Baireuth, the consequent union of which with the kingdom of Prussia subsequently gave rise to important events. Frederick divided his possessions among his sons; the second, Frederick, succeeded to the electorate, and subsequently reunited the territories belonging to it. Frederick II., who succeeded his father in 1440, and who was surnamed the Iron-toothed, in honor of his military prowess, extended the possessions of his family by policy as well as by valor. He repurchased the New March from the Teutonic knights, to whom it had been sold by the Emperor Sigismund. In 1470 he abdicated in favor of his brother Albert III., surnamed Achilles, who, by a family ordinance (Hausgesetz), prepared the way in an important respect for the future greatness of his house. Albert resigned the active administration of the government to his son John Cicero in 1476. He died in 1486. John I. was succeeded in 1499 by his son Joachim I., who reduced the last strongholds of his recalcitrant nobility. He founded the first university in the electorate, that of Frankfort-on-Oder, in 1506; and he established a supreme legal tribunal (Kammergericht) at Berlin. He zealously opposed the Reformation, which during his reign spread rapidly in his dominions. In 1510 he expelled the Jews from his territory. His son Joachim II., who succeeded in 1535, embraced the Reformation, and established Lutheranism in 1539. Joachim acquired the title of Hector from the valor he displayed in the Turkish campaigns as imperial generalissimo. In 1537 he signed with Duke Frederick of Liegnitz a hereditary union (Erbverbrüderung), by which the reversion of the principalities of Liegnitz, Brieg and Wohlau was secured to the Hohenzollern house. The Seven Years' war (q.v.) and the acquisition of Silesia by Frederick II. of Prussia were the ultimate results of this agreement. He also acquired a title to the duchy of Prussia. John George succeeded in 1571. He administered his states with a view to relieve them of financial embarrassments entailed by the profuse expenditure of his father. By welcoming the Dutch, who were driven from their country by persecution, he contributed to the industrial prosperity of his country. Joachim Frederick, who succeeded in 1598, married (1603) his son John Sigismund to the daughter of Frederick Albert, duke of Prussia. He effected in 1603 with his cousin George Frederick of Ansbach, on the basis of the Hausgesetz of 1477, the House-treaty of Gera, which was afterward considered the fundamental law of the family. He was succeeded in 1608 by John Sigismund, who united the duchy of Prussia to the electorate in 1618, and brought Brandenburg into contact with Poland (q.v.).

About the same time John William, duke of Juliers, Clèves, and Berg, Count of La Marck and Ravensberg, and Lord of Ravenstein, died without issue in 1609. Among numerous claimants to the succession, in virtue of his wife, was



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John Sigismund. By the Treaty of Xanten (1614) Clèves, La Marck, the Ravensberg, being half the succession, were assigned to Brandenburg. Thus was laid the foundation of the Rhine province, which brought the future kingdom in contact with France. John Sigismund again changed the religion of his state by renouncing the Lutheran for the Calvinistic confession. He was succeeded in 1619 by his son George William. That terrible crisis in the affairs of Germany, the 'Thirty Years' war (q.v.), had now arrived, when owing to the vacillation of its ruler whole tracts of country were depopulated, agriculture was neglected, and trade and commerce abandoned.

Frederick William, son of the preceding, surnamed the Great Elector, and who may be regarded as the virtual founder of the Prussian monarchy, averted the progress of calamity, and soon gave a prosperous turn to the affairs of the state. So wise, prudent, and vigorous was the government of this prince that at his death in 1688 he left a well-filled exchequer, and a fairly-equipped army of 38,000 men; while the electorate, which now possessed a population of one and a half million and an area of 43,000 square miles, had been raised by his genius to the rank of a great European power. His successors Frederick I. (q.v.; 1688-1713) and Frederick William I. (1730-40) each in his own way increased the power and credit of Prussia, which had been in 1701 raised to the rank of a kingdom. The latter monarch was distinguished for his rigid economy of the public money and an extraordinary penchant for tall soldiers, and left to his son Frederick II. (q.v.), Frederick the Great, a compact and prosperous state, a well-disciplined army, and a sum of nearly nine million thalers in his treasury. Frederick II. (1740-86) dextrously availed himself of the extraordinary advantages of his position to raise Prussia to the rank of one of the great political powers of Europe. Frederick was not over-scrupulous in his means of enlarging his dominions, as he proved by sharing in the first partition of Poland in 1772, when he obtained as his portion nearly all West Prussia and several other districts in East Prussia. His nephew and successor, Frederick William II. (1786-97), aggrandized his kingdom by the second and third partitions of Poland in 1793 and 1795. Frederick William III. (1797-1840) succeeded his father in 1797, at a time of extreme difficulty, when continental rulers had no choice beyond being the opponents, the tools, or the victims of French republican ambition. By endeavoring to maintain a neutral attitude Prussia lost her political importance, and gained no real friends, but many covert enemies. But the calamities which this line of policy brought upon Prussia roused Frederick William from his apathy, and, with energy, perseverance, and self-denial worthy of all praise, he devoted himself, with his great minister Stein, seconded by Count Hardenberg, to the reorganization of the state. In the years 1806-10 Prussia underwent a complete domestic reorganization; and after the battle of Waterloo, which restored to Prussia much of the territory lost at the peace of Tilsit in 1807, the career of progress was continued. A tendency to over-legislation, however, became the predominating evil feature of Prussian administration; and the state, without regard to the incongruous ele-

ments of which it was composed, was divided and subdivided into governmental departments, which, in their turn, under some head or other, brought every individual act under governmental supervision, to the utter annihilation of political independence. The people soon perceived that this administrative machinery made no provision for political and civil liberty, and demanded of the king the fulfilment of the promise he had given in 1815 of establishing a representative constitution for the whole kingdom. This demand was not acceded to, and its immediate fruits were strenuous efforts on his part to check the spirit of liberalism. The accession of Frederick William IV. (1840-61) seemed to open a better prospect to the friends of constitutional freedom. A political amnesty was proclaimed, religious toleration was announced, and a contest betwixt the crown and the pope, in which the first signs of the coming Kulturkampf (q.v.) may be traced, was brought to a close by concessions on the part of the king. Frederick William, however, was an enthusiastic upholder of the divine right of kings, and it soon became apparent that he was in no way prepared to follow up his vague promises of political liberty by sharing political power with the people. The bureaucratic spirit of over-governing became daily more and more irksome to the nation, and it was evident that a constitutional struggle was inevitable. The king and his advisers, underrating the importance of the movement of 1848 in Germany, thought they had satisfied the requirements of the hour by granting a few unimportant reforms and by making equivocal promises of future concessions. A collision betwixt the troops and the citizens of Berlin, in which blood was shed, awoke the king to the full gravity of the crisis, and he hastened to allay the general discontent by the nomination of a liberal ministry, the recognition of a civic guard, and the summoning of a representative chamber to discuss the proposed constitution. The conversion of the monarch to liberalism was but temporary; and although, after much obstruction, a constitution, superseding the old Prussian estates by a representative parliament, was promulgated in January 1850, it was repeatedly modified in the following years, until few of its democratic features were left. Frederick William had early distinguished himself and delighted many Germans, both within and without Prussia, by his patriotic utterances in favor of a new united Germany. He was deeply chagrined when in 1848 the national assembly at Frankfort, influenced by Austrian jealousy of the military strength of Prussia, declined to accept him as the national leader, and elected instead the Archduke John of Austria as lieutenant-general of Germany. Yet, when in the following year he was offered the imperial crown, he found himself unable to face the responsibility of accepting it. He hesitated to make so important a move in the contest with Austria for the hegemony of Germany. Among the affairs taken cognizance of by the Frankfort assembly was a revolt of the duchies of Schleswig and Holstein against Denmark, which was alleged to have violated their constitutional privileges as German states. The king of Prussia intervened in this quarrel at the instance of the Germanic Confederation in 1848-9. After some severe fighting a treaty of peace was concluded



## PRUSSIA — PRYNNE

on 2 July 1850, by which the right of Denmark to the duchies was acknowledged, while Holstein was recognized as a member of the Germanic Bund or Confederation. The duchies revolted against this settlement, and the matter was referred, at the instance of the Emperor Nicholas, to the great powers. By the Treaty of London, 8 May 1852, Prince Christian of Schleswig-Holstein, afterward Christian IX. of Denmark, was recognized as heir to the Danish crown, the integrity of the Danish monarchy was recognized, but the rights of the Germanic Confederation over Holstein and Lauenburg as members of the Bund were reserved. The later years of this reign were characterized by great advances in the material prosperity and internal improvement of the country, and especially in the expansion of the Prussian and North German Zollverein (q.v.). William I. (1861-88), who became German emperor in 1871, had been regent of the kingdom since 1858, owing to the illness of his brother, the late king. William was no more a lover of constitutional, or at least of popular, liberty than any of his predecessors; and in his opposition to the progress of the popular movement, in so far as it aimed at interference with the regal power, he was powerfully aided by his great adviser Bismarck (q.v.), who became prime minister in 1862 and imperial chancellor in 1871. For the successful wars with Austria (1866) and France (1870-1), which so enhanced the prestige of Prussia and which resulted in the united Germany of to-day, see GERMANY; FRANCO-GERMAN WAR. Since the king of Prussia became German emperor the history of Prussia has been practically merged in the history of Germany.

Consult: Hillebrand, 'La Prusse contemporaine et ses Institutions' (1867); Ranke, 'Memoirs of the House of Brandenburg and History of Prussia' (1849); Tuttle, 'History of Prussia' (1884-96).

**Prussia, East, or Ostpreussen**, öst-prois'sën, the northeasternmost province of Prussia, Germany. Area 14,284 square miles; pop. (1900) 1,996,626. Capital, Königsberg. See PRUSSIA.

**Prussia, West, or Westpreussen**, vëst-prois'sën, a northeastern province of Prussia, Germany. Area 9,859 square miles; pop. (1900) 1,563,658. Capital, Dantzic. See PRUSSIA.

**Prussian Blue.** See DYES.

**Prussian Brown**, a color obtained by adding a solution of the yellow prussiate of potash to a solution of sulphate of copper, which throws down a precipitate of deep brown. This, when washed and dried, is equal to madder, and possesses greater permanency.

**Prussian Orders and Decorations.** See ORDERS, ROYAL.

**Prussic Acid.** See HYDROCYANIC ACID.

**Pruten'ic**, in astronomy, a term applied to certain tables published by Rimbold in the 16th century, founded on the principles of Copernicus.

**Pruth**, prooth (Ger. proot), a river of Europe, which rises on the eastern side of the Carpathian Mountains, in the southeast of Galicia; flows circuitously east, then south-southeast, forming the boundary between Rumania and Bessarabia, and after a course of more than 500 miles enters the Danube on the left, about

12 miles below Galatz. On the bank of Pruth, near Husi, in 1711, the army of Peter the Great was surrounded by the Turks, and the Czar was not allowed his freedom until he ceded Azov to Turkey.

**Prutz**, proots, **Hans**, German historian: b. Jena, Germany, 20 May 1843. He was educated in Jena and in Berlin and became privat-docent at the latter place in 1873. He was engaged in a government expedition into Syria in 1874, and in 1876 accepted a chair at the University of Königsberg, from which he resigned in 1902. Among his principal works are: 'Heinrich der Löwe' (1865); 'Aus Phönicien' (1876); 'Kulturgeschichte der Kreuzzüge' (1883); 'Aus des grossen Kurfürsten letzten Jahren' (1897); 'Preussische Geschichte' (1899-1901); etc.

**Prutz**, **Robert Eduard**, German poet and historian: b. Stettin, Prussia, 30 May 1816; d. there 21 June 1872. He was educated at Berlin, Breslau, and Halle, and edited, with Arnold Ruge, a radical periodical 'Hallesche Jahrbücher,' designed to promote more liberal views in science, politics, and religion. In 1849 he became professor of literature at Halle, but soon resigned to devote himself exclusively to science and literature. His poetry is of the patriotic order, as are also his dramas; his novels display keen powers of satire, and his researches as a historian gave him high rank in that field of literature. He was editor in 1851-66 of the 'Deutsches Museum' and his works include, in verse, 'Gedichte' (1849); 'Herbstrosen' (1865); the dramas, 'Moritz von Sachsen'; and 'Erich der Bauernkönig'; 'Der Göttinger Dichterbund' (1841); 'Vorlesungen über die Geschichte des deutschen Theaters' (1847); numerous novels, etc.

**Pryce**, **Richard**, English novelist: b. Boulogne, France, 14 May 1864. Among his fictions, several of which have been re-issued in this country, are: 'The Ugly Story of Miss Wetherby' (1889); 'A Just Impediment' (1890); 'Miss Maxwell's Affections' (1891); 'Elementary Jane' (1897); 'Jezebel' (1900).

**Prynne**, prĭn, **Hester**, the principal character in Nathaniel Hawthorne's romance, 'The Scarlet Letter' (1850). For her sin with the young minister, Arthur Dimmesdale, she was condemned to stand holding her child upon the platform of the pillory in the sight of the populace, and wear a scarlet letter A embroidered upon her bodice. This badge of her shame was worn thereafter, while she did expiation by deeds of mercy among her townspeople.

**Prynne**, **William**, English author and politician: b. Swanswick, Somerset, 1600; d. London 24 Oct. 1669. He was graduated at Oriel College, Oxford, in 1621 and admitted to the bar in 1628. He early became a militant Puritan, wrote pamphlets against Arminianism and the frivolities of the age, and in 1632 published a huge volume, entitled 'Histriomastix, the Players' Scourge,' further devoted to assaults on theatres, court masques, cards, and music. Passages alleged to reflect on the king and queen brought down on him savage punishment. He was prosecuted by the Star Chamber and underwent sentence which included the payment of a £5,000 fine, expulsion from Lincoln's Inn and loss of his degree, having his work burned by the hangman, the loss of his ears, exposure in



the pillory, and imprisonment in the Tower. Unbroken in spirit he issued tracts from prison, one of which he facetiously entitled 'News from Ipswich,' against Archbishop Laud and other prelates, calling them, among other names, "Luciferian lord bishops, execrable traitors, devouring wolves." The Star Chamber, in consequence, ordered what remained of his ears again cut off, fined him another £5,000 and had the letters S. L. (seditious libeler) branded on both his cheeks. He remained in prison,—still vigorously writing, though, because of a stricter guard, not for the public,—till 1640. He was then released by the House of Commons, was awarded damages and made a triumphal entry into London. Later he was member of Parliament for Newport in Cornwall, and took part in the prosecution of Laud, but was expelled by Cromwell in 1648 for opposition to the extreme measures leading to the execution of the king. He now published such virulent articles against Cromwell that he was twice imprisoned. In 1660, after Cromwell's death, he again sat in Parliament, and upon the Restoration was made keeper of the record. Pamphleteering again brought him into trouble with the House of Commons, but he recanted; and busied himself with the collection of Parliamentary records. He produced more than 200 volumes, of which the most valuable are: 'Collection of Records' and 'Calendar of Parliamentary Writs.'

**Pryor**, prī'ôr, **Roger Atkinson**, American soldier and lawyer: b. Dinwiddie County, Va., 19 July 1828. He was educated at Hampden-Sidney College and the University of Virginia; was special minister to Greece, under President Pierce; sat in Congress 1859-61 and in the Confederate Congress in 1862. He entered the Confederate army in 1861; was brevetted brigadier-general in 1863; and after the war settled in New York as a lawyer, held various judicial posts, and from 1894 to 1899 was justice of the State supreme court.

**Prytane'um**, the building in the capital of a Greek state possessing similar features to the town-hall of modern communities, but having in addition a religious significance, and devoted to purposes peculiar to the Greek state. It was dedicated to Vesta and contained the perpetual fire of the state hearth. At Athens the state here entertained its foreign ambassadors, its envoys returned from a public mission, its distinguished generals, victors in the Panhellenic games, and citizens who had done important service to the state. In the latter case the privilege lasted for the life-time of the recipient.

**Przemysl**, pzhēm'isl, Austria, a town in Galicia, on the river San, 51 miles west of Lemberg. It is strongly fortified, being a place of strategic importance. It has an active trade and thriving industries. Przemysl was founded in the 8th century by the Polish prince Przemyslaw, and called after his name. The ruins of the ancient residential castle are on a neighboring hill. Pop. (1900) 46,295.

**Psalmazar**, sāl-ma-nā'zèr, **George** ("THE FORMOSAN"), French literary impostor: b. probably in Languedoc, France, about 1679; d. London, England, 3 May 1763. He was educated by the Jesuits, led a vagrant life in France, and finally attracted the attention of Innes, chaplain of a Scottish regiment at Sluys, Holland, who

apparently converted him to Protestantism and took him to England, where he was presented to Bishop Compton and others as a native of Formosa. Whether Innes was duped by Psalmazar or was an accomplice is uncertain, but the supposed Formosan was treated with great honors, encouraged to write 'A History and Description of the Island of Formosa off the Coast of China' (1704), translated parts of the English Catechism into the pretended Formosan language, and later was sent to Oxford. He repented of his imposture, however, confessed his duplicity, and devoted himself to study. He became a fine Oriental scholar and led a much respected life in London. He wrote an 'Essay on Miracles'; several volumes of the 'Universal History'; and completed Palmer's 'History of Printing.' Consult autobiographical 'Memoir of George Psalmazar' (1764).

**Psalmody**, sāl'mō-dī or sã'mō-dī, a singing of the Psalms of Scripture in metrical versions to simple tunes. Psalms and hymns were sung in the religious assemblies of the early Christians; and the psalms of Scripture form the bulk of the daily religious service or "Divine office" of the Catholic Church, the custom having been borrowed from the synagogue and the temple of Jerusalem. After the Reformation in the 16th century psalmody was greatly encouraged in the Protestant churches of Germany, France, and the Low Countries, and most of the psalm melodies now sung in churches were composed or adapted by German musicians of the 16th century. Metrical versions of the Psalms were made in German, French and English. Marot's French metrical psalms for a while displaced profane music in fashionable society at Paris: Bishop Jewell, describing (1560) the effect of the psalm-singing after the sermons at Saint Paul's Cross by congregations of as many as 6,000 persons, says "It makes the mass priests and the devil sick" (*sacrificos et diabolum agrehabet*). The Scotch reformers paid great attention to psalmody: in John Knox's psalter the Sternhold and Hopkins metrical English version of the psalms was arranged with four-part harmony. The metrical version now used in Scotland is the one made by Francis Rous during the Commonwealth and approved by the General Assembly of the Scottish Church.

**Psalms**, sãms, **Book of**, the Old Testament book which was the hymn book of the Hebrew nation. Most of the psalms were not written specifically for the temple worship, but the whole collection was used for that purpose. The English name, Psalms, came through the Vulgate from the Septuagint name (*psalmoi*). The common Hebrew name for the book means Book of Praises.

**Divisions**.—A division of the book of Psalms, at least as old as the Septuagint translation, is into five collections, called books. The books are: Psalms i.-xli.; xlii.-lxxii.; lxxiii.-lxxxix.; xc.-cvi., and cvii.-cl. The English versions, as well as the Hebrew, the Septuagint, the Peshitta, and the Vulgate, reckon the number of the psalms as one hundred and fifty, although the Septuagint gives an additional one which it declares to be "outside the number." But the Septuagint unites Psalms ix. and x. and cxiv. and cxv. of the Hebrew, and divides cxvi. and cxlvii. The Peshitta partly follows the Septua-



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gint, uniting cxiv. and cxv., and dividing cxlvii. Most English versions follow the Hebrew, but the Septuagint is followed by the Vulgate, the Roman Catholic versions, and some old English versions.

*Poetical Form.*—The poetry of most of the psalms is lyric, although in a few it is didactic. The form is usually simple. The most elaborate are those having the alphabetic or acrostic structure, in which the separate lines, or verses, or two successive verses, begin in Hebrew with the successive letters of the alphabet. These are Psalms ix., x., xxv., xxxiv., xxxvii., cxi., cxii., cxix., and cxlv. Psalm cxix., however, is distinguished by being divided into sections of eight verses, each verse in a section beginning with the same letter.

*Titles.*—Most of the psalms have titles, which are of five different kinds, many psalms having more than one. The first class indicates the particular character of the poem. The second gives musical directions, such as the name of the melody to which the psalm was to be chanted. The third is liturgical, indicating, for example, the occasion on which the psalm was to be used. The fourth indicates, according to the usual interpretation, the authorship of the psalms. The titles indicating authorship assign one psalm (xc.) to Moses; seventy-three to David; two (lxxii. and cxxvii.) to Solomon; twelve to Asaph; eleven to the sons of Korah; one (lxxxviii.) to Heman the Ezrachite; and one (lxxxix.) to Ethan the Ezrachite. Thirty-four have no designation of authorship, and are called by the Jews "orphans." The fifth class gives the historical occasion of the composition, and is found prefixed to thirteen psalms, all of which are attributed to David.

*Age and Value of Titles.*—The liturgical titles seem to have been added after the exile, while the indications are that the musical directions are pre-exilic. The age and value of the titles indicating authorship are much disputed. One view is that they are in every case historically accurate, having been added at or near the time of writing. Another is that, though they were added some time after the writing, they yet rest upon tradition, which is accurate in many cases, but not in all. A third view is that they were added much later, and represent simply the conjecture of a later time, being therefore all, or nearly all, inaccurate. It is to be noted that the contents of the particular psalms are in some cases inconsistent with the designations of authorship. But in many cases there is no such inconsistency. For this and other reasons the second view above indicated seems the most likely. The titles of occasion are in most cases inconsistent with the contents, and hence are probably later and of less value. It should be added that some eminent authorities have thought that the Hebrew phrase rendered "of David," does not denote authorship, but should be rendered "belonging to David," in which "David" was the name of an earlier collection of psalms, some of which were Davidic. This view is possible, but less natural than the one above indicated.

*Davidic Psalms.*—How many psalms David wrote, is a question on which there is much difference of opinion. The old view was that he wrote the seventy-three attributed to him by the titles, and also the thirty-four that are any-

mous. At the present time it is sometimes held that he wrote all, or nearly all, assigned to him by the titles. Many, however, maintain that he wrote none; and some assign to him various numbers, from three to forty. The conception of the character of David and of the age in which he lived is not affected so much by the number of Davidic psalms, as by the decision whether any are from him. In fact, one prominent argument with those who deny entirely the Davidic authorship is based upon the claim that the historical books represent David simply as a bloodthirsty freebooter, which claim, however, is not borne out by the facts. It may be regarded as probable that David wrote approximately forty of those assigned him by the titles.

*Maccabean Psalms.*—The question of Maccabean psalms has an importance second only to that of Davidic psalms. Many modern writers hold that all or nearly all of the psalms were written in connection with the Maccabean struggle in the second century B.C. Some in modern as well as ancient times attribute a few to that period; while others deny that any were written so late. The chief direct argument for Maccabean psalms is that some harmonize well with the historical conditions of that time, an argument which is perhaps strongest with lxxiv. and lxxix. Further, the circumstances of the time were naturally such as to stimulate the production of religious poetry. Some general considerations, however, are unfavorable to a belief in Maccabean psalms. None are mentioned in the history of the time. Again, it is probable that the Old Testament books had already been collected and formed into the threefold division, the law, the prophets, and the writings, in the time of the Maccabees. It is not probable that many new productions would be added after that. Also, the Septuagint translation of the psalms, if not made before the Maccabean period, probably dates from a time only a few years after, and the Septuagint translators found unintelligible the musical titles of some psalms often attributed to this period, such as lx. and lxxx. It seems improbable, therefore, that any psalms are Maccabean.

*Age of Division into Books.*—Each of the five books of the psalms has a heading, and each of the first four has at its close a doxology, namely, Psalm xli., 13; lxxii., 18-19; lxxxix., 52; and cvi., 48. All these doxologies markedly resemble each other, and have no connection with the psalms to which they are attached. They were evidently added as concluding doxologies to the books, and are not a part of the individual psalms. It is probable that Psalm cl. was intended to serve a similar purpose as an extended concluding doxology for the last book and for the whole psalter as well. The doxology at the end of the fourth book is included in 1 Chronicles xvi. 36, as a part of a longer quotation. This indicates the existence of this doxology, and so of the division into books, at the time of the composition of Chronicles, late in the Persian period. All indications suggest that each book was compiled separately, so that this division existed from the first.

*Use of Divine Names.*—In the first, fourth, and fifth books the divine name Yahweh is used almost exclusively; while Elohim greatly prepon-



derates in book two. In the first part of book three, Psalms lxxii.-lxxxiii., Elohim has the preference, while the reverse is true of the latter part of the book, Psalms lxxxiv.-lxxxix. But no clear reason appears for this variation in usage.

*Distribution of Davidic Psalms.*—In book one, all the psalms are ascribed to David except four, which are anonymous; eighteen are ascribed to David in book two; one in book three; two in book four; and fifteen in book five.

*Arrangement of Psalms.*—It is probable that the present order of the books represents the chronological order of their compilation. Many would hold that all were compiled after the exile. It seems probable, however, that the first book was compiled before the exile; books two and three soon after the exile; and books four and five at about the time of Ezra and Nehemiah. Some have supposed that originally there were only three books, the second and third being later divided, each into two parts. The evidence, however, seems to be against this view. The psalms within each book are not arranged chronologically, nor in such a way as to give a regular progress of thought. The principle of arrangement seems rather to have been to put together psalms which had similarities with each other, in some cases the same author, in others a similarity of thought, but more often than otherwise some external resemblance, such as the use of the same word or phrase.

*Unity of Book.*—Many of the psalms are the expression of individual feeling and aspiration; some have in mind the circumstances or history of the nation; while others are written with especial reference to worship. Yet in spite of this varied character and of the diversity of authorship substantial unity in thought is found throughout the whole collection.

*Teaching concerning God.*—The amount and value of the theological teaching of the book of Psalms should not be underestimated. Yet it must be remembered that such teaching is often incidental, in harmony with the usual character of the psalms as lyrical rather than didactic. In the teaching concerning God, it is his power that is most strongly emphasized. The greatness of his power as seen in the wonders of nature and in the creation of man is depicted with poetic fervor. Of his moral attributes, justice receives chief emphasis. This is presented as the ground for expectation that the wicked will be punished, and his servants, the righteous, avenged and rewarded.

*Messianic Teaching.*—The Messianic teaching in the psalms is much less than has often been thought. It is usually indirect, prophecy concerning a present king containing elements which find their entire fulfilment only in the Messianic king. Such prophecy tells of the world-wide rule of the Messiah. Similar predictions, not directly Messianic, are found in some of the later psalms, which foretell the coming of Yahweh to punish the wicked and bring salvation to the oppressed righteous. This is substantially equivalent to the day of Yahweh of prophetic expectation.

*Teaching concerning Man's Relation to God.*—The teaching concerning man's relation to God is substantially the same in the psalms as in the prophets. Sacrifice and ritual are alluded to as customary and important. Yet they are

not highly esteemed as merely external acts. Obedience, thankfulness, contrition of heart, prayer, are considered as of value in the sight of God rather than sacrifice. The true way to forgiveness is through repentance. Although many psalms are national, yet in the relation to God the importance of the individual is emphasized, more even than in the earlier prophets.

*Teaching concerning the Future Life.*—Like other parts of the Old Testament, the general teaching concerning the future life in the psalms is indefinite. The shadowy region of Sheol is for the most part the limit of expectation. Yet there are several suggestions of a future condition in which there is a clear separation of the righteous and wicked, with especial emphasis upon the reward of the righteous. In these passages it is taught that the strength of the fellowship with God in the heart of the true believer is such that it can not be interrupted by death, but must continue in the future life.

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**Psalter**, sâl'tér, the Book of Psalms (q.v.); also a book containing the Psalms separately printed; also specifically, the version of the Psalms in the English Book of Common Prayer. It is also the name of an ancient string instrument of music, the Hebrew *Kinnor*; called by the Germans *Rotta* (*Cithara Teutonica*). Sometimes the rosary of 150 beads used by some order of nuns is called the Psalter, as the Psalter contains 150 Psalms.

**Psammetichus**, sa-mět'î-küs (PSAMATIK I.), Egyptian king, first monarch of the 26th (650-527 B.C.) dynasty. He is first heard of as feudal lord of Saïs, the chief centre of the western delta. He formed an alliance with Gyges, king of Lydia, against the suzerain power of Assyria; and by the aid of Carians and Ionian Greeks supplied by Gyges, defeated the Assyrian vassal-kings and was crowned "lord of the two Egypts." Herodotus says he blockaded Azotus (Ashdod) for 20 years; and he may indeed frequently have besieged it. He made Phœnicia a vassal state, and devoted much attention to art and architecture. The demotic (or enchorial) writing which, because of greater facility, superseded the hieratic, was invented during his reign, though it cannot be ascribed to his initiative.

**Psara**, psä'rä, or **Ipsara** (Gr. *Psyra*), an island of Turkey, in the Grecian Archipelago, seven miles northwest of Scio; about five and a half miles in length, and as many in breadth.



It consists almost entirely of a rock, thinly covered with a vegetable mold. At one time it had considerable commerce, and a population of 30,000. Pop. (1903) 4,870.

**Pseu'do-Isido'rian Decretals.** See DECRE-TALS.

**Pseudolucæmia**, sū'dō - lū - sē'mī - a, or **Hodgkin's Disease**, a disorder of the lymphatic glands and sometimes an affection of the spleen, characterized by anæmia and progressive hyperplasia. It is also attended by secondary lymphatic growth variously distributed in the body. Leucocytosis—excess of white corpuscles in the blood—which accompanies many blood diseases, is not present in pseudolucæmia. See BLOOD.

**Pseudomorph**, the name applied to a mineral which has replaced another, or which appears in crystal forms which are foreign to its original formation. Massive varieties of minerals are more subject to such changes, but the action is frequently more difficult to trace. There are three kinds: Pseudomorphs, epimorphs, and paramorphs. See also MINERALOGY.

**Pseu'donym** (Fr. *pseudonyme*, from Gk. *pseudonymos*). A name adopted by an author who desires to remain unknown, or assumed for the purpose of attracting more attention at first than might follow from the use of the author's own name. (See ANONYMOUS.) Consult: Barbier, 'Dictionnaire des Ouvrages anonymes' (1872-9, with supplement 1889); Halkett and Lang, 'Dictionary of the Anonymous and Pseudonymous Literature of Great Britain' (1882-8); Cushing, 'Initials and Pseudonyms' (1885-8).

**Pseu'doscope**, in optics, an instrument, invented by Wheatstone, for producing an apparent reversion of the relief of an object to which it is directed, by the transposition of the distances of the points which compose it. A false impression is thus conveyed to the eye, a globe becoming apparently concave and a hollow body assuming a convex form. See OPTICS.

**Pseudosu'chia**, an order of *Crocodylia*. See HERPETOLOGY.

**Psilomelane**, a hard, dull, black mineral, essentially a hydrous manganese manganate, but part of the manganese usually replaced by barium. It occurs abundantly massive or in botryoidal and stalactitic forms in Germany, England, Arkansas, and many other localities. It is one of the commonest ores of manganese.

**Psittaci**, sīt'a-sī, the parrot tribe, a family of scansorial birds, comprising over 300 species, of which the genus *Psittacus* is the type. See PARROT.

**Pskov**, psköf, or **Pleskov**, Russia, (1) town, capital of the government, on the right bank of the Velikaya, which here receives the Pleskova, 165 miles south-southwest of Saint Petersburg. It is walled, flanked with towers, all in a very dilapidated state, as are also many of the houses. It consists of the Kremlin, the Central city, the Great city, and a considerable suburb. All the private houses and the far greater part of the public edifices are of wood. The finest buildings are in the Kremlin. The principal manufacture is Russian leather; and there is a considerable trade in hemp, flax, tallow, hides, etc. Pskov is the see of an arch-

bishop, and possesses a theological seminary and a well-managed hospital. It is said to have been founded by the Princess Olga toward the end of the 10th century. Pop. (1897) 30,424.

(2) A government of Russia, bounded north by Saint Petersburg, northeast by Novgorod, east by Tver, southeast by Smolensk, south by Vitebsk, west by Livonia; area, 17,069 square miles. The surface toward the southeast is traversed by the Valdaï Hills, but sinks gradually down near the centre, having only a gentle slope toward the north and west. The soil is throughout of poor quality, and can only be made to yield tolerable crops by fertilization. Wheat is seldom grown, and the principal crops are oats and barley, which are raised in considerable quantities, so as to leave a surplus for export. Forests are extensive; but the wood is not of the best quality. The only other manufacture of importance is leather. Pskov is divided into eight districts. Pop. (1897) 1,136,540.

**Psoriasis**, sō-rī'a-sīs, chronic skin disease, allied to alphas and lepra, non-contagious but often hereditary. It is characterized by an inflammatory condition, with slightly elevated patches, dry and various in number, size, and shape, to which grayish scales adhere. These exfoliate, to be repeatedly renewed. The extensor sides of the extremities, the elbows, knees, trunk, and scalp, become first affected, and the flexor sides of the limbs are afterward attacked. Only the mucous membranes of the body are exempt from this disease, the cause of which is little understood, and which requires for treatment competent medical skill.

**Psovie**, or **Borzoï**. See GREYHOUND.

**Psyche**, sī'kē, in Greek mythology, a beautiful maiden regarded as an allegorical personification of the human soul. In a version of her story given by Apuleius in 'The Golden Ass' she is the daughter of a king and far outshines in loveliness her two elder sisters. Men take her for Venus herself and pay her the homage due to the goddess. In anger Venus directs Cupid to inspire Psyche with love for some unworthy wretch, but Cupid himself falls in love with Psyche. Meantime her father consults the oracle of Apollo regarding his daughter's marriage, and is commanded to convey her to the summit of a mountain and there leave her, for she is the destined bride of a monster dragon feared by gods and men. Sorrowfully he obeys, but when Psyche is left alone she is wafted by Zephyr to the palace of Cupid who visits her every night and departs unknown before morning. She is warned by her lover never to seek to know who he is, and no break would have occurred to her happiness had she not allowed her jealous sisters whom she admitted to her confidence to half persuade her that she held a hideous monster in her arms. One night while Cupid slept she came with a lamp to see him and in her astonishment and joy at beholding the most beautiful of the gods she lets fall a drop of heated oil upon his shoulder. Cupid awakes, reproaches Psyche for her suspicions, and leaves her. After trying in vain to drown herself, Psyche wanders from place to place seeking her beloved till she comes to the temple of Venus. Having Psyche at last in her power Venus treats her as a slave and



imposes menial tasks, under which the maid would sink but for secret help obtained from Cupid. At length Venus orders Psyche to descend to the realm of shadows and bring away Proserpine's box of cosmetics. She succeeds in the adventure, but on opening the box is assailed by a deadly vapor issuing therefrom and perishes. Cupid now reappears, touches her with an arrow and restores her to life. Venus is reconciled, and Jupiter places Psyche among the immortals. Her marriage to Cupid is celebrated with great festivities, while her envious sisters cast themselves from a precipice. Consult a translation of Apuleius' story in Walter Pater's 'Marius the Epicurean,' and poetical versions of the tale in Morris' 'Cupid and Psyche' in 'The Earthly Paradise'; and Bridges, 'Eros and Psyche.'

**Psychiatry**, sī-kī'a-trī, the study and treatment of mental diseases. The psychiatrist or alienist, whose specialty has greatly developed in recent years, must needs be likewise a pathologist and a neurologist, to make his scientific and clinical equipment adequate to the task of dealing with the various conditions and symptoms usually present in the patients committed to his skill. No clinical work is more delicate and none more strictly required than that of the practitioner in this branch of medical science. See INSANITY.

**Psychical Research.** In its technical sense psychical research refers to objects and methods of investigation employed by The Society of Psychical Research, which was founded in England in 1882. The function of this society is set forth in the following announcement: "It has been widely felt that the present is an opportune time for making an organized and systematic attempt to investigate that large group of debatable phenomena designated by such terms as mesmeric, psychical and spiritualistic. From the recorded testimony of many competent witnesses, past and present, including observations recently made by scientific men of eminence in various countries, there appears to be, amidst much illusion and deception, an important body of remarkable phenomena, which are *prima facie* inexplicable on any generally recognized hypothesis, and which, if incontestably established, would be of the highest possible value. The task of examining such residual phenomena has often been undertaken by individual effort, but never hitherto by a scientific society organized on a sufficiently broad basis." The society's membership has included the names of Henry Sidgwick (the first president), A. J. Balfour, W. F. Barrett, Balfour Stewart, Edmund Gurney, Frederic W. H. Myers, Oliver Lodge, William Crookes, Lord Rayleigh and Alfred Russel Wallace. In 1884 an American Society for Psychical Research was established and later (1890) incorporated with the British society. Similar organizations have been formed in Germany and other countries. In 1904 the combined membership of the British and American branches exceeded 1,300 names. The records of the society fill more than twenty volumes of Proceedings and Journals. Besides these official reports, individual members have published numerous works on psychical research. The investigations of the Society have been directed by six principal committees to whom the fol-

lowing tasks were severally assigned in 1882: (1) An examination of the nature and extent of any influence which may be exerted by one mind upon another, apart from any generally recognized mode of perception. (2) The study of hypnosis, trance, clairvoyance and other allied phenomena. (3) A critical revision of Reichenbach's researches with certain organizations called "sensitive." (4) An investigation into apparitions and haunted houses. (5) An inquiry into the various physical phenomena commonly called spiritualistic; with an attempt to discover their causes and general laws. (6) The collection and collation of existing materials bearing on the history of these subjects. In brief, the work of the committees has covered the subjects of telepathy, hypnosis, trance, automatisms, "magnetic sensations," apparitions and "spiritualistic manifestations." Three principal methods have been employed by the committees and by individual members of the Society: (1) the examination of accumulated evidence and of current cases; (2) experimental investigation, and (3) statistical treatment. The first of these methods has been used widely in the study of apparitions and alleged spiritualistic phenomena—ghost-stories have been collected and noted mediums examined; the second, in hypnosis, in tests of Reichenbach's claims, and in the collection of evidence for telepathy; and the third, in interpreting extensive data regarding apparitions and hallucinations.

The results obtained by the several committees are quite unequal. Investigations into the "magnetic sense," into clairvoyance, haunted houses and the grosser physical manifestations of "spirits"—that is, raps, table-tipping, slate-writing, levitation and "materializations"—have turned out, on the whole, negatively. Many instances of fraud, of defective observation and of involuntary deception have been brought to light. Hypnosis and allied states have been investigated, not so much for their own sake as for the study of telepathy and of subconscious states. The work of the Society may be said to centre in the questions of telepathy and the existence of mind independently of the body. In order to secure evidence touching both these matters the Society for Psychical Research instituted, in the years 1889-92, an extensive census on hallucinations. Answers to the number of 17,000 were returned to the following question: Have you ever, when believing yourself to be completely awake, had a vivid impression of seeing or being touched by a living being or inanimate object, or of hearing a voice; which impression, so far as you could discover, was not due to any external physical cause? About one tenth (1684) of the answers were affirmative, and, of this number 80 were "death-coincidences, that is, cases of recognized apparitions occurring within twelve hours of the death of the person represented, the death being unknown to the percipient at the time." The committee in charge of the census draws the conclusion that "between deaths and apparitions of the dying person a connection exists which is not due to chance alone." In the last few years, the Society has devoted much attention to the study of trance states as produced in certain persons called "sensitives." This study is said to furnish evidence of telepathy. It is considered, by some



members of the Society, to be the most fruitful subject for further investigation.

The achievements of psychical research are difficult to estimate. The movement has undoubtedly contributed to knowledge of the facts investigated and the conditions under which these facts arise. It has also performed a service to mankind in its critical examination both into the validity of human testimony and into certain unreliable factors in the motives to the establishment of belief. The evidence offered for a telepathic agency and for the independent existence of mind apart from cerebral functions is considered in some quarters as amounting to proof; in others, as lending probability only to these hypotheses; and, by many educated persons, as entirely lacking in cogency. It is of importance to notice, in this connection, that belief in the factual basis of telepathy—that is, in the influence of one mind upon another where no physical medium has yet been discovered—does not necessarily imply a theory regarding the nature of, and the conditions underlying, such influence. Various hypotheses intended to explain the facts in question have been offered, but no one of them has as yet found general acceptance.

Psychical research, in so far as it examines conscious experience, sustains a somewhat intimate relation to psychology; although it is more closely allied to abnormal than to general psychology. It should be pointed out, however, that its aims, and, in some respects, its methods, also, bring it into closer relation to certain practical aspects of life and to philosophy than to psychology.

Consult: Proceedings of the Society for Psychical Research; Gurney, 'Phantasms of the Living' (1886); Myers, 'Human Personality and Its Survival of Bodily Death' (1903); Parish, 'Hallucinations and Illusions' (1897); Podmore, 'Studies in Psychical Research' (1897).

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**Psy'chidæ**, a family of moths (q.v.).

**Psychological Apparatus.** The object of the psychological laboratory is, in brief, to standardize the conditions of introspection (see PSYCHOLOGY); to make it possible that psychological observations shall be taken in the most favorable circumstances, so that they may be repeated (by the same or by other observers), isolated and varied. It is only under these experimental conditions that the results of introspection can lay claim to universal validity. The single, hap-hazard observation, made under all the distractions of ordinary life, is worth as little in psychology as it would be in physics or physiology. Hence it was nothing less than a revolution in psychology when W. Wundt founded in 1879, at Leipsic, the first psychological laboratory that the world had known. Wundt's example was quickly followed in America by G. S. Hall, who founded a laboratory in 1881 at the Johns Hopkins University. At the present time, all the more important seats of learning in Germany and the United States are equipped with psychological laboratories, while there are a large number distributed through the other civilized countries of the world.

To give an idea of the problems with which

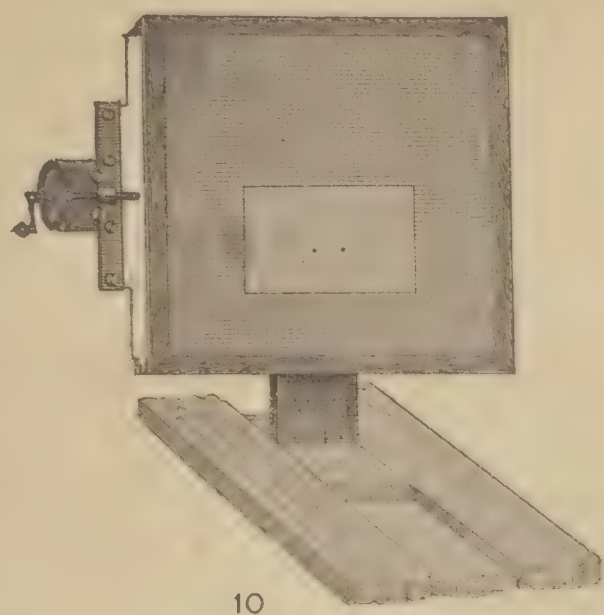
the experimental psychologist is busied, we may mention some of Wundt's early apparatus and the questions which he hoped to solve by their aid. In 1861 Wundt devised the *complication pendulum* (Fig. 1) in order to determine the behavior of attention under the influence of two simultaneous stimuli. Suppose that I am subjected, at one and the same time, to a sight and a sound. Do I hear and see together? Do I see before I hear, or hear before I see? The question was of great practical importance, since it was involved in the "eye and ear" method then in vogue for a certain type of astronomical observations. Its general psychological importance is obvious. The instrument, now, "consists of a large heavy wooden pendulum. The bulb carries a pointer, which as the pendulum swings passes over a circular scale. Near the point of rotation *m* there is fixed to the stem a horizontal metal bar *ss*. A movable vertical standard *h* has attached to it a metal spring, also in the horizontal line. The spring is fixed in such a way that the bar *ss* in passing by produces a short single click, the end of the bar and the point of the spring just touching each other, while the shock is so slight that the course of the heavy pendulum is not noticeably affected. By watching the course of the pointer attached to the bulb of the pendulum, while the upper part of the instrument remains concealed, we can determine at what point of its passage to or fro the click of the spring takes place. For example, if the pointer appears to be at *e'* at the moment of the sound, the bar *ss* will be in the position *ab*, and this will mean that the passage is put too early. If the pointer seemed to be at *e''*, the bar would be in the position *cd*, and this would mean that the passage was put too late. If we know the duration and amplitude of the pendular vibration, and measure the angular difference between *e'* or *e''* and the actual point at which the bar *ss* comes in contact with the spring, we can easily calculate the interval between the giving of the sound and its apperception." The instrument has been gradually refined, and its scope extended, until it now has the form shown in Fig. 2.

Another of Wundt's early experiments was made to determine the range of consciousness for auditory impressions. I hear a number of similar sounds; say, of metronome strokes. How large a group can I keep in mind at once? I must not count; for that would mean a separate attention, and a verbal association, to every sound. Suppose that a group of 20 strokes, marked off by bell-tones, is followed by a group of 21, marked off in the same way. Do the two groups appear the same, or can I tell that they are of different lengths? This question was answered by Wundt by aid of the instruments shown in Fig. 3. The metronome *M* gave the series of sounds, and the limits of the series were indicated by the bell *G*. Fig. 4 shows a later and better instrument, for the determination of the range of consciousness to visual impressions.

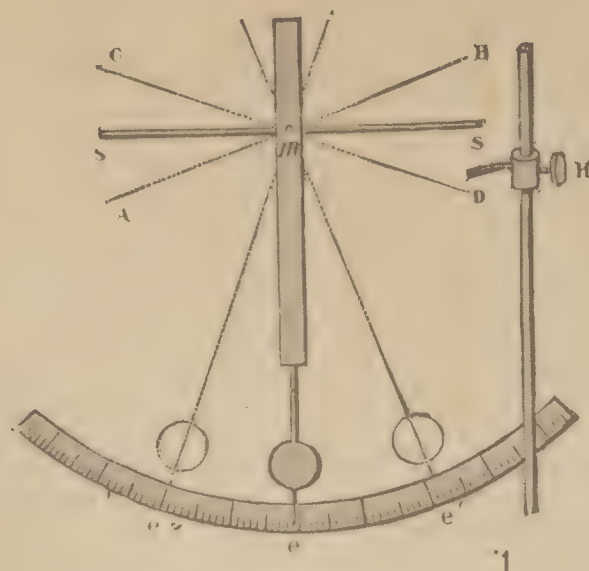
A third experiment concerns our judgment of time intervals. A wheel, driven by clock-work, carries a pointer which clicks against contact strips arranged along the circumference. The instrument is shown in Fig. 5. It is possible to give two clicks, and to let the observer



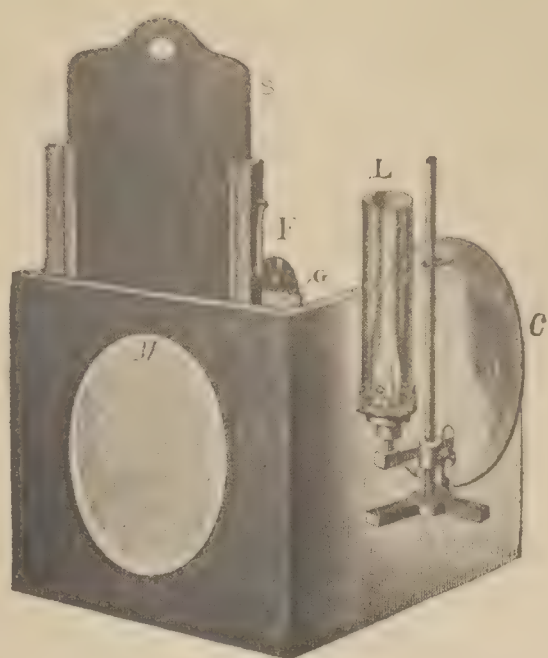
# PSYCHOLOGICAL APPARATUS



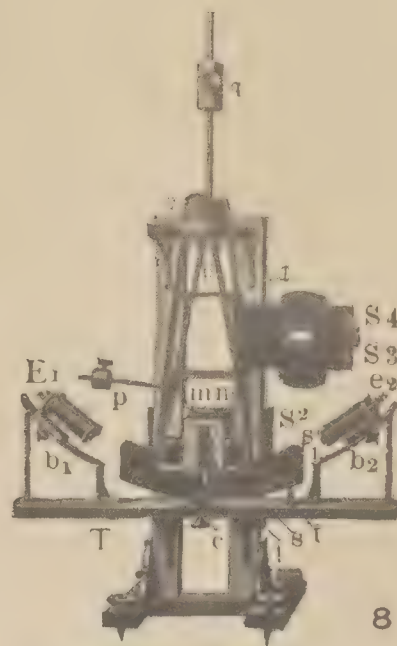
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9



8



7



6

For explanation see article.







## PSYCHOLOGICAL APPARATUS

arrest the clock after an interval which seems to him to be equal to the interval that separates the clicks; or to sound three clicks,—two continuous intervals,—and to let the observer judge of the equality or inequality of the times enclosed by them; or, finally, to sound four clicks,—two intervals with a pause between,—and to see how the observer's judgment of equality or inequality of the times varies with variation of this intervening pause. A newer and more elaborate instrument is shown in Fig. 6.

A fourth experiment, known as the "simple reaction experiment," is important for the psychological analysis of attention and action. A simple stimulus (a flash of light, or the sound of a ball falling on a wooden plate) is given to the observer, and he replies to it by making some simple movement, which has been determined beforehand. Instruments are so arranged that the giving of the stimulus starts an electric clock, and the responsive movement stops it: so that the time elapsing between stimulus and answer to stimulus can be exactly measured. It is clear that the "reaction" experiment reproduces for us, in an elementary form, the consciousness of voluntary action. We see or hear something, and act upon it. Since the experiment can be repeated as often as necessary, it is possible, by means of it, to subject the action consciousness to minute and refined introspective examination. We find, further, that the time of reaction varies, according as the attention is directed predominantly to the stimulus or to the reaction movement, according as the stimulus attended to is to be apprehended in its qualitative or intensive character, according as the observer is fresh or fatigued, etc. The apparatus employed are shown in Fig. 7. The falling of the ball upon the plate in *F* starts the electric clock *H*, whose unit is 1-1000 sec. Pressure of the finger upon the key *U* stops the clock: this pressure constitutes the movement of reaction. *C* is a hammer, whose time of fall is constant; it serves to check the accuracy of the clock (chronoscope). The other instruments figured are subsidiary. Fig. 8 shows an elaborate apparatus for giving visual stimuli in reaction work.

The reaction experiment may be adapted to more complex consciousnesses. Thus the observer may be told that he will hear either a noise or a tone: he is not to move until he is sure of the stimulus given (discrimination reaction). Or he may be told that he will hear either a noise or a tone, and that he is to react to noise with the right and to tone with the left hand (choice reaction). Or again, the stimulus may be a spoken word, to which the observer reacts by speaking a second word which he has associated to the stimulus. Instruments have been devised which meet the requirements of these and of many other variations of the experimental procedure.

The four experiments thus far discussed are typical of the problems with which experimental psychology set out. In a well-equipped modern laboratory, the apparatus fall into three main groups: demonstration instruments, with which experiments may be performed upon the lecturer's desk; class instruments, which are put into the hands of undergraduate students for training and drill-work; and research instruments, the materials of investigation by graduate students and by the instructing staff. As

an illustration of the demonstration group, we may cite Wundt's apparatus for negative after-images of vision (Fig. 9). A large circle of colored glass, placed directly behind a ground glass plate, and illuminated by a powerful lamp, is fixated by the members of the class for some 30 seconds. At the end of this time a screen is dropped between colored glass and lamp. The ground glass surface then appears, as a light gray; and upon this gray background the after-image of the colored stimulus develops. As an illustration of the second group, we may mention an apparatus for the determination of the *minimum visibile* of distance (Fig. 10). Two black points appear upon a white cardboard surface. The one point is fixed: it is painted upon the back surface of a sheet of glass which covers the cardboard. The other, painted upon the cardboard background, can be moved to or from the fixed point by means of a micrometer screw (reading to 1-200 mm.) placed at the side of the frame. The problem is to determine the least separation of the points which (under given conditions of experimentation) can still be perceived by the observer. Finally, as an illustration of a recent research instrument, we may refer to the drop-tachistoscope for range of visual attention shown in Fig. 11 (see Fig. 4).

The range of psychological instruments is very wide. In the sphere of sensation, we have apparatus for work on color mixture, contrast, adaptation, after-images, color blindness, and the spatial distribution of the retinal sensitivity; for work on tonal fusion, beats, combination tones; for work on the sensations of pressure, warmth and cold, on the sensations of taste and smell, and on the organic (muscular, articular, etc.) sensations. In the sphere of affection, we have instruments which register exactly the bodily changes that accompany change in the affective disposition (pleasantness and unpleasantness): pulse recorders or sphygmographs, breathing recorders or pneumographs, volume recorders or plethysmographs, and strength recorders, ergographs and dynamographs. In the sphere of attention, we have instruments for measuring the duration and the range or span of the attentive state. In the sphere of perception, we have, for example, all sorts of instruments for the analysis and synthesis of visual space perception: among them the familiar stereoscope, and its converse, the pseudoscope; instruments for the measurement of the various types of optical illusion, and so on. Memory and association have a whole laboratory of apparatus of their own: one of these, which exposes at regular intervals a series of words or syllables to be memorized, is shown in Fig. 12.

It should be clear, even from this hasty and imperfect survey, that the arrangement and furnishing of a modern psychological laboratory is a very complicated matter. There must be a large lecture room, fitted with all conveniences for desk demonstrations and class experiments. There must be a dark room, for work in psychological optics, and an absolutely quiet room, for work in psychological acoustics. There should be a special room, specially ventilated, for work on olfactory sensation and perception. There must be a series of fairly large and well lighted rooms for the group work of undergraduate students. There must be a series of



## PSYCHOLOGICAL ASSOCIATION — PSYCHOLOGY

closet-rooms for the research students. There must be research laboratories for the instructing staff. There must be a workshop: or rather, there should be two workshops,—one in the general laboratory, in which the students themselves may assemble complicated pieces, and make the necessary modifications in existing instruments; and another sacred to the mechanic, who is an indispensable part of the staff of an adequate laboratory. Every new investigation—and experimental psychology presents far more novel problems than can be solved, at the present rate of work, in a human generation—demands its own new set of instruments. It must be confessed that, as things are, psychology is for the most part rather shabbily housed. The science of mind appeared on the scene later than the sciences of life and of inorganic nature; and, when it came, funds and buildings were very largely preempted. There are, however, some signs that it is coming to its rights in this regard; and the next ten years should see a very considerable improvement in the material conditions under which experimental psychologists are called upon to work in colleges and universities.

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**Psychology** has been defined, from time immemorial, as the science of mind. This definition, which agrees well with the etymological meaning of the word "psychology," may be accepted by the modern psychologist, provided that its two terms ("science" and "mind") are themselves correctly defined. This is an important point: for it is clear that the terms of a definition must be mutually compatible. If we speak of a "science of mind," we must define the word "science" in such a way as to make it cover the field of mental phenomena, and we must define the word "mind" in such a way as to make it amenable to scientific treatment. To speak of a "science of mind" when one meant by "mind" something outside and beyond the reach of scientific method would be absurd.

The general characteristic of science is just its method. All science proceeds by observation; but the term science is not usually applied to any body of knowledge until it has reached the stage of experiment,—the stage, that is, at which its observations can be taken under standard conditions, can be repeated, isolated, and varied at will. Further, the term science is usually reserved for classified and coherent knowledge; for experimental observations that can be grouped together, as illustrative of some natural law or uniformity. One of the tests of a science, from this point of view, is its capacity to predict, on the basis of natural law, what will happen, under given conditions, in the individual case. Yet again, the term science, in its strictest sense, is reserved for explanatory knowledge: the observations must not only be accurate, must not only fall into groups, under general laws, and thus render it possible to predict the outcome of

new observations, but must also be linked with and referred to their own causes or conditions in the world at large. Experiment, uniformity, and explanation,—these are the three tests which psychology must satisfy, if it is to rank as a science among the sciences.

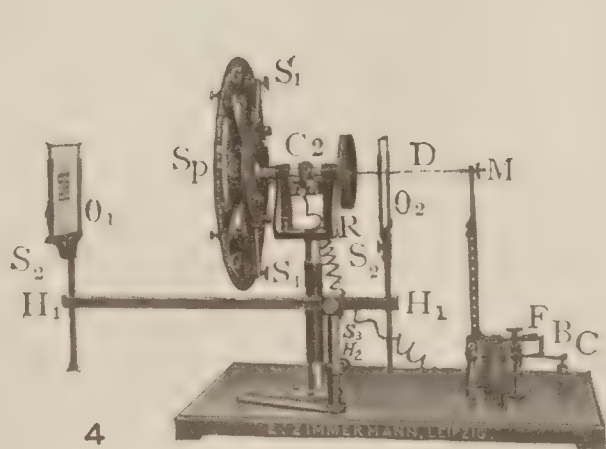
Within the scope of these general requirements, the sciences are differentiated by differences of their subject-matter. Now the subject-matter of psychology is mind: not mind as popularly understood, perhaps, but mind which is accessible to experiment, mind whose uniformities we can discover, mind whose processes we can explain. Descartes, when he set to work to reconstitute philosophy, took his stand upon the proposition "I think." It is a long two hundred and fifty years since Descartes gave his 'Discourse' to the world; and what, to him, was metaphysical speculation has now become an unquestioned belief of common sense. We all tend to look at mind as Descartes looked at it; we all tend to say "I think," and so to separate the "I," as active thinker, from the "thought" which is the result of the I's activity. Psychology cannot recognize this distinction. The datum for a psychology, if it is to be a scientific psychology, is rather "Thought goes on:" "there are processes of thought in the world." And so the subject-matter of psychology is thought just as thought exists, thought looked at for its own sake and interest. Or rather, since mind is a wider term than thought, and covers the facts of feeling and of will as well as the facts of intellect, the subject-matter of psychology is mental process: the whole tangle of thoughts, memories, fancies, feelings, emotions, resolves, desires, aspirations, that make up our mind as we look at it from moment to moment. The problem of psychology is to bring order into this chaos, to reduce the infinite variety of our immediate experience to a coherent and manageable system.

If it be asked how precisely this material differs from the material upon which other sciences are working, what is the criterion that differentiates the subject-matter of psychology from the subject-matter of physics, the reply is simple. Mental process, the material of psychology, is confined to the experience of a single individual; psychological experience is unshared experience. The universe of nature is common to all of us; the universe of mind is open but to one,—to each man his own. The laws of physics and of physiology take no account of the individual: sound is a certain motion of the air waves, digestion is a certain sequence of chemical changes; and the phenomena of sound and of digestion are treated abstractly, so that we can conceive of a deaf man as understanding acoustics, or of an anæsthetic patient as familiar with physiological chemistry. Psychology, on the other hand, deals with the sound as we hear it, with the hunger and thirst that we feel; and these experiences, however accurately we may express them in words, are, as experiences, incommunicable.

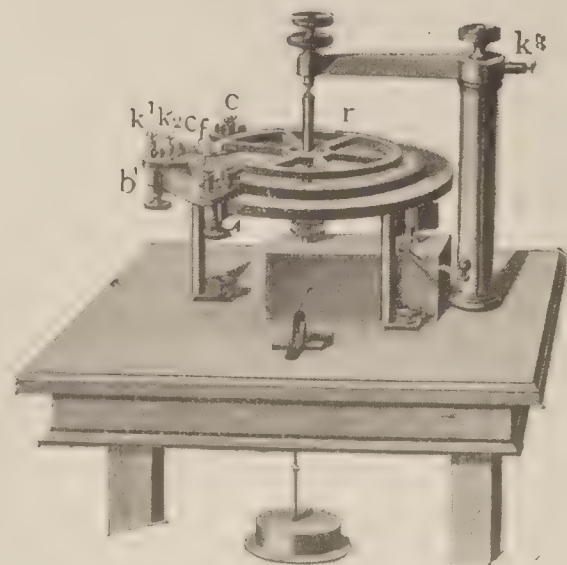
Two results follow from this peculiarity of psychological subject-matter. The first is that the method of psychology differs from the methods of the physical sciences. All science demands observation, we have said; all exact science demands experiment. So far, then, all scientific method is one and the same. But the observations and experiments of physics and



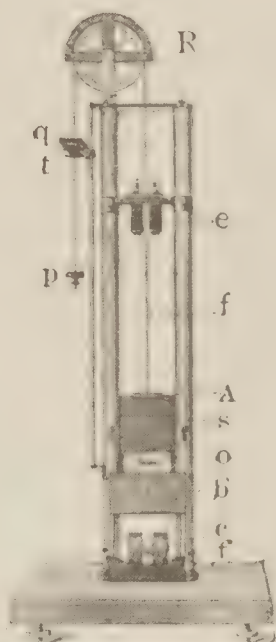
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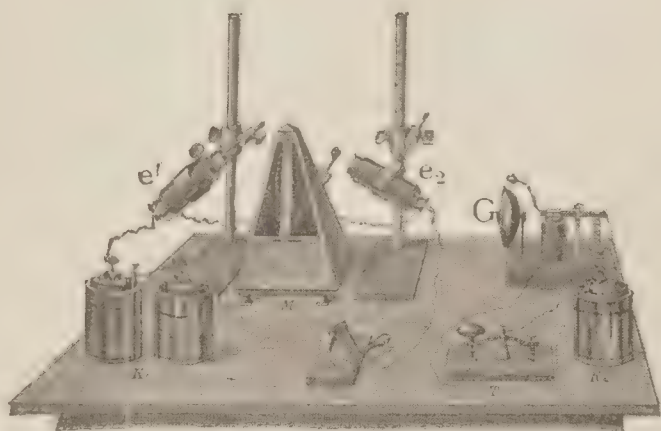
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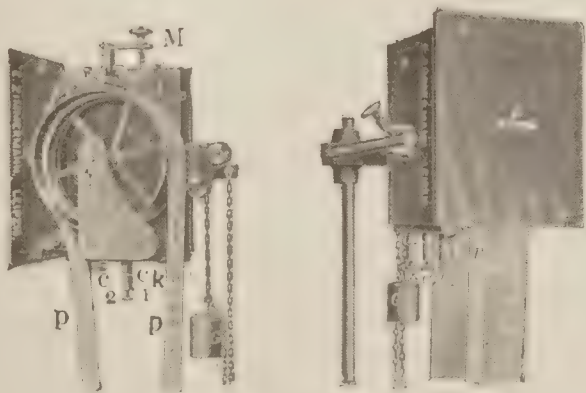
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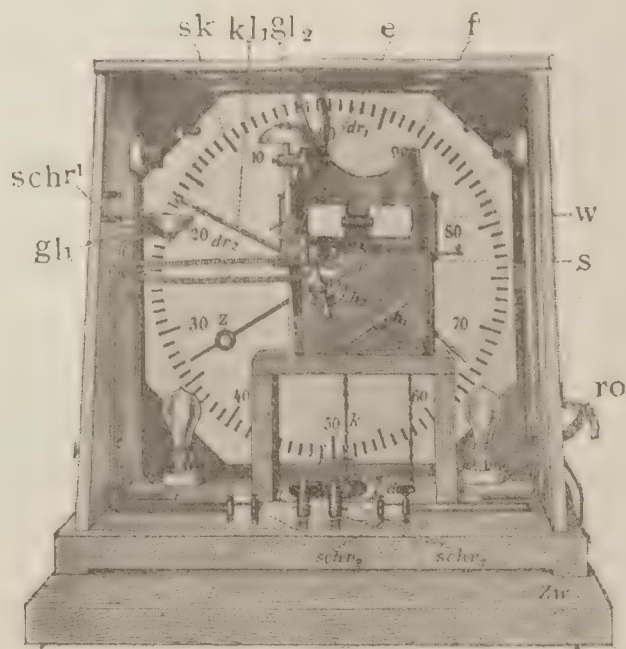
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chemistry, physiology and zoology, are made upon material that is common scientific property; the observations and experiments of psychology are made upon private property, and, more than that, upon property which is inalienable. If we class the former all together as inspection, we may oppose the latter to them as introspection. In the physical sciences we look out upon a world that is shared by everyone alike; in psychology we look within, upon our personal world. From this difference in method it follows, in the second place, that the need of an experimental verification of results is more pressing in psychology than in any other department of science. If we cannot, in some way, transcend the intrinsic defect of introspection, its personal and individual character, we are likely to have as many psychologies as there are psychologists to introspect. In actual fact, the history of psychology records not a few cases of introspective deadlock,—of observation pitted against contrary observation. It was not until the introduction of the experimental method in psychology that this danger ceased to be serious.

"But," it may be asked, "is modern psychology really free from this danger? Are all psychologists always agreed? Are there not still schools of psychology?" To answer these questions we must distinguish a little. In principle, modern psychology is free from the danger of introspective deadlock. Divergent observations are still made, in plenty; but psychology herself furnishes the means of reconciling the divergence. Let us take an illustration from physics. Two competent observers may be analyzing a compound body by the spectroscopic method: the one may find the lines of a certain rare element, the other may be wholly unable to see these lines. Both analyses are published. We read them, and notice that they disagree. Do we at once lose confidence in the method? Not at all: we simply hold our judgment in suspense until further observations, by the same method, are forthcoming. We say that there must, in the one case or the other, have been some unsuspected source of error which vitiated the result; and we appeal to the method itself to indicate this source of error. More observations are made, with stricter regard to the conditions of the analysis; and presently we reach a final conclusion. It is precisely the same in psychology. Experimental introspection may yield conflicting results, as does experimental inspection. But we have merely to go on experimenting, and the true result will ultimately emerge. In principle, then, psychology has nothing to fear from this particular danger. On the other hand, it must be frankly admitted that there are many and various schools of psychology. Only, the points of disagreement are points that lie outside of psychology itself. Let us, again, take an illustration from the sciences of nature. Listen to a group of mathematicians discussing the character of the infinitesimal; to a group of physicists discussing the definition of energy; to a group of physiologists discussing the mechanics of life. To hear them, one would think that the status of their respective sciences was precarious in the extreme. Yet we all make use of the calculus; we build locomotives and power-plants and rely upon the balance and the thermometer; nay, we trust our actual lives to the surgeon and the physician. Moreover, the practical work of all these sciences goes on, and goes on with increasingly

fruitful result, despite the theoretical difficulties that lie behind it. So it is in psychology. Psychologists are apt to dispute the greater and more fundamental issues that lie before and after their science: these issues will always be disputed, so far as we can see, while human nature remains human nature, and men are individualized by training and temperament to envisage the universe from different points of view. In a general sketch, like the present, such differences must be baldly and plainly stated. The reader must, therefore, be warned not to lay too much stress upon them. The extreme opinions of opposing schools shade into one another by imperceptible gradations. And however extreme they may be, they have little if any bearing upon the practical work, the teaching and investigation, of mental science.

*The Problem of Psychology.*—We said above that the problem of a scientific psychology is to bring order into the chaos of the immediate experience. We may now note that, chaotic as this experience is, it nevertheless is something more than chaos; it groups itself, roughly and indefinitely, no doubt, but still quite noticeably. If we reserve the wider term "mind" for the sum total of mental processes running their course between birth and death, we may say, first of all, that mind splits up into "consciousnesses." A consciousness is a mental present; a mind that has a temporal "now" stamped upon it; a bit of mind that is occupied with a single, however complicated, topic. Thus, to put the matter crudely, we begin the day with a getting-up consciousness; this is followed by a breakfast consciousness; this by a newspaper or a correspondence consciousness; this by a daily-work consciousness; this by a luncheon consciousness; and so on. The divisions are real, even if they are not very accurate or precise. We notice, further, that these consciousnesses themselves fall into groups. Sometimes we are stirred and moved by the topic of consciousness: we are ill-humored, angry, anxious, pleased, relieved, aggrieved, hopeful, satisfied, and what not. Sometimes we are passive, indifferent, taking things as a matter of course. Sometimes we are hard at work, resolute to solve a problem or to overcome a difficulty or to extricate ourselves from an embarrassing position, bending all our energies upon a given end. Sometimes, again, we are unable to concentrate ourselves; we are talkative, reminiscential, fanciful, dreamy, whimsical. A very little introspection of this sort will suggest the distinction of the great mental categories of memory, attention, imagination, emotion, etc. Once more, we notice that the consciousnesses which fall under these categories are complex. Take the emotion of anger. It is not a simple, unanalyzable experience, but is made up of part-processes. There is the idea of the scene or act that has called up the anger; the idea of retaliation; the feeling of injury or of wounded self-esteem; all sorts of memories of one's own or of others' conduct on similar past occasions; and all sorts of "bodily" feelings,—a choking or strangling, perhaps, or a feeling of strength and power, coming with a brace of the body and a clenching of the fist. These part-processes are readily distinguishable; and they take us a step further in the analysis of consciousness, and show us the concrete processes that are termed, technically, perception and idea, feeling and de-



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sire, etc. Lastly, we may notice, after a little scrutiny, that these processes in their turn are, literally, concrete: not simple, but made up of simpler elements. My idea of retaliation, for instance, is an idea of something that would take time for its fulfilment, of something that would run its course in stages or phases. And it is more than probable that each one of the stages would, under accurate observation, turn out to be a concretion and not an elementary process.

Now this work of analysis, which we have so far pursued without the aid of any technical method, constitutes the first part of the real problem of psychology. The psychologist is called upon, first of all, to determine the number and nature of the mental elements. Mind, like all other organizations,—like the natural world itself,—is built up from certain irreducible elements; and if we are properly to understand it, we must catalogue and describe its elementary processes. Psychologists are nowadays fairly well agreed that the mental elements are of two kinds or classes: sensations (blue, cold, sour, the tone C, the sensations of pressure on the skin, of muscular contraction, of smell, etc.), the ultimate constituents of the intellectual life, and affections (pleasant, unpleasant), the ultimate constituents of the life of feeling and emotion. There is no simple process underlying the volitional life; all acts of will, all resolutions and choices, are made up of sensations and affections in conjunction. On the other hand, mind is not adequately described as a resultant or derivative of the two elements. It is true that every consciousness, in the last resort, is compounded of so many sensations and a certain affection. But we find that the elementary processes of a consciousness may differ, not only in degree or intensity (as strong and weak, loud and faint), but also in clearness or distinctness. So we may speak of a "state" of consciousness, very much as we speak of the state of the roads, or of the weather, or of a man's affairs. We speak always in terms of the same material: in terms of the road-bed, of rain and shine, of capital and interest. In the case of consciousness, we speak always in terms of the ultimate elements, sensations and affections. Only, as the road may be firm or muddy, the weather clear or threatening, the financial outlook good or bad, so may the processes in consciousness be clear or obscure, distinct or indistinct, powerful and insistent or ineffective, overshadowed by rival processes. It is worth noting that modern psychology thus finds a use for the phrase "state of consciousness" which is altogether different from its use in the older psychology. When consciousness was identified with the "I," the phenomena that we now call processes of consciousness were naturally identified with the "states" or "manifestations" of the active principle; and even to-day, in popular writing, the phrase "states of consciousness" is oftentimes employed with the meaning of "conscious processes." Such confusion of language can only minister to confusion of thought. The processes, the materials of consciousness, are one thing; the state or condition in which the materials are presented is another.

The most important states of consciousness, in the normal life, are those of attention and inattention. In attention, the processes that make up a consciousness run their course at two

different levels. The processes attended to are more clear and distinct, sometimes are stronger and last longer than their fellows; the processes attended-from are depressed, checked, obscured. In inattention, all the processes run at the same low level.

Analysis, then, the first part of the problem of psychology, leaves us with the two elementary processes, sensation and affection, and with the elementary states of attention and inattention. The psychologist is next required to bring the results of his analysis together, to make a synthesis, to formulate laws of the connection of the elements. The synthesis is tested, at every step, by appeal to introspection, that is, to the actual facts of mental experience. If the analysis has been faulty, the reconstruction will be faulty, will not square with the facts; the method thus becomes its own test of truth. Proceeding in this way, psychology is able to rise to laws or uniformities; it states the laws of color mixture, the laws of affective sequence and composition, the limits of the grasp and duration of attention. Proceeding still further along the same road, it states the laws of the association of ideas, or of the expression of the emotions. In time, it becomes quantitative, and gives numerical formulæ for the intensity of a color contrast or the trustworthiness of memory. In doing all this, it is simply following the example of the sciences of nature, organizing and systematizing its material.

If, now, psychology went no farther, it would still have claims to rank as a science. But it would be a merely descriptive, not an explanatory science. As a matter of fact, it goes on to explain its phenomena, to give the conditions under which they occur or appear. And at this point we come upon one of those theoretical differences of which we spoke above. What are the conditions of a mental process? Some psychologists affirm that, as the mind is always found together with a living body, so it is always conditioned upon physiological processes; a mental formation or concretion is to be explained by reference to the bodily condition that underlies it. Others, again, make appeal to unconscious or subliminal mental processes, which are the condition of our conscious experience, of the supraliminal mind. And yet others would explain mind by mind, deriving mental process from mental process by a principle of mental causality. We cannot decide between these suggestions; limits of space forbid us even to give an adequate account of them. It may be said, however, that the second is the least satisfactory of the three, while controversy is keenly concerned about the other two. The experimental psychologists tend, perhaps, rather toward the first than the last.

*The Method of Psychology.*—The special method of psychology is experimental introspection. Two questions arise with regard to it. Is introspective observation ever really valid? And is the experimental method adequate to the whole mind, or only to its simpler processes?

It has been objected that introspection can never yield valid results, for the simple reason that it interferes with the course of consciousness. If consciousness is made up of mental processes, then introspection itself is a process or a group of processes. Hence, whenever I set



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out to observe a given complex, I introduce into consciousness (by the mere fact of observation) another complex, which must clash with the object of my observation. But that is a poor method which interferes with the very thing which it purports to examine and describe! The objection is usually met by the rule that one must wait to observe a mental process until after it has completed its passage; that introspective examination must always be a *post mortem* examination. On this rule, every introspection would involve memory, and be subject to the errors to which memory is subject; though the memory is in play so soon after the event to be remembered that these errors may be considered minimal. In reality, both the objection and its answer seem to beg the question of what introspection is. What the psychologist does, when he introspects, is to experience attentively, to live attentively, the process under investigation, and to make a report about his experience in words. No new process is introduced into consciousness. Whether the words that describe the experience are uttered as the process runs its course, or are pronounced after it is over, will depend upon the circumstances of observation and upon the psychologist's ability and training: no single rule can be laid down in the matter. As thus understood, there can be no question but that introspection is a valid form of scientific observation. And even apart from this theoretical justification, introspection is justified by its results.

The second question, that of the scope of experiment in psychology, has been much discussed, and with very different results. If we face it in the light of history, it seems to answer itself. Psychologists were told, at first, that they could not push the borders of experiment beyond sensation. But they invaded the spheres of affection and attention. They were then told that experiment was adequate only to the simplest states and processes of mind. But they experimented upon perception and idea, upon association and memory and imagination. They were told, again, that experiment could never attain to the purely intellectual, or indeed to any of the higher aspects of the human mind. But they made experiments upon judgment and reasoning, and upon the æsthetic consciousness. It is true that these latter experiments are few and scattered, and that whole consciousnesses still await experimental investigation. But there seems to be no doubt that, in principle, the entire realm of mind is susceptible to experiment. With a method thus justified, it can only be a matter of time for psychology to establish herself as securely as physics or physiology.

*The Various Departments of Psychology.*—Many attempts have been made to classify the different departments of psychology in accordance with some logical plan. As no such classification has received general acceptance, we may ourselves abandon the attempt to be logical, and simply pass in brief review the most important branches of psychology that exist at the present time.

We may distinguish, at the outset, an analytical from a genetic psychology. Defining roughly, we may say that analytical psychology takes the human mind as it is, and aims to discover its elements and laws, while genetic

psychology seeks to trace the growth of mind from its first beginnings, and to explain the present in the light of mental history. It is needless to say that the two psychologies overlap at many points. Analysis can seldom be completed, except by help of genetic considerations; and the study of psychogenesis implies, on its side, an analytical knowledge of the developed mind. Genetic psychology is also termed comparative psychology, and has various subdivisions: animal psychology, child psychology, the psychology of adolescence, etc.

We may distinguish, secondly, between qualitative and quantitative standpoints within psychology. Suppose, for example, that I am interested to determine the least difference between two weights that can be perceived by the lifting hand. The numerical result that I obtain is a quantitative result in analytical psychology. If, however, I attempt to trace out the various conscious factors that contribute to my judgment of difference or no-difference,—factors of expectation, of habit, of fatigue, of attention, that may affect the judgment; factors of attentive comparison, of association, of first impression, of effort or ease, that may directly prompt the judgment,—then I am performing a qualitative experiment. The two sorts of result should always go side by side, and should (in a perfect psychology) run exactly parallel,—a numerical statement accompanying the introduction of every qualitative term. Both are indispensable to complete knowledge. Genetic psychology is, at present, almost entirely qualitative, and will probably remain so for a considerable period. It is but the other day that statistical methods were introduced into the study of organic evolution.

We may distinguish, once more, between psychology as a science of mental function and psychology as a science of mental structure. The difference is very much like that which obtains between anatomy and physiology. Structural psychology seeks to discover what consciousness is composed of, when the organism is functioning in a certain way. I remember, or I recognize, or I imagine. What, then, are the constituent processes of the memory consciousness? What is my mind made up of, when I am recognizing? What actually takes place, mentally, when I imagine? Many interesting facts have been brought to light by structural psychology. Thus it has been shown that, when we recognize an object, we ordinarily do so, not by way of a comparison of the perceived thing with its memory image, but simply by way of a diffused "feeling of familiarity," consisting essentially of those organic (internal) sensations which enter into the bodily attitude of relief or freedom from tension. Functional psychology seeks, in its turn, to classify and derive the functions of consciousness, the uses to which mind is put in the service of the organism. Thus it may reduce the root-functions of mind to those of cognition and interest, and trace the differentiation of the former into discrimination, integration, comparison, etc., and that of the latter into the manifold modes of conative (will) and emotive consciousness.

All these psychologies are, in one sense of the term, individual psychologies; they discuss the composition or genesis of a single, typical mind. There is, however, a specific, individual,



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or differential psychology, whose problem it is to trace the correlation between the processes or functions characteristic of a certain type of mind, and to compare this with other minds of different types. Thus it is a fact of individual psychology, in this sense, that some minds depend mainly upon visual, others again upon auditory, and still others upon kinæsthetic (motor) images in the processes of memory, imagination, and thought. Over against individual psychology, in this meaning of the word, stands national or racial psychology, which attempts to discover the forms of thought and feeling characteristic of the common mind of a people.

This common mind is, indeed, a fertile field for psychological cultivation. The mind of a people is, from one point of view, nothing more than the aggregate of the minds of the individuals composing the people. There are no new processes in the common mind: common mental processes are impossibilities. From another point of view, however, the common mind offers a distinct problem to psychology. The mental productions of men in society differ from the mental productions of the individual. No single man would ever have invented language in order to talk with himself; language is a product of the common mind. One mind may take on a habit; it requires at least two to make a law or a custom. These products of the common mind—mythology, and religious observances, language, law, and custom—are treated by social psychology, which approaches them by analytic, comparative, and genetic methods, and seeks to explain them in part from the nature of the individual mind, in part from the circumstances in which man, as a social being, has at various epochs of his history been placed.

Lastly, we may contrast normal with abnormal psychology. This deals with such transitory abnormalities as sleep and hypnosis, or with the chronic derangements of insanity. In every case, the key to the abnormal mind is to be found in the status of attention. In dreams, we have a limited and irregular distribution of attention; in hypnosis, an exaggerated passive attention, with its accompanying suggestibility. And we have misdirection, inertia and decay of attention variously exhibited in the various forms of mental disorder.

Here our list of the principal departments of psychology may come to an end.\* All through, introspection is the special psychological method, and the dictum of introspection is the final appeal. Animals and infants and the insane cannot, of course, be called upon to introspect. Nor, for that matter, can a "common" mind. But we observe the conduct of children and animals, and interpret it in the light of our own adult introspections; we search for parallels to the abnormal in our own normal consciousness; and we base our study of social psychology upon the laws of the individual mind.

*Mind and Body.*—The question of the relation of mind to body is an old one in the history

of philosophy; but it is a question that still awaits its answer. Psychology cannot avoid it; and we may therefore give here a brief indication of current views.

The two rival theories now most in vogue among systematic psychologists are those of psychophysical parallelism and of interaction. The former declares that mental and bodily processes run side by side, without mutual influence or interference. Every mental process is paralleled by a nervous process. But the nervous processes are links in the unbroken chain of physical causation; and this is complete in itself. Mind is wholly unable to work changes in matter. The latter theory affirms, on the contrary, that mental process influences, and is in turn influenced by bodily process: our grief makes us cry, our idea that it is late makes us run to catch a train, as truly as our fit of indignation makes us gloomy, or a cold in the head makes us stupid.

Common sense is, naturally enough, on the side of interaction. Nevertheless, the theory presents grave difficulties. We must either admit that mind is a special mode of energy, capable of give-and-take with the various forms of energy familiar to us in the natural world; or we must assume that the mind can, without expenditure of energy, deflect the course of physical molecules. Parallelism, while it sins against common sense by making mind causally inefficient, epiphenomenal, has at least the advantage that it leaves the order of the natural universe intact. It has, indeed, further advantages. It has proved to be an admirable working hypothesis for scientific psychology; and it is a purely empirical and non-committal statement of the relationship of mind and body,—a statement that may be reconciled with diverse forms of philosophical belief. It leads, perhaps, most directly to the philosophical doctrine of panpsychism, according to which consciousness is the reality and the concomitant brain-process a phenomenal symbol of this reality. This doctrine serves to reconcile the conflict between parallelism and interactionism, seeing that it guarantees the efficiency of mind while it insists upon the parallel relation of mind and body. It may be noted that Gustav Theodor Fechner (1801–87), the father and founder of experimental psychology, combined an acceptance of psychophysical parallelism, as a working hypothesis for the laboratory, with a belief in panpsychism as the only tenable metaphysics.

*The Relation of Psychology to Other Sciences and to Philosophy.*—Psychology comes into manifold relation with the natural sciences. As a quantitative science, it requires the aid of mathematics; as an experimental science, it requires the aid of physics. In all its forms, it presupposes a knowledge of the physiology of sense-organs and nervous system: if it seek its explanations in physiology, this knowledge must be accurate and detailed. Insanity can be understood only in the light of pathological histology; comparative psychology rests upon comparative anatomy and comparative physiology.

Nor is the relation less close with the "mental sciences." Social psychology comes into contact with anthropology and ethnology; with political history and sociology; with philology; with the history of art, religion, law,—the history of civilization at large. It is, indeed, hardly too

\* "Experimental psychology" is simply psychology approached by the experimental method; it is not a special branch of psychology. "Physiological psychology" is a phrase used sometimes as an equivalent of experimental psychology, sometimes as an inclusive term, covering (besides experimental psychology) a portion of the physiology of the central nervous system.



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much to claim for psychology the central position in the classification of the sciences: a position that connects it equally with the sciences of nature, on the one hand, and the sciences of the productions of the human mind on the other.

The relation of psychology to philosophy is less easily defined. Until very recently, psychology was not a science at all, but a branch of philosophy. Now that her independence is established, psychology naturally tends to emphasize the breach between herself and the philosophical disciplines. Philosophy, on the other hand, unwilling to recognize the independence of a revolted subject, insists that psychology runs into danger as soon as ever she rejects metaphysical guidance. There is truth in both attitudes. One may be a good psychologist, at the present day, without having opened a philosophical book. Contrariwise, one cannot approach the fundamental questions that lie before and after psychology without plunging, at once, into problems of epistemology and of metaphysics. As with life and matter, so with mind: there is practical work to be done in physics and biology and psychology that may be done, and well done, without philosophical reference. But the practical work springs out of, and leads toward, theoretical issues of the widest kind.

It may be added that the central position of psychology is further warranted by its relation to the special departments of philosophy. Functional psychology is the necessary basis of logic; social psychology is the only straight path to a sound ethics; a psychological analysis of the sentiment of beauty is the prerequisite of æsthetics; the psychology of the religious consciousness is the propædæutic to a philosophy of religion.

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**Psy''chophys'ics.** By some this science is regarded as synonymous with physiological psychology; by others, as dealing particularly with the phenomena which bring out the relation of sensations to physical stimuli. In this character it deals with the study of Fechner's and Weber's laws as a separate department of psychological science. Psychophysics deals particularly with the measurements of intensity of sensations, and endeavors to establish general laws regarding the phenomena. Consult: Wundt, 'Physiologische Psychologie'; Baldwin, 'Dictionary of Philosophy.'

**Psychrom'eter**, an instrument for measuring the tension of aqueous vapor in the atmosphere. See **HYGROMETER**.

**Ptah**, ptä, or **Phtha**, Egyptian god of the most ancient type, described in inscriptions as "creator of the earth, father of the gods and all the beings of this earth, father of beginnings." He was compared by the Greeks to Hephæstus, being, like him, patron of metal-workers and sculptors. Representing the beginning of all things he was shown as an undeveloped child or dwarf (Ptah-Patack), or as a mummy. He had a magnificent temple at Memphis.

**Ptarmigan**, tär'mī-gan, a grouse of the genus *Lagopus*, which differs from the ordinary grouse in having the legs feathered to the claws, giving somewhat the appearance of a hare's foot (whence the generic name). The truncated tail has 14 or 16 feathers, most of the species become white in winter, and the nasal groove is densely clothed with feathers. There are six or eight species described, inhabiting the northern and snow-covered regions of both hemispheres, being one of the few genera characteristic of the arctic fauna; they are as much at home in snow as are the web-footed birds in water, and their plumed feet enable them to run over its surface without sinking in. They live in families during most of the year, and are monogamous; the females incubate, but the males assist in rearing and feeding the young. The males have a loud harsh or sometimes clear cry, and the females cackle like a hen. They fly swiftly without a whirring noise, and run well. They feed upon berries, buds, mosses, and lichens, and insects. Their pursuit affords an exciting sport; they are very shy, but when started are easily shot on account of their regular flight. The summer plumage is varied with brown, black, and gray, most of the wing remaining white; in the males the mottling is finer and the colors brighter. There are three well ascertained species in America, besides several sub-species and races. The white ptarmigan or willow grouse (*L. lagopus*) is about 16 inches long and 24½ inches in alar extent; the bill is black, very stout, and convex, and broad at the tip; the general plumage in summer is rufous or orange chestnut on the head and neck; feathers of back black, closely barred with yellowish brown and chestnut; most of wings and lower parts white; tail brownish black; in winter white, with black tail; no black stripe through the eye. It occurs commonly in the northern parts of America, and in rare instances in the northern United States (Maine and Minnesota). It is found in open rocky grounds and among dwarf willows and birches. In winter they scratch in the snow down to the mosses and lichens on which they



## PTERANODON — PTEROSAURIA

feed, collecting often in considerable flocks. In winter the flesh is dry, but is tender and with an agreeable aromatic flavor in summer. They breed in Labrador about the beginning of June, placing the nest under the creeping branches of low firs; the eggs are from 6 to 14, of a fawn color or rufous ground with irregular spots of reddish brown; only one brood is raised in a season. The rock ptarmigan (*L. rupestris*) is 14½ inches long; the bill is slender, rather compressed at the tip; in summer the feathers of the back are black banded with yellowish brown and tipped with white; in winter white, with the tail black (the four middle feathers white), and the male with a black bar from the bill through the eyes. It occurs in arctic America, from Alaska to Labrador and the Gulf of Saint Lawrence. The white-tailed ptarmigan (*L. leucurus*) is found on the alpine summits of the Rocky and Cascade Mountains from New Mexico to the Arctic Regions. This species is entirely white in winter; and in summer the tail, wings, and lower parts of the breast are white, the remainder of the plumage being a fine mixture of gray, brown, and black. A fourth species (*L. welchi*) is attributed to Newfoundland. Of the Old World species the red grouse (*L. scoticus*) is peculiar to the British Islands and a famous game bird. Unlike the other members of the genus it does not become white in winter. A typical ptarmigan (*L. alpinus*) is found in northern Europe, especially in Norway. Our own willow grouse, or a closely related species, also occurs. Consult Baird, Brewer, and Ridgway, 'North American Land Birds' (Boston, 1874). See GROUSE.

**Pteran'odon.** See PTERODACTYLS.

**Pteras'pis,** a fossil fish. See OSTRACODERMI.

**Pterichthys,** tĕ-rik'thĭs, a genus of extinct fishes belonging to the sub-class *Ostracophori* and considered to be remotely related to the modern lampreys. *Bothriolepis* is a related genus from the upper Devonian formations of America, as well as the Old World. None of the species exceed a few inches in length. The affinities of these strange forms are little understood. See OSTRACODERMI.

**Pter'iodophytes.** See FERNS AND FERN AL-LIES.

**Pterodactyls,** tĕr-ō-dāk'tĭls, extinct flying reptiles of the Mesozoic group *Pterosauria*. These bird-shaped reptiles are distinguished by the enormous elongation of the fore-limbs into wings, and especially the fifth or outermost finger, which served for the attachment of a membrane, by means of which these animals could support themselves in the air like bats. No outer skeleton of scales, etc., seems to have been developed. The dorsal vertebræ are hollow in front and convex behind, the front ribs of the trunk possessing double heads. The cervical or neck vertebræ were of large size, those of the pelvis being exceedingly small. The breast-bone was broad, and, as in birds, bore a median ridge or keel for the attachment of the pectoral or breast muscles, used in flight. The sternal ribs were ossified. The jaws were elongated, and provided with teeth, set in sockets. The head itself was of relatively large size. The eye was protected and strengthened by possessing a row of bony plates in its outer or sclerotic coat. The bones of the shoulder-girdle consisted of a

shoulder-blade or scapula, and of large coracoid bones, which, as in birds, were attached directly to the breast-bone. No collar-bones or clavicles appear to have been developed. The bones of the fore-arm were elongated, the outermost finger being excessively developed in this respect, and clawless, while the other digits were furnished with claw-like nails. The elongated finger gave support to a wing-membrane, which extended along the sides of the body to the comparatively small and weak hind limbs, and also stretched between the hind limbs and short tail. The bones were hollow, as in birds.

The Pterodactyls are exclusively confined to the Mesozoic rocks, being found from the Lower Lias to the Middle Cretaceous rocks inclusive. The lithographic slates of Solenhofen in Bavaria, belonging to the Upper Oolitic system, are especially rich in pterodactyl remains. Most of them are of small or moderate size. Familiar species, among many, are the *P. crassirostris*, *P. longirostris*, *P. longicollis*, *P. brevirostris*, *P. medius*, etc. Other genera are *Dimorphodon*, which possesses large, sharp, front teeth, and small, lancet-shaped hinder teeth; *Ramphorhynchus*, which has no teeth in the front portion of either jaw, but possesses hinder teeth in both jaws. The front portion of the jaws in the latter form may therefore have formed a bird-like beak. *Pteranodon*, however, has no teeth at all, and has been made the basis of a separate group (*Pteranodontes*). One of its species (*P. longiceps*) from the Middle Cretaceous of Kansas had a wing expanse of 20 feet. Consult: Zittel-Eastman, 'Text-book of Paleontology' (1902); Seeley, 'Dragons of the Air' (1902).

**Pterop'oda,** a group of mollusks, formerly regarded as a distinct class, but now known to be only a sub-order of the opisthobranch gastropods, especially modified for a pelagic life. Like the other opisthobranchs, they are simple in structure, the heart being posterior in position and the nervous system without a trust. They are hermaphroditic. The name pteropod refers to the ring-like development of lateral processes (parapodia) of the foot, which serve as fins by means of which the animals swim. The head and usually the tentacles and eyes are lacking. Some of the species are naked, while others secrete delicate shells, which are in some cases spiral (*Limacinidæ*), or straight slender cones (*Carolinidæ*) or more or less pyramidal (*Hyalidæ*). All of the species are small, many being almost microscopic in size. In certain parts of the ocean these animals are so abundant that their dead shells, accumulating on the bottom, have given the name "pteropod ooze" to the deposits. In the northern seas one species (*Clione papilionacea*) occurs in enormous numbers, forming a large element in the "brit" on which the right whales feed. Fossil pteropods are well known from all rocks from the Lower Cambrian to the present. Consult authorities cited under MOLLUSCA. See OOZE.

**Pterosau'ria,** a subclass of Mesozoic reptiles, prominently characterized by the power of flight; the pterodactyls. Anatomically, they have fixed quadrate bones, and the anterior limbs formed into wings, with enormously elongated ulnar finger carrying a patagium. The group consists of an order (*Pterosauri*), divided into two suborders *Pterodactyli* and *Pteranodontes*. See PTERODACTYLS.



## PTERYGIUM — PTOLEMY

**Pteryg'ium**, a fan-shaped patch of mucous membrane on the ocular conjunctiva, its base being usually at the inner angle of the eye (the canthus), its apex at the margin of the cornea or overlapping it. It may appear on the temporal side of the eye; sometimes two of the patches occur in the same eye and cover the whole cornea as with a thick veil, preventing vision. Pterygium occurs in middle and advanced life, and may be either stationary or progressive. In the progressive form the patch is fleshy and the vessels are pronounced; in the non-progressive form it is pale and flat. The ordinary (regular) pterygium is due to irritation of the conjunctiva by dust and minute bodies. It may become inflamed and lead to ulceration of the conjunctiva and cornea and to impaired vision. Irregular pterygium is usually the result of burns or ulcerations. Paronychia is sometimes spoken of as pterygium digiti; pinguicula, a fan-shaped yellowish patch on either side of the cornea in old age, due to irritation from dust, etc., and leading to colloid inflammation, is sometimes called pterygium landaceum or pterygium pingue. Pterygium unguis is a condition in which the epidermis coats the nail with a thin transparent layer. For treatment of pterygium, removal by excision, strangulation, cauterization, or curettement may be employed.

**Pterylog'raphy**, the description of the arrangement and habit of growth of feathers (*pterylosis*) on the body of a bird. A bird's plumage does not grow evenly from the whole surface of the skin, but in certain tracts (*pterylæ*), the form, extent, and disposition of which differs in the various orders, families, and genera; so that the pterylosis is a character of importance in classification. The fact that the nearest approach to a uniform clothing of feathers occurs now in the ratite birds, penguins, and the like, which are lowest in organization and of most ancient origin among birds, indicates that pterylosis is a comparatively modern acquisition, and its more striking manifestations occur among birds otherwise referable to a high rank in classification. The principal feather-tracts are similarly disposed in all the groups, and consist of a tract embracing the head; a tract along the spine; a line along each side of the neck, down each side of the breast, and along the side of the abdomen curving inward to meet at the vent; a line lengthwise across the shoulders; two patches upon each leg; and the regions of growth of the wing and tail feathers. The disposition of the powder-down tracts is also a part of pterylography. This matter was first expounded by the German naturalist Nitzsch, author of 'Pterylographie' (Halle, 1847), whose work was translated and extended in a volume of the Ray Society of London for 1867. Consult Newton, 'Dictionary of Birds' (1893-6).

**Pterylo'sis.** See PTERYLOGRAPHY.

**Ptolema'ic System**, in astronomy, the system by which Claudius Ptolemy tried to explain celestial motions. The earth is the fixed centre of the universe; a vast sphere, the "primum mobile," carries all the celestial bodies, and rotates once a day; the sun and moon travel in eccentric circles round the earth, and this accounts for the annual motion of the sun, and the monthly motion of the moon; each planet moves in a circular path, termed its epicycle,

about a point, and this point travels in an eccentric circle round the sun; all motions in each order of circle being described uniformly, this explained the looped paths, the progressions, stations, and retrogradations of the planets. Every new astronomical observation required a new contrivance on this system, and at length the necessary cyclic and epicyclic combinations became excessively cumbrous.

**Ptolemais**, töl'ë-mā'is. See ACRE.

**Ptolemy**, töl'ë-mī (PTOLEMAIOS), the name of a line of Græco-Egyptian kings, who ruled from the death of Alexander the Great till the Roman occupation of Egypt 323-30 B.C. The name Ptolemy, though the common, was not the exclusive name of the kings of this dynasty, and they are better distinguished by the surname Lagidæ, from Ptolemæus Lagus, the founder of the dynasty, also surnamed Soter.

**Ptolemy I.** (called SOTER, "the Saviour"): b. Macedonia; d. 283 B.C. According to Lucian he was born about 367 B.C., but on the supposition of his being a son of Philip it must have been some years later. In 330 B.C. he was admitted into the body-guard, and from this time appears in important transactions. During the Indian campaigns he was regularly employed in the most important commands, and distinguished himself alike for valor and capacity as a general. He continued on terms of intimate friendship with Alexander, and accompanied him in his last campaign 324 B.C. On the death of Alexander he attached himself to the party of Perdiccas, and secured for himself the government of Egypt. He then proceeded to strengthen himself in his government, and concluded a secret league with Antipater against Perdiccas. In the arrangements made after the death of Perdiccas Ptolemy retained Egypt; and subsequently strengthened himself by marrying Eurydice, daughter of Antipater. On the death of Antipater (319 B.C.) Ptolemy united with Cassander and Antigonus against Eumenes, and on the defeat of Eumenes by Antigonus joined Cassander and Lysimachus against Antigonus, who invaded Syria in 315, overran Phœnicia, and laid siege to Tyre, which he took in 314. Cyprus revolted in 313, and Ptolemy proceeded thither in person, and reduced the whole island. In 312 he invaded Palestine. In 311 a general peace was effected, but it was not of long duration and was broken by Ptolemy in 310. In 308 he invaded Greece, but made little progress, and Antigonus now resolved to wrest Cyprus from Ptolemy (307). The Egyptians were totally defeated at Salamis, and Cyprus fell into the hands of the victor, who assumed the title of king. In 305 Ptolemy assisted the Rhodians against Demetrius, and from the Rhodians on this occasion acquired his surname of Soter. In 302 a league was formed against Antigonus, but alarmed by a false report that Antigonus had won the battle of Ipsus he retired to Egypt. The defeat and death of Antigonus in this battle raised Seleucus to a position of great power, and a dispute ensued between him and Ptolemy for the possession of Cœle-Syria and Phœnicia, which were ultimately acquired by Seleucus. In 295 Ptolemy recovered Cyprus, which became a permanent dependency of Egypt. Ptolemy had two sons by Eurydice, but determined to bestow the crown on Ptolemy Philadelphus, a younger son by his favorite wife



## PTOLEMY

Berenice. He announced his own retirement, and caused him to be proclaimed as his successor, 285 B.C. Ptolemy is regarded as the most prudent of the successors of Alexander. His internal administration of Egypt was enlightened and successful. He raised Alexandria to the highest rank in commercial prosperity, and founded in that city a colony of Jews, to whom the special place taken by Alexandria in subsequent times in philosophy and literature, as well as in politics, was in great measure due. He was also an eminent patron of literature, science, and art, and founded the library and museum of Alexandria. He himself wrote a narrative of the wars of Alexander, used as an authority by Arrian.

**Ptolemy II.** (PHILADELPHUS): b. Cos, 309 B.C.; d. 247. He was raised to the throne during the lifetime of his father Ptolemy I. He concluded a treaty with Rome after the defeat of Pyrrhus, and continued faithful to his alliance during the Carthaginian war. There was a chronic but uneventful war carried on during his reign with Syria. Toward the close of his reign it was terminated by the marriage of Ptolemy's daughter Berenice to Antiochus III. Either by the treaty or in the course of the war Ptolemy acquired Cœle-Syria and Phœnicia. He was also, in general, on hostile terms with Macedonia. But the chief care of Ptolemy was directed to the internal administration of his kingdom and the encouragement of commerce. He founded Arsinoe (on the site of Suez) to protect the navigation of the Red Sea, and Berenice, on the Red Sea coast, and from the latter place formed a road to Coptos on the Nile, by which the commerce of India and Arabia continued for ages to pass to Alexandria. The chief glory of Philadelphus was his munificence as a patron of science and literature. He raised the institutions founded by his father to the highest degree of splendor and spared no pains to fill the library of Alexandria with all the treasures of ancient literature. Among architectural works of merit erected during his reign were the lighthouse on the island of Pharos, the Alexandrian Museum, and the royal burying-place. He founded numerous cities and colonies not only in Egypt, but in Syria and Cilicia. He is supposed to have been the patron of Manetho in his Greek rendering of Egyptian history, and there is a tradition that it was at his instance that the Seventy made their translation of the Old Testament. During his reign the dominion of Egypt extended into Ethiopia, Arabia, and Libya, and embraced the provinces of Phœnicia and Cœle-Syria, besides extensive tracts in Asia Minor and the islands of the Mediterranean.

**Ptolemy III.** (surnamed EUERGETES), son of Ptolemy II.; d. 222 B.C. He was early engaged in an important war with Antiochus III. of Syria, who had put away his wife Laodice to marry Berenice, daughter of Ptolemy II. On the death of Philadelphus he put away Berenice and restored Laodice. The resentment of Laodice, however, was not appeased, and she sacrificed to her revenge her husband, her rival, and their infant son. To avenge his sister Ptolemy invaded Syria and advanced to the confines of India. Recalled to Egypt by intelligence of seditions there he brought with him the statues of Egyptian gods carried off by Cambyes, which

he restored to their respective temples, and thus earned the title of Euergetes (benefactor) from his subjects. The fleets of Ptolemy had at the same time subdued the coasts of Asia Minor, and carried his arms to the Hellespont and to the coast of Thrace. Ptolemy took some part in the affairs of Greece generally, as was the policy of Egypt, against the rulers of Macedonia; maintained friendly relations with Rome, but declined the assistance of the Romans in his war with Syria. He continued the patronage of literature, and added largely to the library of Alexandria. Like his predecessors he was the patron of scholars, and his court was the resort of the most distinguished men of his day. In his reign the Græco-Egyptian kingdom attained its highest prosperity at home, and its widest dominion abroad.

**Ptolemy IV.** (surnamed PHILOPATOR), son of Ptolemy III.; d. 205 B.C. He put to death his mother Berenice, his brother Magas, and his uncle Lysimachus, and abandoned the cares of state to his minister Sosibius, his adviser in these and other crimes. Roused from his lethargy by the loss of his Syrian possessions, wrested from him by Antiochus the Great, Ptolemy completely defeated Antiochus at Raphia, in 217. By this victory he recovered Cœle-Syria, but speedily made peace and returned to his pleasures. He continued in general the policy of his ancestors, patronized literature, and dedicated a temple to Homer as a divinity. During the Carthaginian war he supplied the Romans with corn.

**Ptolemy V.** (surnamed EPIPHANES), son and successor of Ptolemy IV.: d. 181 B.C. He was but five years old at his father's death and Philip of Macedon and Antiochus III. (the Great) of Syria combined to dispossess him, and divide his dominions. Instead of relying on the internal resources of the kingdom to repel this danger, the guardians of the young king took the fatal step of placing him under the protection of Rome. The charge was gladly accepted by that crafty state, and Philip and Antiochus were commanded to restore their conquests. Antiochus, to avoid embroiling himself with the Romans agreed, 199 B.C., to give Ptolemy his daughter Cleopatra in marriage, with the Syrian provinces as her dower. The marriage took place 198, and in the interval of peace Egypt began to recover prosperity under the administration of Aristomenes. After the death of Aristomenes the government of Egypt was chiefly conducted by Polycrates, who encouraged the king to give himself up to debauchery. Ptolemy was cut off by poison, while he was preparing to recover Cœle-Syria from Seleucus, the successor of Antiochus. Nearly all the foreign possessions of Egypt were permanently lost during the unfortunate minority of this reign.

**Ptolemy VI.** (surnamed PHILOMETOR), son of Ptolemy V., was also a child at the death of his father. His mother Cleopatra, who assumed the regency, maintained peace and preserved internal tranquillity by an able administration; but the ministers who succeeded after her death (173 B.C.) provoked a war with Antiochus Epiphanes, and were totally defeated near Pelusium. Antiochus advanced to Memphis and took Ptolemy prisoner (170 B.C.). Upon this the brother of Ptolemy caused himself to be pro-



## PTOLEMY

claimed king at Alexandria, under the title of Ptolemy Euergetes II. Antiochus then re-established Philometor as king at Memphis, and returned to Syria. The brothers ruled jointly till 168. Dissensions now broke out between them, and Philometor, expelled from Alexandria, went to Rome 164 B.C. By the intervention of the Romans he was replaced, but agreed to erect Cyrene into a separate kingdom for Euergetes, who afterward persuaded the Romans to grant him Cyprus also. In the later part of his reign Philometor showed an energy of which he did not at first appear capable, and he is generally praised for the mildness and moderation of his character. During his reign a great migration of Jews, caused by factions in their own country, took place from Palestine into Egypt.

**Ptolemy VII.** (surnamed EUERGETES and also PHYSCON), son of Ptolemy V., was king of Cyrene at the death of his brother Ptolemy VI. d. 117. Cleopatra caused her infant son to be crowned; but Ptolemy invaded Egypt, and by the intervention of the Romans it was agreed that he should marry Cleopatra and be recognized as king. Immediately after the marriage he put his nephew to death. His reign was one of tyranny and bloodshed, and compelled at length to flee from the indignation of his subjects, he escaped to Cyprus 130 B.C. He was restored to authority 127, and died in peaceable possession of the throne of Egypt. He was not only a patron of literature, but the author of a considerable work on natural history.

**Ptolemy VIII.** (surnamed SOTER II., or LATHYRUS); d. 81 B.C. He was the son of Ptolemy VII. by the latter's niece Cleopatra. Already married to his sister Cleopatra at the time of his accession his mother compelled him to divorce her and marry his younger sister Silene, and for ten years she continued to sway the government, although she and her son were frequently opposed in policy. She accused him of conspiring against her life, and he was compelled to flee. For 18 years he held Cyprus as an independent kingdom. After the death of Cleopatra 90 B.C. he was recalled to Egypt, which he governed till his death. He was succeeded by his daughter Cleopatra.

**Ptolemy IX., or Alexander I.,** youngest son of Ptolemy VII.; d. Cyprus 81 B.C. On the expulsion of Ptolemy VIII. he shared with his mother Cleopatra the throne of Egypt, although he appears to have had little power. The violence of his mother at length caused him to flee; but persuaded to return, and suspecting her of designs against his life, he caused her to be assassinated. After reigning a year he was expelled by an insurrection of his people and soldiers, who recalled his brother.

**Ptolemy X., or Ptolemy Alexander II.,** son of Ptolemy IX.; d. 80 B.C. He was nominated king of Egypt on the death of Ptolemy VIII.; but the Egyptians having already placed Cleopatra Berenice, the daughter of that king, on the throne, it was arranged that he should marry her and admit her to a joint sovereignty. Nineteen days after the marriage he caused her to be assassinated, upon which the Alexandrians rose in insurrection, dragged him to a gymnasium, and put him to death.

**Ptolemy XI.** (AULETES, surnamed NEOS DIONYSUS), an illegitimate son of Ptolemy

VIII.; d. 51 B.C. He succeeded Ptolemy X., with whom the legitimate race of the Lagidae became extinct. In vice and debauchery he appears to have rivaled the worst of his predecessors. The oppressive taxes he imposed caused his expulsion by the Alexandrians in 58 B.C. In 55 B.C. A. Gabinius, proconsul of Syria, by the influence of Pompey and a bribe of 10,000 talents, was induced to restore him. The Egyptians, who had placed Berenice, the daughter of Ptolemy, on the throne, were defeated, and Ptolemy put Berenice to death. During the rest of his reign Egypt was occupied by the Romans.

**Ptolemy XII.** (AULETES), son of Ptolemy XI.; d. 48 or 47 B.C. He reigned jointly with his sister Cleopatra till 48 B.C., when Cleopatra was expelled, and raising an army in Syria invaded Egypt. It was at this time that Pompey landed in Egypt after his defeat, and was assassinated by the ministers of Ptolemy. On the arrival of Cæsar, Cleopatra by her charms acquired an ascendancy over him, which made it manifest that he would decide her dispute with Ptolemy in her favor. Ptolemy put himself at the head of the insurgents, was defeated by Cæsar, and drowned in attempting to make his escape.

**Ptolemy XIII.** (AULETES), youngest son of Ptolemy XI.; d. 43 B.C. He was declared king by Cæsar in conjunction with Cleopatra in 47 B.C. He was married to his sister and was put to death by her. Consult: Mahaffy, 'The Empire of the Ptolemies' (1895); Strack, 'Die Dynastie der Ptolemäer' (1897); Meyer, 'Das Heerwesen der Ptolemäer und Römer in Aegypten' (1900); Budge, 'A History of Egypt' (1902).

**Ptolemy** (CLAUDIUS PTOLEMÆUS), Alexandrian astronomer: flourished about the middle of the 2d century after Christ, being born at Ptolemais in the Thebaid. The geocentric system of astronomy which he taught was accepted in Europe until after the time of Dante, whose poem takes this theory as its frame-work. In producing his principal work, 'Μεγάλη σύνταξις τῆς Ἀστρονομίας' Ptolemy relied very much on the labors of Hipparchus; but his planetary theory is his own, as well as his theory of the moon's evection (q.v.). The Ptolemaic system of astronomy was only exploded by the arguments of Copernicus (q.v.). The mediæval writers speak of the astronomical treatise of Ptolemy under its Arabian name of the *Almagest*. It consists of 13 books, the principal of which, the first, reveals the trigonometrical theory of the Greeks; contains a method for calculating chords, and demonstrates the basal doctrine of trigonometry, that the rectangle of the diagonals of an inscribed quadrilateral equals the sum of the rectangles of the opposite sides. There is also to be found there sufficient spherical geometry and trigonometry to enable a calculation to be made of the sun's declination to each degree of longitude. These principles are applied in detail through the remaining 12 books. The predecessor of Ptolemy in the field of geography was Marinus Tyrius, whose works he utilized and corrected. His geographical treatise is entitled Γεωγραφικὴ Ὑφήγησις, and contains little more than a list of places with their longitude and latitude. He also corrects the geographical methods of Eratosthenes, Hipparchus and Marinus, and he actually executed 26 maps in illustration of his



## PTOMAINES — PUBLIC DOMAIN

theories. There are other spurious works of Ptolemy, and many of his writings have been lost. Consult: Voll, 'Studien über Claudius Ptolemäus' (1894).

**Ptomaines**, a series of organic nitrogenous bodies, closely resembling the vegetable alkaloids in many of their chemical properties. They are present in many animal products, and are formed either by the chemical breaking down of complex nitrogenous molecules or by bacterial agencies capable of inducing similar decompositions. Most of the ptomaines are ammonia compounds. By the older chemists all of this group of so-called animal alkaloids were termed ptomaines, but later studies have given a series of groups of these bodies. Thus ptomaines, leucomaines, and toxins are at present recognized; the former being the results of abnormal catabolic changes, due to chemical or bacterial agencies; the leucomaines being usually normal catabolic compounds of this group. The toxins are ptomaines, products usually of bacterial decomposition or ferment activity of some type or other, and which are poisonous. Modern conceptions regarding these bodies are modifying so rapidly that hard and fast definitions are apt to be more misleading than informing. Many of the ptomaines are inert; others, the toxins, are poisonous, some highly so. Ptomaine-poisoning resulting from eating altered sausage meat, mussels, tinned meats, etc., is due to some form of toxin. Chemically the ptomaines contain carbon, hydrogen and nitrogen. They belong mostly to the amines or substituted ammonia

compounds, monomethyl amine,  $\text{N} \begin{array}{l} \diagup \text{H} \\ \diagdown \text{CH}_3 \end{array}$  being

one of the simplest of these bodies. It is present in many decomposing foods, and even as mercurialine in a living plant. Dimethylamine,  $(\text{CH}_3)_2\text{NH}$  and tri-methylamine,  $(\text{CH}_3)_3\text{N}$ , are similar ptomaines of this simpler group. Amines of higher alcohols are also common forms, ethylamine, butylamine and others being examples. Putrescine and cadaverine are more complex ptomaines which have been isolated from putrescent meat. They are both diamines. Neuridin,  $\text{C}_5\text{H}_{14}\text{N}_2$ , was one of the first of this class isolated by Brieger, the practical founder of the study. Choline, neurine, betaine, and muscarine are four oxygenated ptomaines of closely related chemical structure that are peculiarly convertible one into another by simple chemical processes. Choline is non-poisonous, but neurine and muscarine are highly toxic. They are found in decomposing meat. Muscarine, from the poisonous fly-mushroom, is thought to be identical or very closely similar to the choline, neurine, muscarine compound. Mytilotoxin is the specific poison of the mussel. Typhotoxin and tetanotoxin are ptomaines supposed to be the active poisons produced by the typhoid fever and lockjaw bacteria. Tyrotoxicon is a toxic ptomaine found in cheese and in ice cream. At least 200 ptomaines have been described. Consult: Vaughan and Novy, 'Cellular Toxins' (1902), for a full consideration of all of the many new lines of thought on this subject.

**Ptosis**, tō'sīs, a falling or drooping of the upper eyelid owing to paralysis of the muscle that lifts it. It is sometimes congenital, and it

may be produced by various disorders of the brain.

**Pty'alin**. See SALIVA.

**Pty'alism**. See SALIVATION.

**Pu-lu**, poo'loo. See *Filicales* (6) under FERNS AND FERN ALLIES; FIBRE.

**Pu'berty**, the period in both male and female marked by functional development of the generative system. This period, when capacity for reproduction begins, is indicated in both sexes by certain characteristic signs. In the male puberty is generally reached, in temperate climates, between the ages of 15 and 18, and although it is commonly believed to be reached somewhat earlier in warm regions, climatic conditions appear to affect the male less than the female. Before the attainment of this period the physical powers have been appropriated to the nutrition of the body. This is in accordance with a well known law of physiology, whereby the processes of nutrition and reproduction are mutually antithetic; the reproductive energies are opposed to the nutritive, and act as an important drain upon the physical and nutritive powers. Therefore the generative instincts are limited or restrained until nutrition and growth have been duly advanced.

In the male the occurrence of puberty is marked by a varied and general change in the physical constitution. The body attains, within a comparatively short period, a large relative increase in size. The form acquires greater fullness and stamina. The larynx particularly enlarges; the voice deepens; there is a growth of hair upon the face, the pubes, etc.; and the entire sexual system receives an unwonted stimulus, the testes secreting the seminal fluid characteristic of full sexual vigor. The male thus reaches sexual maturity. In ordinary cases his virile powers decrease after the age of 50 or 60, when the energies seem to be withdrawn from the reproductive function in the interest of nutrition.

In the female the state of puberty usually begins, in temperate climates, between the 14th and 16th years. At this period the female form acquires a characteristic fullness and roundness. The breasts enlarge, depositions of fat taking place in the mammæ and on the pubes, and over the body generally. The internal organs of generation also enlarge, and their functional perfection in woman is marked by the most unequivocal of the signs of puberty, the appearance of menstruation (q.v.). The production of ova, ready for fertilization, is the most essential and significant sign of the full attainment at once of puberty and of the true female generative functions. (See OVARY.) Puberty in both man and woman may be retarded or advanced by individual and inherited peculiarities of constitution and by modifying circumstances and habits of life.

**Public Debt, United States**. See DEBT, NATIONAL; DEBT, PUBLIC; FINANCE.

**Public Domain, The**. The United States is the only great nation in the world which has passed title to the bulk of its territory direct to the intending occupant. In the earliest years of the nation, when government was organized over a comparatively limited area along the coast of the Atlantic Ocean, the federation of



## PUBLIC DOMAIN

States had no control over the land within the boundaries of each separate commonwealth. Eighteen States, Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, Connecticut, New York, New Jersey, Delaware, Pennsylvania, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Tennessee, and Kentucky, each retained jurisdiction over their own land, and disposed of the same as the local governments saw fit.

Later on, when Texas was admitted to the Union, that State also retained jurisdiction over its public domain and is administering the same to-day under State laws and entirely independently of national control. Without exception, all other territory of the United States, including Alaska, has been disposed of by Congressional action. Since the United States went into the land business the government has acquired for sale and disposal nearly 2,000,000,000 acres of land on this continent. This vast public domain reached from the eastern boundary of Ohio to Puget Sound and from Florida to California, with Texas as the only break in its continuity.

For a century the United States has been known to the people of all the world as the country of free homes, with the result that the land-hungry millions, flocking hither, have built up a great nation with such rapidity that the history of the world affords no parallel. Leaving Alaska and the new possessions out of consideration, owing to peculiar and unsettled conditions existing therein, Congress in its legislative capacity, and the Interior Department in its executive capacity, have since the foundation of this government been given control of over 1,500,000,000 acres of land. There have been reserved from sale and settlement, for various purposes and for reasons of public policy, about 170,000,000 acres. Under various authorizations from Congress, title to about 800,000,000 acres has passed from government to other ownership. The government still holds for sale or gift, as the law may direct, something less than 500,000,000 acres of land, practically all of it lying between the Mississippi River and the Pacific Ocean on the east and west respectively, British America to the north and Mexico to the south.

The people of the United States acquired title by cession, occupation, and purchase to the area now occupied on this continent. At least three quarters of this territory was acquired by purchase. Including the cost of survey and administration, the nation has paid over \$400,000,000 in cash for this realty. The sales of land have returned over \$350,000,000, thus leaving \$50,000,000 approximately as the net cost of the remaining 500,000,000 acres still upon the market. These figures are necessarily valueless, however, for the purpose of arriving at a balance, for in addition to the actual cash paid for the land, the cost of war, political and criminal jurisdiction, and a certain proportion of the cost of running all departments of the government can rightly be charged to this land account. Speaking in the narrower sense, the people have paid about 20 cents per acre for their public domain. This includes merely the original sum invested, and the cost of survey and administration. The average price received for land sold has been about 40 cents per acre. Few administrations have considered this department of the govern-

ment from that point of view, however, the real purpose of the disposal being that of populating and developing the country. The cash account has been held as of little concern.

Over 100,000,000 acres of public land have been given away in the form of bounties and for military service, and over 10,000,000 acres have been given to the various States for express purposes, generally educational. Nearly 100,000,000 acres passed to individuals under the so-called swamp reclamation law, long since repealed, through which by means of perjury and misrepresentation valuable agricultural land was stolen in enormous tracts. Over 100,000,000 acres have been donated for educational purposes, most of this land passing under the jurisdiction of State governments for that purpose. Millions of acres have been alienated under the mineral land law, grants for wagon roads, under laws providing for the location of salt, stone, and timber at minimum acreage prices. During the past 50 years over 100,000,000 acres have been disposed of as railway grants, much of this land being of the very best character. With all this liberality, however, Congress must be given credit for having refused to consider thousands of wild-cat schemes whereby millions of acres of the public domain were to be diverted to individual ownership. No session of Congress has passed without the introduction of numberless bills, each proposing a land grant to some allegedly meritorious enterprise. These propositions have taken a remarkable range. Grants of land have been asked for to aid in Arctic exploration, to start dairies, private schools, to pay the expenses of trips abroad, and in fact, it would be difficult to name any industry or branch of human invention which Congress has not been asked to favor with a land grant.

Of the vast amount of money paid by the government for its public estate, nearly half, or about \$200,000,000, has been paid to the Indians for quit claim deeds to territory under their control. The record of sales also shows that the government has paid in cash more for the Indian lands than white settlers have been charged for similar lands, to say nothing of the rations, supplies, and interest on deposits, and other valuable privileges granted the Indians in return for their holdings, to which their title at the best was more or less indefinite. The United States has also paid nearly \$100,000,000 to individual States and foreign countries for land. To survey the entire public domain and pay the expenses of the land office from the foundation of the government to the present day has cost nearly \$200,000,000.

When the United States government first went into the land business, the only idea prevailing was to sell the public domain in any quantity to any one who might apply, at such price as could be realized. This system practically prevailed until 1841. In that year was first recognized the desirability of limiting individual holdings, and an attempt was made to discourage non-resident ownership. By this time the government had disposed, under previous arrangements, of over 150,000,000 acres. In 1841 the preemption law was enacted. This was the first legal recognition of the fact that 160 acres, or a half-mile square, is the ideal size for a farm, being sufficient agricultural land to fully occupy the energy and attention of a single



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family and yield, under conditions prevailing in the United States, an adequate return. Under the provisions of this law any citizen could take 160 acres of government land and secure title thereto by paying \$1.25 per acre after living six months upon the property. In 1862 Congress enacted the homestead law. This measure reflected the views of those who believed that the public land should be given at minimum cost to such people as would show their good faith as home-builders by a continuous residence of five years, and an honest attempt at cultivation. This proved a slow process, however, for those desiring to increase their land holdings, and the law was soon amended so that after six months residence a settler could obtain title by paying \$1.25 per acre, thus commuting his option of obtaining it free if he lived upon it for five years. Later on the law was again amended into the shape in which it now is, extending the time of residence from six months to 14 months before commutation was allowed. In 1873 the timber culture law was passed, which gave the settler the opportunity of acquiring another 160 acres by planting a certain number of trees. The law was apparently correct in principle, but in practice the conditions were found to be almost impossible of fulfilment, especially upon the semi-arid plains of the West, and the law was finally repealed as offering inducements to fraud. In 1875 another law was enacted which offered 640 acres of arid land to any settler who would fulfil certain conditions of reclamation by carrying an artificial supply of water thereto and paying the government \$1.25 per acre in addition. This law still stands, but has been so amended as to reduce the amount of land which can be taken by each claimant to 320 acres, and the conditions of reclamation have been made more severe. This law originated in California, and when it was first enacted in 1875 it applied only to that State. Its application to all of the public land States was made general in 1877. In 1891 Congress became alarmed at the inroads which were being made upon the public domain by those who were manifestly not legitimate settlers. The laws as they then stood enabled a single claimant to secure 1,120 acres of land at comparatively little expense to himself and without complying seriously with the purpose of the whole plan of public land disposal, that of residence and cultivation. On 3 March 1891 the agitation over this matter resulted in the repeal of the preemption and timber culture laws. Under the timber culture law nearly 37,000,000 acres had been disposed of, and even under the lax administration of the conditions required, less than 9,000,000 acres had been earned by planting trees as the law specified.

The laws now in force governing the disposal of the agricultural portion of the public domain are, therefore, the homestead law and the desert land law. The homestead law gives the settler two options: he can settle upon, enter, and acquire title to 160 acres of land practically free of cost, by establishing and maintaining residence thereon for a period of five years. He may, on the other hand, at the end of 14 months of such continuous residence, secure a patent from the government by paying \$1.25 per acre for his land, if it lies without the limit of rail-

road grants, or \$2.50 per acre if within such limits.

In either case actual residence, improvement, and cultivation are at least theoretically required. He must, according to the law, make application for this land in "honesty and good faith," not as an agent for others, but with the intention of making it a home, and all agreements to sell prior to the issuing of the patent are forbidden. Since the passage of the homestead act in 1862 there have been about 1,500,000 original homestead filings, involving an area of about 200,000,000 acres or more. About 50 per cent of those who have made original homestead filings have carried the process through to completion and received title to the land.

Since the Desert Land Act was passed in 1875 about 12,000,000 acres have been preempted under its provisions, though less than 3,000,000 acres have been finally proved up upon. As the law now stands, any citizen of the United States or person who has declared his intention of becoming such can take up 320 acres of arid land by making a deposit of 25 cents per acre at the time of filing and paying \$1 per acre more when title is asked of the government. The law requires that before securing title the settler shall prove the ownership of sufficient water to irrigate the entire tract, shall prove that he has expended at least \$1 per acre each year in improving the land, and that he has actually irrigated within three years from the time of filing, every legal subdivision or 40-acre tract of his claim. Experience has proved that an average expenditure of at least \$10 per acre is necessary to fully comply with the letter of this law.

There have been a number of special laws enacted with the intention of encouraging the settlement of the arid and semi-arid public domain through indirect agencies. The most notable of these is the so-called Carey Act, which proposes to grant to each State 1,000,000 acres of arid land, title to be passed from the general government to the State when such land is reclaimed by irrigation. A few of the States have taken advantage of this law, made selections from the public domain within their borders and offered inducements to private capital to undertake the enterprise. The workings of the law have not been entirely successful. Wyoming, the home of Senator Carey, the author of the act, being the only public land State to take advantage of the opportunity to any extent. Idaho and Washington have seriously attempted the reclamation of large areas in this manner, but as yet without notable success.

Among the most important features of the land laws are those provisions whereby mineral claims can be secured by individuals. The regulations governing the securing of mineral rights or rights to mine upon the public domain, vary in different mining districts; but under the federal law any citizen can stake out a limited amount of ground, and after proving that he has expended a certain amount of money for development work can receive title to his claim. The acreage taken from the public domain under the mineral land laws is inconsiderable in itself, but from this acreage has come a great part of the wealth of the nation. There are also



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laws providing for the taking up and purchase from the government of coal lands, salt claims, stone and timber. With a few notable exceptions these laws have operated to the development and prosperity of the country. What is known as the timber and stone act has been notoriously abused in its application to timber land. This law allows any citizen to secure 160 acres of saw-mill timber by filing a claim and paying the government \$2.50 per acre for the land. The General Land Office at Washington estimates that nearly 5,000,000 acres of valuable timber has been so disposed of by the government at a price sometimes returned to the purchaser by the sale of a single tree from an acre of his quarter section, or 160 acres. In other words, the government has probably sold for less than \$13,000,000 timber conservatively estimated to be worth at least \$100,000,000. As the population of the United States increases, and the conservation of resources receives more and more attention, it is realized that the arable land and forest timber of the nation has been distributed with lavish, not to say careless, generosity, the results of which are already felt in the exhaustion of the free-home area and a narrow limit to the once apparently inexhaustible timber supply of the country.

During recent years conditions have changed with marvelous rapidity. For a century the building of homes has only been limited by the number of home-seekers. The land lay fallow awaiting the plow. As the plow turned its furrow the guiding spirit could foretell the almost immediate harvest. This is no longer true, for there is now hardly a spot left in the great public domain of the United States where the hardest pioneer, without resources other than willing hands and indomitable spirit, can suc-

cessfully establish himself. The easily arable habitable public land has all been reserved or segregated to private ownership. What is left is wonderfully valuable and susceptible of the highest production, but under different conditions of settlement from those which have heretofore prevailed. It is estimated that the remaining public domain, if scientifically developed, will support in comfort at least three times the present population of the entire United States. A partial recognition of this condition was secured from Congress in 1902 by the enactment of a National Irrigation Law. The fight preceding the enactment of this law recalled to older members of Congress the desperate struggle necessary to secure the passage of the Homestead Law in 1862. The National Irrigation Law is, in reality, a modified Homestead Act, made particularly applicable to the arid public domain. It provides that the government shall create an artificial water supply by the building of storage reservoirs and the diversion of rivers, and then dispose of the land reclaimed thereby to actual settlers who will not only live upon it, but who will, through a series of annual payments, return to the government the cost of irrigation. In this law the principle of residence and cultivation is more fully recognized than in any land law upon the statute books. Speculation is practically impossible, and the enterprise possesses no attractions for others than home-seekers. This law is a recognition of the need for a general revision of the land laws, in view of the very great changes which have taken place in the conditions of settlement since the earlier days of American pioneering. Under the terms of the National Irrigation Law the money derived from the sale of public lands is to be devoted to the reclamation of the arid region.

STATE OR TERRITORY	Area unappropriated and unreserved			Area reserved.	Area appropriated
	Surveyed	Unsurveyed	Total		
	Acres	Acres	Acres	Acres	Acres
Alabama .....	258,420	.....	258,420	52,020	32,347,480
Alaska .....	(a)	367,983,506	367,983,506	b 120,174	(a)
Arizona .....	11,691,038	35,312,783	47,003,821	20,159,837	5,628,662
Arkansas .....	2,759,553	.....	2,759,553	2,560	30,781,567
California .....	29,456,676	7,508,854	30,965,530	19,718,027	43,286,363
Colorado .....	33,638,530	4,288,086	37,926,616	5,486,643	22,934,901
Florida .....	1,179,197	160,070	1,339,267	19,259	33,714,114
Idaho .....	12,376,285	29,409,495	41,785,780	1,334,031	10,173,629
Illinois .....	.....	.....	.....	.....	35,842,560
Indiana .....	.....	.....	.....	.....	22,950,400
Indian Territory .....	.....	.....	.....	19,658,880	.....
Iowa .....	.....	.....	.....	.....	35,646,080
Kansas .....	1,047,831	.....	1,047,831	987,875	50,347,014
Louisiana .....	109,964	65,018	174,982	1,468,434	27,411,944
Michigan .....	365,065	.....	365,065	120,695	36,333,440
Minnesota .....	3,498,127	1,670,558	5,168,685	2,686,355	43,343,040
Mississippi .....	112,720	.....	112,720	.....	29,572,400
Missouri .....	227,158	.....	227,158	.....	43,568,682
Montana .....	18,244,326	39,641,337	57,885,663	17,384,134	18,323,803
Nebraska .....	8,848,906	.....	8,848,906	606,611	39,681,763
Nevada .....	30,792,220	30,485,688	61,277,908	5,983,409	3,075,323
New Mexico .....	39,336,648	14,435,711	53,772,359	6,606,759	18,049,682
North Dakota .....	8,749,864	4,447,475	13,197,339	3,325,490	28,387,251
Ohio .....	.....	.....	.....	.....	26,062,720
Oklahoma .....	3,091,333	.....	3,091,333	3,762,462	17,920,605
Oregon .....	17,182,749	5,923,067	23,105,816	12,801,800	25,369,824
South Dakota .....	10,522,553	382,601	10,905,154	12,722,374	25,578,872
Utah .....	11,526,008	29,843,553	41,369,561	6,187,645	4,984,234
Washington .....	4,464,185	5,021,007	9,485,192	11,865,205	21,396,483
Wisconsin .....	113,001	.....	113,001	432,524	34,729,395
Wyoming .....	34,543,998	2,574,871	37,118,869	15,790,840	9,523,571
Grand total .....	284,136,355	579,153,680	863,290,035	169,284,043	776,965,802

a The unreserved lands in Alaska are mostly unsurveyed and unappropriated.  
b So far as estimated.



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In 1904 the fund represented an accumulation of about \$16,000,000 with a promise for several years to come of annual additions amounting to at least \$5,000,000 more. The theory of the law implies a revolving fund, as the money is to be returned to the government by the beneficiaries. If this plan works out successfully, the government will in course of time be able to utilize fully, for the benefit of the arid region, all possible sources of water supply.

In 1904 the General Land Office issued an estimate of the status of the public domain on the North American Continent. This is comprised within the United States proper and the Territory of Alaska. The result may be seen from the table on the preceding page.

In the foregoing table, the territory in the Philippines, Porto Rico, and other new possessions is not included. In securing this new territory the United States fell heir to a large area formerly under Spanish sovereignty, but with more or less indefinite title. When the governments of these new countries were finally organized by Congress, it was decided to give the title of all public land into the hands of the local authorities, hence they did not become part of the public domain of the United States within the strict meaning of the term. The Philippine government and the government of Porto Rico have since enacted laws indicating the manner in which land can be disposed of. These regulations are necessarily more or less temporary and experimental. It will be several years before surveys can be completed and the boundaries of tracts already in private ownership determined. Effort has been made, however to embody the homestead idea and thus encourage settlement upon small holdings. The problem of dealing with tropical areas has yet to be worked out through actual experience. There has been as yet no great demand for this land except by exploitation companies interested in the mining or lumber industry. Profiting by past mistakes, Congress has been very slow to grant many privileges of this kind, but in course of time some plan will be adopted whereby the valuable natural resources of the new possessions can be utilized without permanently destroying their recuperative power.

In the table above given it will be noted that of the more than 863,000,000 acres remaining about 368,000,000 acres are credited to Alaska. This territory is as yet practically unsurveyed, and its possibilities undetermined. Mineral land laws and regulations are in force similar to those prevailing in the older States, but the agricultural possibilities are so indefinite that little necessity has yet arisen for providing for homeseekers. A great future has been predicted for Alaska in the direction of agriculture, but with vast areas not only in the United States, but in adjoining Canadian territory, still open for settlement, it is not probable that much will be done in the direction of farming in Alaskan valleys, other than to attempt to supply the local demand for produce created by the mining settlements.

That portion of the public domain marked reserved amounts to about 170,000,000 acres. In this area are included military, Indian, and forest reservations. The military reservations are quite numerous, but small in acreage and are gradually being done away with. The Indian reservations

are large and included among them is the whole of Indian Territory. By treaty, purchase, and individual allotment to the Indians these reservations are rapidly decreasing in size, and some time in the future they will practically disappear. The forest reservations amount to over 60,000,000 acres and are the most important feature of the more modern and scientific administration of the public domain characterizing government control. Under authority given by Congress the President of the United States has the power to withdraw from settlement any portion of the public domain which may be determined to be more valuable for forest conservation and the protection of watersheds than for promiscuous disposal under existing land laws. This authority has been freely exercised within the past five years and great areas of noble timber have thus been preserved from speculators, and the water supply of nearly all the great rivers rising in the western mountains has been assured by perpetuating the wooded covering of the hills and valleys at their sources. That these reservations will be extended until practically all the great virgin forests are protected is a foregone conclusion, for in 1904 over 50,000,000 acres of forest and woodland were under consideration for possible addition to the reserved territory. The sentiment of the country has been very much divided as to the wisdom of this wholesale reservation of forest. The prosperity of the West, in many sections, depends upon free access to timber for mining, construction, and domestic purposes. From these sections has naturally come no little opposition to the creation of forest reserves, but with the adoption in the near future of a scientific system of forestry which will allow of lumbering without total destruction, and the general encouragement of reforestation this opposition will be overcome.

The table showing the area of unappropriated public domain still existing in the States and Territories shows that a greater part of it lies in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah and Wyoming. Notwithstanding the many years the Southern States have been settled there still remains within the boundaries of Alabama, Arkansas, Florida, Louisiana, Mississippi, and Missouri considerable unappropriated land. Most of this land is worthless, however, and is found on rocky ledges and mountains where the timber is not of sufficient value to induce the exercise of citizens' rights to obtain it from the Federal government. In one or two of the Southern States, however, notably in Mississippi, there has been a recent and rapid absorption of the few remaining acres, this being due to the increasing value of pine timber and the discovery that there was enough of such timber on some of these tracts to warrant their being preempted under the homestead law.

Nevada is the most notable example of a State where the preemption of a small percentage of its total area has resulted in a check to the absorption of the balance into private ownership. But a little over 4 per cent of the surface of Nevada is owned by private individuals. Owing to the arid character of the land and the control of the water supply within the boundaries of this 4 per cent, the other 96 per



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cent is valueless, except possibly for limited grazing purposes. It is in such States as this that the national irrigation work is expected to produce the greatest results in the direction of opening new territory available for home-seekers. One of the great problems connected with the administration of the public domain has been the control of the grazing privilege. The great industry of the West, that of raising live-stock upon government-owned land, rests entirely for its support upon this privilege. Congress has shown a marked disinclination to perpetuate government control of the public lands by initiating any form of lease which would exclude the possible home-builder. There are many millions of acres, however, which so far as can be seen now will never be used except for grazing purposes, and in time some form of government control which will result in the production of revenue and a conservation of this great property must be adopted.

At various times Congress has passed laws giving land rights in payment for services performed or property confiscated. These laws resulted in the issuing of what is known as land scrip, and out of the use of this scrip grew many abuses which caused the practice to fall into disfavor. There are, perhaps, less than 2,000,000 acres of scrip not yet utilized, and it commands a ready sale upon the market at good prices. The amount used each year is inconsiderable, however, and it is gradually disappearing. When a forest reservation is created, owners of private holdings within its boundaries are compensated by being given the privilege to locate an equal acreage upon other public domain. There have been serious abuses of this privilege also, for very often land almost valueless in character has been traded to the government for new location privileges which were used upon valuable forest areas. The readily salable lands have disappeared, blindly distributed with lavish hand at minimum prices and in almost unlimited areas to whomsoever might apply. From the very richness and value of the land much gain to the country as a whole has come. State after State has been added to the Union by virtue of the settlement of public lands. Cities and towns have been built and a nation has grown to manhood. Apparently unlimited in area and unparalleled in richness, the land has passed from the government without much public concern, and, with the evils accomplished, lost sight of in the great growth of the country. Nearly every secretary of the interior for 25 years past, however, has been so impressed with the dangers of an approaching crisis that an alarm has been sounded from each administration. Thoughtful men of the present day are now concerned with this economic problem peculiar to the United States and the public land administration during the 20th century promises to be of a more conservative character than that which prevailed during the 19th.

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**Public Domain.** The lands constituting the public domain of the United States were acquired through treaties and cessions from foreign governments, and the original States of the Union and by annexation.

By the definitive treaty of 1783 England relinquished all lands east of the Mississippi River

which lay north of the 31° of north latitude, but all lands east of the Alleghany were claimed by the original States, while all lands between the Alleghany Mountains and the Mississippi River, except the extreme northern and southern portions, were claimed by Massachusetts, Connecticut, New York, Virginia, Georgia, and the Carolinas, under the terms of their original crown grants, which described the lands granted as extending westward to the "South Sea" or Pacific Ocean. There was nothing in the grants to the other six colonies which could form the basis of such a claim, and upon the formation of the Union they jealously protested against the continued ownership of the lands west of the mountains by the States named, and these lands were later relinquished to the national government as follows:

In 1781 New York ceded without reservation 202,187 acres, now in the county of Erie, Pennsylvania. In 1784 Virginia ceded 169,559,680 acres north of the Ohio and east of the Mississippi rivers and known in subsequent legislation as the "Northwest Territory," reserving therefrom 150,000 acres for the benefit of George Rogers Clark and the officers and soldiers who aided him in his successful expedition into that country against the British, and also so much of 3,800,000 acres in Ohio as should be needed to satisfy certain donations to her Revolutionary soldiers. This cession also contained a stipulation that the possession of French, Canadian, and other settlers of Kaskaskias, Saint Vincents, and other neighboring villages, who then professed to be citizens of Virginia, should be recognized and confirmed. In 1785 Massachusetts ceded without reservation 34,560,000 acres, which now forms a part of southern Michigan and Wisconsin and northern Illinois. In 1786 Connecticut ceded 26,600,000 acres, which now forms the northern parts of Ohio, Indiana, and Illinois, reserving, however, 3,800,000 acres—a strip in northern Ohio, 120 miles long, which was afterward known as the "Western Reserve," and of which Connecticut donated 500,000 acres subsequently known as "Fire Lands," to certain of her citizens who had suffered loss by fire and raids during the Revolutionary War. The remainder of the lands reserved by Connecticut were sold to a company for \$1,200,000. In 1787 South Carolina ceded without reservation 3,136,000 acres—a strip 15 miles wide, which now forms the northern parts of Georgia, Alabama, and Mississippi, while in 1790 North Carolina ceded 29,184,000 acres which now forms the State of Tennessee, reserving the right to satisfy therefrom certain donations made to her soldiers and certain claims theretofore initiated under her land laws which absorbed the bulk of the lands embraced in her cession. In 1802 Georgia ceded 56,689,920 acres, now forming parts of Alabama and Mississippi, in consideration of the payment to her of \$1,200,000 and the satisfaction of certain outstanding obligations known as the "Yazoo Claims," the settlement of which finally cost the United States \$5,000,000.

The claims of Massachusetts and Connecticut, based upon their crown grants, conflict with the claim of Virginia which she asserted under her grant, and also by virtue of the successful expeditions of her State troops under George Rogers Clark into that country.



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In 1803 France ceded 757,961,920 acres, now known as the "Louisiana Purchase" (q.v.), the government paying therefor \$27,267,621, including interest, etc. These lands now constitute a part of Mississippi, Alabama, Texas, Colorado, Wyoming, Montana, and the States lying between them and the Mississippi River. In 1819 Spain ceded 37,931,520 acres, now constituting the State of Florida, at a total cost of \$6,289,768. In 1848 Mexico ceded 334,443,520 acres, now constituting the States of California, Nevada, Utah, and parts of New Mexico, Arizona, Colorado, and Wyoming, at a cost of \$19,250,000. In 1850 Texas ceded 61,892,480 acres, now constituting a part of New Mexico, Oklahoma, and Colorado, for \$16,000,000. In 1853 Mexico ceded 29,142,400 acres, known as the "Gadsden Purchase," now part of New Mexico and Arizona, for \$10,000,000. In 1867 Russia ceded all of Alaska, embracing approximately 599,446,000 acres, for \$7,200,000. In 1897 the Hawaiian Islands, containing 4,313,600 acres, were voluntarily annexed. In 1898 Spain ceded Porto Rico, containing 2,304,000 acres; Guam, 112,000; the Philippine Islands, containing 91,520,000 acres, for \$20,000,000. In 1899 Tutuila and other small Samoan Islands, containing in all 46,720 acres, were annexed. In 1901 Spain ceded Sibu-tu and other small islands, containing in all 43,520 acres, for \$100,000. The "Oregon Country," containing 183,480,960 acres and embracing Oregon, Washington, Idaho, and part of Montana, was claimed by the United States through discovery and exploration and that claim was afterward recognized by England and Spain.

That part of the lands ceded by South Carolina which lay north of Georgia was, by act of Congress, added to that State; the lands ceded by North Carolina, which remained unabsorbed in the satisfaction of her outstanding claims, were donated to Tennessee; Virginia consented to the creation of Kentucky from her uncaded western lands. The lands ceded by New York were sold to Pennsylvania, and New York relinquished her claims to lands in Vermont, while Massachusetts consented to the erection of the State of Maine from lands claimed by her under her original charter. All of these States disposed of the lands within their borders under their own law and for their own benefit. The act under which Texas and Hawaii were annexed authorized them to hold and dispose of their lands, and the public lands in Porto Rico and the Philippines are to be disposed of by their local authorities under laws and regulations specifically applicable to them. All of the other lands mentioned above are disposed of for the benefit of the national government under a general system of laws applicable mainly to all alike with the exception that a modified system is applied to lands in Alaska.

Three forms of government existed in the colonies out of which the Union was formed—that of New Hampshire, New York, Virginia, Georgia, and the Carolinas being provincial; that of Pennsylvania, Delaware, and Maryland being proprietary, while that of the other was created by charters. Notwithstanding these differences lands in all of the colonies were held of the Crown, in fee and common socage, and not *in capite*, or by knight service. No trace of feudal tenures, such as existed in England, was found among them, and their different systems of disposing of their public lands furnished the

germ and basis of the principal methods afterward adopted by the federal government.

In some instances large grants were made to favorites of the Crown, but the bulk of colonial lands were sold under local laws and regulations at 50 cents and upward per acre, with quit rent stipulations, and to actual settlers and occupants who were given preferred rights and protected in them. In some instances every immigrant, and the person who sent or brought him, each received a donation of lands, with an additional donation when the first had been occupied and cultivated.

*Methods of Disposing of Public Lands.*—Two antagonistic theories have at different periods controlled in the disposal of public lands. The first was the theory that the lands were an asset of the government to be handled and disposed of by it for revenue purposes only, and the second was the theory that they should be held by the government in trust for distribution to and actual use by the people in the manner most conducive to their occupation, cultivation, and home building. The revenue theory first controlled in this country. The Continental Congress, having no power to levy taxes for the payment of its war debt, induced the States owning lands west of the Alleghany to relinquish them to the national government on the theory that they were "important resources" from which that debt could be discharged. Settlements upon public lands were discouraged and in fact forbidden by Congress in 1785 and 1804, and later the President was empowered to use soldiers to enforce the removal of settlers. In 1785 auction sales at \$1.25 per acre in unlimited amounts were authorized, but prior to the adoption of the Constitution but three sales had been made—one to the Ohio Company for 822,900 acres, one to John Cleves Symmes, under which 248,540 acres were patented, and another to the State of Pennsylvania for 202,187 acres, now in Erie County. In 1790 Alexander Hamilton, then secretary of the treasury, submitted a detailed plan for the disposal of the public lands, which embraced the basic principles of both the colonial and the present systems. In 1795 the substance of the present system of surveys into rectangular townships, six miles square, containing sections of 640 acres each, was provided for, and auction sales of unlimited amounts, at not less than \$2.00 per acre, were authorized. This system was modified in 1800, and speculators, stimulated by the prospects of early sales to immigrants who continued to come to the new country in constantly increasing numbers, took advantage of the credit system authorized by this law and purchased so largely in excess of their means that 5,756,622 acres of the 19,399,158 acres sold prior to 30 June 1820 were forfeited for nonpayment of the purchase money, and the government, instead of receiving \$47,689,563, received \$27,900,279 from that source.

The inability of purchasers to meet the payments upon their lands caused distress in the newly settled country and the clamor for relief became so great that the law was repealed in 1820 when the minimum price of lands was reduced to \$1.25 per acre, and all lands which had failed to sell when offered at public auction could afterward be bought in unlimited quantities at that price.

The theory that the public lands should be



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regarded as a source of revenue early met with opposition in this country as well as in England. In 1785 Edmund Burke brought a bill before the British House of Commons under which he strongly advocated the opposite theory as the sounder principle of political economy. He contended that any measure which would induce a more extensive settlement and cultivation of the soil would more greatly benefit the government, and this doctrine was adopted and strongly urged by the minority in this country until it resulted in the pre-emption system which preferred the settler above the speculator. This system found its origin in 1801, when Congress protected the settlers on lands which had been excluded from the original purchase made by Symmes, and continued to grow under the active support of President Jackson, Senator Benton, and others, until it developed through various amendments into the pre-emption law of 1841, which continued in force with slight modifications until it had outlived its usefulness and was repealed in 1891. Approximately, 200,000,000 acres of lands were disposed of under this act.

Under this system a citizen with certain prescribed qualifications could, after residing upon cultivating, and improving the land, to a limited extent, purchase it at \$1.25 per acre.

The theory that the largest possible inducement should be offered to the home builder found its fullest expression in the present homestead law, under which citizens having other requisite qualifications may obtain title to 160 acres of public land, without paying for the same, by simply residing upon and cultivating it for five years. The theory of this law, long advocated, found a place in a political platform in 1852, and remained an issue before the people until it became a law in 1862, having been introduced by Representative Galusha A. Grow of Pennsylvania. Under this law 96,495,414 acres had been patented prior to 30 June 1904.

In 1878 a law was enacted to encourage the growth of timber in the treeless regions, under which title could be obtained to 160 acres by planting and cultivating 10 acres of timber. This law was repealed in 1891.

Any citizen or person who has declared his intention to become a citizen of the United States may now purchase, at \$1.25 per acre, not exceeding 320 acres of arid lands reclaimed by them through artificial irrigation, or he may purchase at \$2.50 per acre 160 acres of lands more valuable for timber than for agriculture.

Lands containing valuable mineral deposits may be purchased at \$2.50 per acre for placer mines, \$5.00 per acre for lode mines, or \$10.00 and \$20.00 for coal lands, owing to their proximity to a railroad.

A large amount of public lands have been set aside as reservations for occupation by the Indians, for military purposes, for the protection of forests, etc., which are not subject to any kind of appropriation under the public land laws—62,354,965 acres having been reserved for the protection of forests alone prior to 30 June 1904.

Scrip of various kinds and warrants issued for military services in the wars of 1812 and the Mexican War have been issued, under which a large amount of lands have been disposed of, about 60,000,000 acres having been patented for military services alone.

The policy of encouraging education in the newer States by liberal grants of land was early adopted and resulted in donations, at first of one section of 640 acres and later of two sections in each township, and in some instances special additional grants were made, and 5 per cent of the receipts from the cash received for lands were donated to the States.

Internal improvements, and particularly the construction of wagon and rail roads, have also been encouraged by large grants of public lands, under which 110,782,286 acres have been patented prior to 30 June 1904.

To induce their drainage and reclamation, swamp lands were granted to certain of the States and 62,645,909 acres have been patented under this grant prior to 30 June 1904.

It is estimated that prior to 30 June 1902 764,000,000 acres, approximately, or the equivalent of 4,500,000 farms of 160 acres each had been disposed of by the government, and there remained approximately 894,000,000 acres, including Alaskan lands, yet to be disposed of. See LANDS, PUBLIC.

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**Public Health Association, American.** See AMERICAN PUBLIC HEALTH ASSOCIATION.

**Public Opinion, the Power of.** In attempting to estimate the sources, the power and limitations of public opinion, it is necessary first to determine what public opinion is. Webster defines private opinion as "the judgment or sentiment which the mind forms of persons or things." More broadly, it may be defined as a conviction based on evidence, an assent secured by argument, or a view acquired, perhaps unconsciously, through the reading habit. Public opinion may be described as the aggregate of private opinion. It is what the mass or the majority believes or feels. A popular government is government by public opinion expressed in elections and formulated in statutes. Public opinion as it regulates the conduct of a community is an unwritten law—a dominant sentiment representing a common agreement or code of morals and manners.

History shows in nearly every age the force of public opinion. In the democratic communities of Greece the great orators Pericles, Demosthenes, and their disciples influenced events through their appeals to the people. In Rome, public opinion was potent, alike under the republic and the empire. Mark Antony's harangue stirring up civil war was to the populace. It was not until the Reformation in England had finally gained over public opinion that it became firmly established. It was responsible for the civil war, for the reaction in favor of Charles II., for the expulsion of James II., his brother and successor, for the selection of William of Orange and the introduction of the Hanoverian dynasty. Public opinion in England forced upon successive Cabinets the necessity for reform of the franchise and of the corn laws. Public opinion directed the Declaration of Independence in this country and sustained the long war for freedom. Public opinion was the prime cause of the unification and emancipation of Italy and of the consolidation of the German empire. Public opinion inspired and carried through the successive revolutions in France in 1789, 1830, 1848, and 1870. In the latter year the fall of the em-



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pire and the establishment of the republic was effected by a proclamation in the streets, and without the shedding of blood.

In every state whose system of government is in essence democratic no change of dynasty, of administration, of constitution can be effected that is not directly caused by the operation of public opinion. In modern government public opinion is effective in exact ratio to the freedom of the people. Jefferson called public opinion "that lord of the universe." But it is not lord in Russia, for it is fettered there. Wendell Phillips, at the height of the anti-slavery agitation in New England, said if he lived in Russia he should be an Anarchist, because in that land there was "no free press, no Faneuil Hall, no ballot-box." But in a country like ours, where, as General Grant said, "the will of the people is the law of the land," it is highly important to know what are the creative causes of public opinion. When is it to be followed and when opposed? What is the best method of influencing it? How shall it be directed to produce practical results?

Public opinion as a moral and political force finds its inspiration and its expression in the press and on the platform. Gutenberg was the founder of modern public opinion. The printing press was a most important factor in disseminating the religious views advocated by the Reformers and in thus fashioning a supporting public opinion. The spoken words of Luther reached only the few; printed they reached the many. Thousands of tracts and pamphlets were scattered throughout Germany, carrying the thought-germs of the new religious ideas. With the advent of the newspaper there began to be felt in the world a new power—"the mightiest ever known for the creation, development, and direction of the greatest of modern forces—majority public opinion."

The astute De Tocqueville said: "A newspaper can drop the same thought into a thousand minds at the same moment." But now one newspaper can drop the same thought into a million minds on the same day. In 1900, according to the census of that year, the 2,226 daily newspapers of this country had an aggregate circulation of 15,102,156 copies. The total circulation per issue of all newspapers and periodicals was 114,299,334, and the aggregate number of copies circulated in a year reached the almost inconceivable total of 8,168,148,749. Nearly one thousand of the principal daily papers of the country, with an aggregate circulation of more than 13,000,000, belong to one great news organization—the Associated Press of the United States. They receive the same despatches, covering every habitable quarter of the globe. The same facts, the same condensations of news and views, are "dropped into the mind" of these millions of readers on the same day.

This instantaneous and constant enlightenment of the people as to the affairs of our own country and of the world was what the writer had in view in saying, 10 years ago: "Publicity is the greatest moral factor and force in the universe." President Eliot of Harvard expressed the same view, seven years later, in saying: "Publicity is the great security for democracy, the best weapon against political, social, industrial, or commercial wrong-doing, and in the long run the most trustworthy means of political

and social progress." And Justice Brewer, of the United States Supreme Court, in a brief but pregnant statement on "the effect of a free press on American life," written for the *New York World*, spoke of the service of the press "in the evolution of the court of public opinion, that court mightier than any organized tribunal, at whose bar are judged all men, events, and parties."

It is sometimes said by superficial observers that the influence of the press is declining. How can it decline when its character has steadily improved and its aggregate circulation has enormously increased? Have facts lost their power? Does information no longer promote intelligence? Are men less responsive than formerly to sound arguments and sensible appeals? Thirty years ago an eminent bishop of the Episcopal Church said: "It is the press that creates public opinion. It is the grand fact of the hour that popular sentiment has been educated by the press up to the point of spurning party trammels and voting on principle."

If this were true in 1873 how much more universally true is it now! Nearly every great newspaper in this country to-day is independent—financially and politically. The last six Presidential elections have been decided by the independent vote, led by the independent press.

The result of the municipal election in the city of New York in 1903, when the Tammany candidate for mayor was elected by a plurality of 62,000, in spite of the practically united opposition of the press of the city, has been cited as evidence that the newspapers have not the influence commonly attributed to them. It is to be noted, however, that the Democratic majority was reduced one half from that secured in the preceding year; that in the city there are tens of thousands of illiterate voters, who are not susceptible to the arguments or appeals of the press; that an even greater number cannot read, and that a very large proportion of the total number of voters are impervious to argument in an election by reason of their ingrained but honest partisanship or by a selfish interest in the success of the ticket of their choice—as the saloon-keepers and their patrons, the law-breaking classes, the office-seekers, etc. That in a total vote of nearly 600,000, representing a normal Democratic majority of 120,000, a non-partisan ticket needed only 5 per cent more of the vote to have triumphed, is really a tribute to the influence of the press, particularly in the light of the strange mistake made in defying public opinion by strictly enforcing obsolete puritanical Sunday laws which the majority of the cosmopolitan people of the city regard as odious infringements of their personal liberty.

The journalist acts upon and through public opinion, and therefore, from his point of view, the development of public opinion is the central thread of history. It is inseparably connected with the growth of his own profession. History is filled with accounts of wars and their causes, but to the journalist the remarkable point in that relation is the fact that wars used to be made by individual caprice, while to-day no great duel between nations can be begun or carried on without the support of public opinion. For example, in 1870, Napoleon III. and King William were in legal theory the war lords of France and Prussia. Personally they both sincerely wanted



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peace, yet they could not have it. Bismarck wanted war, and he got it, by manipulating public opinion, which was stronger than the monarchs. He excited the French by permitting the candidature of a Hohenzollern prince for the throne of Spain. Then that was withdrawn and Bismarck seemed checkmated. He and his associates of the Prussian war party, Moltke and Roon, were in despair, when Napoleon III. fatuously helped them by demanding an assurance that no Hohenzollern ever would accept the Spanish throne in the future. Benedetti, the French ambassador, stopped King William on the Parade at Ems to urge this demand, and the king, losing patience, turned his back. The Parisian press raged at this "insult to France," while Bismarck, by some judicious alterations in the despatch in which the king had described this incident, made it appear that the French government had insulted the Prussian sovereign, and the German press was ablaze. Public opinion was roused now in both countries and two almost absolute monarchs were forced to yield to it and go to war against their own desires.

In Morley's 'Life of Gladstone' it is recorded that Lord Aberdeen suffered "incessant self-reproach" for not having striven harder to prevent the Crimean war; and he asked Mr. Gladstone, who was a member of his Cabinet, whether he did not think that he (Lord Aberdeen) "might withdraw from office when we came to the declaration of war," as "all along he had been acting against his feelings." Mr. Gladstone, though sympathizing with Lord Aberdeen's antipathy to any except defensive war, said of the war against Russia: "The government are certainly giving effect to the public opinion of the day."

Many honest Democrats in America, and even some Republicans, doubted the wisdom of opposing secession by war. At the time of his inauguration President Lincoln had no conception of the terrible task before him. He thought in his first call upon the nation for troops that he was going to suppress the rebellion in three months with 75,000 men, an incredible blunder when it is remembered that the total number of men engaged on the Union side during the four years of war became 2,772,408. The press did its duty in that time of danger and doubt. But suppose it had not—suppose it had left public opinion apathetic—would Lincoln have dared to enforce the draft! Would he have dared to call out half the men of military age in the North? Would he have ventured to issue the Emancipation Proclamation? Would he not have offered compromises and concessions for the sake of peace? The public opinion of the North carried on the War for the Union. Lincoln, great genius and matchless leader though he was, was its masterful instrument.

In surveying the growing power of public opinion the journalist must become impressed with a sense of the grave responsibility resting upon all who have any share in the guidance of that mighty force. If he have imagination enough to picture to himself the consequences of inciting national animosities—if he can track reckless words to the grim realities that follow them, on the battle-field and in widowed homes, must he not recoil with horror and indignation from wanton provocation to war?

President McKinley was opposed to the war

with Spain, and, mild-mannered as he was, resisted Congress and the popular sentiment as long as he dared. Yet in the end he had to yield his well-known and freely expressed convictions to the demand of the public and the press, while Congress "held a stop-watch" on him to see that the yielding was not delayed. A less striking but still significant example is the historic fact that Mr. McKinley, who as a representative in Congress voted for the free and unlimited coinage of silver in 1877, became the candidate and champion of the gold standard party in 1896, owing to the change of public sentiment on this question in his own State and in the nation.

In our labor wars, too, public opinion presses with a force that is not to be resisted. In the great coal strike of 1902, the operators, the financial interests, the conservative business men, were almost without exception opposed to arbitration. Many appeals to arbitrate were rejected, yet in the end both sides submitted. To what? To the President of the United States? No! To public opinion, whose effective instrument the President was, and whose condemnation neither side dared to face. The President would never have ventured to take the initiative in the unprecedented, extra-constitutional course he adopted if the popular voice had not encouraged him; nor would he have been listened to if he had.

We witnessed in England in 1903, a most remarkable example of the development of public opinion. It was proposed to change the British tariff. Some centuries ago this would have been done by the king or his minister; later by Parliament. Now it was admitted on all hands that neither the king nor Parliament should have the determining voice in the decision. The House of Commons was gagged and the whole discussion was addressed to the people. Mr. Chamberlain resigned his place in the ministry on the ground, frankly admitted, that public opinion at the time was against his policy. The prime minister accepted his resignation with great regret for the same reason. Then Mr. Chamberlain set himself to convert the nation, and we see at this writing going on before us, with no election pending, the unprecedented spectacle of an appeal to public opinion outside of Parliament that may alter the commercial relations of the world.

Ex-President Cleveland has expressed his belief that "as a general rule the influence of newspapers in leading the judgments and determining the conduct of their readers has greatly diminished in recent years." There are more newspapers now than there were 50 years ago, and it is creditable to public opinion if it is unaffected by and even despises the teachings of many of them; for, if it responded to their appeals, its impulses would often be desperately bad—and dangerous to the republic. The influence of partisan and "organic" journalism has no doubt declined—greatly to the advantage both of the press and the country. But to say that the influence of Publicity has declined is equivalent to saying that the sun increases darkness; that facts and truth lose their effect in proportion as they become more widely disseminated.

Editorial influence—the power of the opinions of the paper as distinguished from its news—now depends almost altogether upon public



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confidence in the honesty, the freedom, the fearlessness and the moral purpose of the journal itself. The people have become very discriminating in this matter. They can detect the advocate of selfish syndicates as well as the equally selfish demagogue and blatant shouter against them. They have shown their appreciation of and confidence in newspapers that are absolutely independent and inflexible in their devotion to what they believe to be right — that "expose all frauds and shams and fight all public evils and abuses" without fear and without favor.

There have been too many notable instances of the influence of newspapers in forming and leading public opinion by their editorial utterances to leave any reasonable doubt as to the continued existence of this power. And this power will persist and increase precisely in proportion to the fidelity of the newspapers to the ideal and the duty of making the press a moral force in the community, serving and battling for the people with entire sincerity, disinterestedness, freedom and fearlessness. The question whether public opinion, however formed and guided, is always to be respected and obeyed admits of but one rational answer. The theory that "the voice of the people is the voice of God" can be accepted only with important reservations. As public opinion is a variable quantity, often, as Jefferson said, "changing with the rapidity of thought," it cannot possibly always be right. Was "the voice of the people the voice of God" when it sustained human slavery in a republic dedicated to freedom? Was public opinion infallible when it sanctioned the instant enfranchisement of a race just freed from the ignorance and barbarism of slavery? Or is it right now in practically acquiescing in the disfranchisement of the same race after a generation of freedom and progress in which their right to the suffrage has been guaranteed by the Constitution? There are often errors of interpretation by those who are most anxious to go with the multitude. Mr. Bryan mistook the hysteria of the Chicago Convention for a cry of the people for cheap money.

No! — nothing is more clear than that it is often the highest duty of the press to oppose public opinion. James Bryce has truly said that "Democracies will always have demagogues ready to feed their vanity and stir passions and exaggerate the feeling of the moment. What they need is men who will swim against the stream, will tell them their faults, will urge an argument all the more forcibly because it is unwelcome."

Public opinion rightly informed is our court of last appeal, and appeal may always be safely made to it against all the public wrongs, official corruption, popular apathy, or administrative faults; and an honest press is the effective instrument in making this appeal.

In the days of the Tweed Ring corruption rioted in the plunder of the city treasury, and as the Ring was in possession of all the administrative machinery and the courts the people seemed helpless. But the *New York Times* exposed the evil with relentless severity, and brought to bear the public opinion that routed the robbers. Tweed died in prison, and his associates sought safety in foreign countries as fugitives from justice. Another notable agitation of public opinion toward the correction

of great abuses, the Lexow investigation, was due to the combined endeavors of the whole press of New York city in exposing the infamous condition of our police system.

The Beef Trust, organized to enhance the price of food and thus to enrich a great corporation by the oppression of the people, was exposed and defeated by the appeal of the *New York Herald* to the same great tribunal of public opinion. At a moment when doubt was prevalent and public opinion was peculiarly in need of enlightenment touching dangerous propositions regarding the currency, the *Evening Post* did splendid service in fighting for the maintenance of the gold standard.

Upon the publication of President Cleveland's Venezuelan message, the *New York World* appealed to the good sense of the country against the war spirit which it was calculated to arouse. Opinions were invited and received by cable from the present king of England, from Mr. Gladstone, the Archbishop of Canterbury, and many other dignitaries of the Church and state in Great Britain disavowing any hostile intentions toward the United States and professing the warmest sentiments of kinship and friendship. Public opinion in this country instantly responded to these fraternal expressions, and the talk of war ended in preliminaries for arbitration.

To reveal public opinion, through interviews and special telegrams, and promptly publish it, is one of the most useful functions of the press. In 1895, deluded by the report that a certain syndicate had control of all the gold in the country, the government was prepared to sell to that syndicate its bonds for \$100,000,000, at 104½. But a telegram sent by the *New York World* to 14,000 banks, brought 7,100 replies within 12 hours, and more than \$235,000,000 in gold was offered to the Government in exchange for its bonds. As a result, President Cleveland annulled the secret contract with the private syndicate and issued a call for popular subscriptions. The entire issue was subscribed for six times over, at a price of about 112, instead of 104½, the syndicate's offer, a gain to the Treasury of more than \$7,000,000.

Agitation for a law taxing franchises was begun by the *World* newspaper in the winter of 1899. It tabulated the value of the franchises for the use of the public streets by street railways, gas companies, etc., from which the corporations reaped enormous profits and paid New York city practically nothing. Day after day the facts and figures were printed, showing the magnitude of the injustice. A bill to tax the franchises as property was introduced in the State senate. Petitions for its passage were circulated by the newspaper and received within a week 30,000 signatures. A special train was despatched from New York city to Albany bearing delegates from organizations of workingmen and taxpayers, representing 250,000 citizens and property valued at \$80,000,000, to demand a report of the bill from the legislative committee, in which corporation and political influence had tied it up. Many other newspapers of New York came to the support of the movement, and Gov. Roosevelt, as a result of this agitation, gave his official and personal influence in its behalf through a special message to the Legislature, which secured its passage.

Here was a concrete example of a right prin-



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ciple, based on justice and advocated with untiring persistence. It is such agitation as this that informs, arouses and leads public opinion in achieving reforms.

The necessity and the power of persistence and reiteration in attempts to create and to render effective public opinion are not sufficiently appreciated by the press or by individual reformers. To arrest the attention, convince the judgment and enlist the sympathetic support of that great inert mass which we call the Public is a delicate and difficult task. The press, as the chief medium of Publicity, is alone equal to it. And as the press does this work intelligently, conscientiously, courageously—disseminating intelligence as the sun diffuses light—so shall the power of public opinion make for justice in government, for purity in politics and for a higher morality in the business and social life of the nation.

JOSEPH PULITZER.

**Public Printer.** See GOVERNMENT PRINTING HOUSE.

**Public, or Common, Schools.** The idea of a free public school maintained entirely at municipal or state expense, and altogether under state and secular control is a modern development, which was not realized until the 19th century. The growth of democracy in the last hundred years has been one of the chief causes of the rapid advance of the free and secularized public school system. Only in the United States, however, has the public school system had a development such as a democratic society logically demands.

A system to be truly democratic must have the following characteristics: (1) It must be free to all; (2) it must extend over all stages of education; (3) it must have what is called the "educational ladder"; that is, pupils must be able to pass upward freely from one grade to the next higher; and (4) it must be patronized by all classes of the community.

It may fairly be claimed that the American public school system has now reached a stage where all these ends have been attained. In Germany, in France and until recently, at least, in England, public education has not been and is not even now, generally free, since, though most of the expenses have been met from public or institutional (usually religious) sources, each pupil unless a pauper has had to pay school fees. No educational ladder exists in those countries, for secondary education begins at eight or ten years of age and always in schools parallel to the elementary schools. The pupil who completes the public school at the age of fourteen must go back from four to six years if he wants to have a secondary education. In the United States, however, the pupil enters the high school without loss of time, since the high school begins where the elementary school ends. It naturally follows that in European countries only the children of the "lower classes" attend the elementary schools, and that it is only in exceptional cases that they ever find their way into schools of secondary and higher education. From the beginning, in those countries, the secondary schools, and later the universities, are patronized by the higher social classes, reinforced to some extent by the children of thrifty and ambitious members of the lower

ones. In sharp contrast to this state of affairs, it is the proud boast of the American school system at its best, that the public school is open to the poorest and is good enough for the highest; that in form, at least, the system is so organized that the road is open for every child in the republic to carry his mental development to the highest possible point; for not only are elementary and secondary schools free and properly articulated, but in most of the States a free education is offered also in the universities. It is furthermore a matter of daily observation that all classes of our population freely patronize the public schools. The only considerable exception is the private religious, or parochial, school, where the motive for segregation is religious, not social. Nearly 90 per cent of all children of elementary grade attend the public school.

*Colonial Beginnings of Public School Evolution.*—The beginnings of the free common school reach back to the earliest colonial times. In New England, at least, the predominant motive for promoting public education was religious rather than political. The elementary school of that period quickly merged into the academy or secondary school, where the promising lads were prepared for college. However, the idea that the early education should be free, and in considerable degree compulsory upon all, found early expression. The general court of Massachusetts in 1642 enjoined upon town authorities the duty of seeing that all children acquired at least the rudiments of an education. The order even went so far as to require the removal of children from those parents who persisted in bringing up their offspring in ignorance. The selectmen of every town were further required "to have a vigilant eye over their brethren and neighbors, to see that none of them shall suffer so much barbarism in any of their families, as not to endeavor to teach, by themselves or others, their children and apprentices, so much learning as may enable them perfectly to read the English tongue and (obtain) a knowledge of the capital laws; upon penalty of 20 shillings for each neglect therein." In 1635 Boston made public provision for the support of a school. The act of 1642 was greatly strengthened by the Massachusetts school law of 1647, which required all towns having 50 householders to "appoint one within their town to teach all such children as shall report to him, to write and read; whose wages shall be paid, either by the parents or masters of such children, or by the inhabitants in general," and which further required that where any town has increased to 100 families or householders, "they shall set up a grammar school, the master thereof being able to instruct youths so far as they may be fitted for the university." This law laid the foundations for the present free elementary and the free secondary, or high school, for though it did not insist that all school revenues should be raised by public taxation, it provided that they *might* be so raised, and it made the community responsible for the establishment and maintenance of schools for all its children. In 1638 New Haven set up a school under Ezekiel Cheever, who was paid "out of the common stock of the town." Rhode Island established a public school at Newport in 1640, and Provi-



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dence one, 20 years later. In 1633 the first Dutch schoolmaster arrived at Manhattan, when the first school tax, amounting to four pounds, was levied and collected. By 1650 the 800 inhabitants of New Amsterdam paid their schoolmasters regularly from the public treasury. The pay was doubtless meagre enough, but the principle of free public education was in active operation.

More or less rudimentary beginnings of public education are found in the older colonies, as in New Jersey, Pennsylvania, Virginia and the Carolinas. In the South, however, the free school idea was not so hospitably received as in New England and in New York. An oft-quoted expression by Governor Berkeley of Virginia may be cited. When the English Commissioners of Foreign Plantations asked what course was taken in Virginia for instructing the people in the Christian religion, Governor Berkeley replied, "The same that is taken in England out of towns, every man according to his ability instructing his children." He also added, "I thank God there are no free schools nor printing presses, and I hope we shall not have them these hundred years; for learning has brought disobedience, and heresy, and sects into the world, and printing has divulged them and libels against the best of governments: God keep us from both!" So far as Virginia and the remainder of the South were concerned, good Governor Berkeley had his wish, for it was not until after the Civil War that that section of the United States was supplied with anything like a system of free public schools.

*The Revolutionary Period.*—In all European countries at this period, the financial responsibility for the education of children was held to belong to the parents, so that neither state nor community, religious or charitable organization, ever desired to make education free, except for children of paupers or others unable to meet the expense. The idea that free schools are only for paupers or the very poor, permeated most of the American colonies during the Revolutionary period of American education. Even where the schools were not strictly private, the "rate-bill" for all who could pay was a common device for helping to meet the expenses of the school. This idea prevailed in Pennsylvania, Rhode Island, New York, New Jersey and the South. Some States raised taxes to school the paupers, but they made those pay who could do so. Only in Massachusetts and in the more democratic settlements west of the Alleghany Mountains did the pauper idea of free schools fail to obtain a firm hold upon the people. The fees were collected in various forms. In cities the assessment was usually in money; in country districts both east and west the rate frequently included a period of board for the teacher, who was thus obliged to "board round" among the families of his district. By 1848 all fees were abolished in Rhode Island. They lasted until 1864 in Vermont, 1867 in New York, 1868 in Connecticut, and until 1871 in New Jersey.

*Development of State Control.*—From the earliest times in America the responsibility for the support of schools was focused upon the settlement, village or town, never upon the colony, or later upon the State as a political entity. This condition of things lasted well into the first quarter of the 19th century. Since that

time, however, there has been a steady advance toward State support, supervision, and control of public elementary education. In no State of the American union has the right to control the public schools been abruptly assumed by State authority; on the contrary, State control has sprung almost spontaneously from natural conditions, chief among which have been the rapid growth of population, and the equally rapid growth of State school funds. The process has been somewhat as follows: As soon as a given State, say Illinois, had at its disposal a considerable amount of money for annual distribution among the school districts, it was natural that the legislature should lay down the conditions with which the districts must comply in order to enjoy such aid. Among the first things prescribed would naturally be (1) a minimum number of days during which the school must be held in session; (2) a course of study that must be taught; (3) the certification of teachers, usually by county authority, but in subjects prescribed by the State. Again, individual communities, however loath to relinquish the management of their own school affairs in their own way, have been obliged to bow to the will of the State, in so far as it saw fit to assert its authority since the power to levy and collect taxes is derived directly from the State. At present all State constitutions contain provisions relating to popular education.

The idea that has everywhere prevailed is that the State should in every way possible stimulate local interest and local effort for the support and improvement of schools, laying its hand of authority only upon those general essentials of the school system which are indispensable to efficiency. This is why the American public school system has manifested such astonishing elasticity. Every community can have as good or as poor schools (down to a certain point) as it desires. The salaries may be high or low, the equipment ample or inadequate, the schools backward or progressive as the community wills. Again, this elasticity is felt also within the teaching body, quite aside from the general tone of the community. It is not uncommon to find public sentiment quickened and elevated by a corps of teachers led by an active and progressive superintendent. The absence of restrictive State control as to subject-matter, methods of teaching, and school organization opens the door to individual initiative, and to consequent progress. The interaction of the two influences, that of the State on the one hand, with its general prescriptions and supervision, and that of the local community, on the other, with its power of adjustment to circumstances, makes the American school system the most perfect adaptation to democratic needs that is to be found in the world. Any civilized European system maintains standards with respect to given particulars that the American public school as a whole can by no means measure up to; but it may be confidently asserted that no European system, however excellent, could, if put into operation in an American State, produce results so wholesome and excellent as those that come from the present system.

*The Growth of Public School Funds.*—Individual States began at a very early period to establish permanent funds for the support of common schools. In 1795 the lands known as



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the "Western Reserve," held by Connecticut, were sold for \$1,000,000, and the money turned into the school fund. New York also made provision for common schools by setting aside a portion of the public lands for this purpose. New Hampshire began a school fund by exacting one half of one per cent upon the capital of banks within the State. Other States made similar but less effective efforts, a favorite means being the granting of lottery privileges for the raising of funds. Much more fruitful sources of permanent school funds in the several States have been congressional land grants that have been made from time to time out of the unsettled government land lying to the west of the original colonies. Each of the States subsequently carved from this vast territory, received a grant varying from one to three sections from each township for school purposes. In addition to the direct appropriation of land, it has been the policy of the government to turn into the State treasuries, also, a percentage of the net proceeds from the sale of public lands within their borders. In some States, the school lands were sold at an early date at low prices; in others the lands are held to the present day. By act of Congress 1836 a surplus in the United States treasury was distributed among the States. The amount actually given was something less than \$30,000,000. In 16 of the 26 States then existing, this money was appropriated in whole or in part to the permanent schools' funds. The present total annual income from permanent school funds and the rent of school lands is something over \$10,500,000, but this amount is very unevenly distributed among the States. When we consider that the total annual expenditure for public schools now closely approximates \$250,000,000, it can be seen that the income from permanent funds forms but a small fraction of what is actually expended; yet it would be an error to assume that the influence of these public funds has been limited to their comparative magnitude.

*Systems of Administration.*—Developing as the public school has done from the individual settlement as the starting point, it can easily be understood why the district system of administration has been so potent in the past, and why in some States the people still cling so persistently to this form of management. The "school district," our oldest and most primary form of school organization, is the smallest civil division of our political system. It was early recognized by law and given legal functions and responsibilities. The district manages its school affairs in a simple way, a board of directors or trustees, usually three in number, being elected to employ the teacher, determine the amount of money to be expended, and in general to conduct the school affairs of the district. This is the most elementary and at the same time the most democratic of methods for school administration. It is particularly well fitted to sparsely settled sections of country, but not so well adapted to denser populations, since it prevents the efficiency that arises from consolidation.

The township system forms the next natural stage in the development of school administration, since it is based on a convenient political unit, not too large for effective local direction. In this system, one set of officers conduct the educational affairs of the whole township, erect-

ing buildings where they will best accommodate the people, employing teachers, grading the schools, in many cases providing for the transportation of children to and from school, and usually crowning the whole with a township high school, to which pupils may be promoted upon the completion of their elementary course. The State of Indiana has been a pioneer in introducing the township system. A number of other States have adopted it wholly or in part. See EDUCATIONAL ORGANIZATION: (a) *Township System*.

Most if not all the Southern States have a county system of school administration, because there the county rather than the township is the unit of government. While in the Northern States the county has never been the unit for civil or for educational organization, it is and has long been the unit for supervision of schools. With but few exceptions each county has a superintendent whose chief duties are: (1) the certification of teachers; (2) the personal supervision of the schools through visitation; (3) the conducting of teacher' institutes. See EDUCATIONAL ORGANIZATION: (b) *County System*.

The foregoing organization exists chiefly for the administration of rural and village schools. Nothing has been more marked than the development of cities. It is obvious that administration through the primitive district system would soon become altogether inadequate for the needs of a city. Legislatures have accordingly made special laws to meet the needs of cities of various classes. The largest cities in a State, like New York city, Buffalo, and Rochester, in New York, usually have special charters enabling them to conduct their schools as they deem best. Cities as a rule have Boards of Education for the administration of the system. These boards differ greatly in size and in the manner of their appointment. In most cities the members are elected by the people for stated periods, sometimes at large, sometimes by wards or sub-districts. In some of the larger cities the members are appointed by the mayor and city council acting jointly. See EDUCATIONAL ORGANIZATION: (c) *City School Systems*.

*Housing and Equipment.*—Nothing is more noteworthy than the development of public school architecture in the United States. In full accord with its democratic genesis, the housing and equipment reflects completely the educational status of the community. The rural school may be a mere unsightly box with the most primitive apparatus; or it may be an artistic building, adequate in size, well heated, lighted and ventilated, supplied with separate wardrobes for boys and girls, and equipped with needed books and apparatus. State and county superintendents have done much to inform their respective rural communities of what is desirable and practicable in country school houses, furnishing freely plans and specifications, and even providing the builders with complete models for their guidance. In the State of Missouri over 600 rural school houses were erected in a short time in accordance with a model furnished by the State Superintendent of Public Instruction. The cost of a building of this type was \$600.

The elementary school covering a period of eight years, the most common type of graded-school building in towns and small cities is



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the eight-room school house,—one room for each grade. The heating, ventilating and lighting of such a building has become an important problem. This problem is rendered much more complex in cities where the plan must be enlarged to accommodate from 1,000 to 4,000 pupils. A typical class room in such a building should be approximately 24 x 32 feet in dimensions, and from 13 to 14 feet in height; it should be lighted entirely from one of its longer sides, the windows reaching to the ceilings; about 2,000 cubic feet of pure warm air per hour should be provided for each pupil; and each room should be provided with a convenient wardrobe. By the use of steam indirect heating, supplemented by "plenum" and "exhaust" fans run by steam or electric power, it has been found practicable to meet the foregoing conditions of heating and ventilating. Practically all of the modern city school buildings secure these most desirable ends. The buildings are usually an architectural ornament to the neighborhood in which they stand. It has gradually come about, therefore, that the public school is one of the best housed institutions of modern society. In the poorer districts of large cities, the school buildings are the palaces of the people; they are moreover the places where the children of the slums find warmth, light, pure air, beauty, and sympathetic humane treatment from their teachers. It is here that their hearts are warmed, their minds developed and supplied with useful and inspiring knowledge; it is here that they are enabled to rise to higher planes of living, and to prepare themselves for a worthier citizenship than their humble origin would seem to warrant. In well-to-do districts of the city, the same beneficent physical surroundings contribute more than any other instrumentality of society to develop the best that there is in democracy. To understand how these forces of the modern school work together to produce the American citizen, the reader is referred to the article by Dr. Wm. T. Harris, U. S. Commissioner of Education. See EDUCATION, ELEMENTARY.

*The Sex of the Teaching Force.*—For the first time in history, society has, since the beginning of the 19th century, undertaken to educate all its children, boys and girls alike. Before that time only certain classes of boys were educated, invariably by men teachers. With the new duty there appeared a new means, namely, the employment of women as teachers. So long as women remained uneducated, it occurred to no one, least of all the women themselves, that they could teach. So long as they could find productive labor in the home, as they could until steam-power and machinery drove industries to the factory, women felt no especial need of a new calling. But when remunerative labor for women failed in the home, when the schools began to educate them along with their brothers, and when the new social undertaking of universal education began to clamor for more and cheaper teachers, then it was that the world awoke to the fact that it had in its midst a new and hitherto unused force—its young unmarried women. Women began to be employed as teachers in large numbers in the United States before 1850, especially in the New England States, where the first normal schools were established. The period of the Civil War saw a rapid increase, owing to the natural withdrawal of the

young men in order to enlist as soldiers. Since the close of the War the percentage of women in the schoolroom has steadily and rapidly increased throughout the Union, until in the cities, at least, men are rarely found as teachers in the grades. They are still employed to some extent in rural schools, especially in the newer States. The following table shows the increase in the number of women teachers in 13 typical States since 1855:

STATES	1855	1875	1880	1886	1902
Vermont.....	21	85	83	88	82
Pennsylvania...	33	50	52	83	87
New Jersey....	39	71	76	79	87
Iowa.....	44	63	67	76	86
Indiana.....	21	42	48	49	55
Illinois.....	39	57	61	67	75
Rhode Island...	60	80	78	87	91
Missouri.....	21	39	43	40	66
Connecticut.....	64	76	76	82	91
Massachusetts...	74	88	87	89	91
New Hampshire	74	86	83	88	91
Ohio.....	46	46	52	56	62
Maine.....	61	69	67	65	86

The women now number 72.2 per cent of all the teachers in public elementary and high schools of the whole Union, while in city elementary schools they rarely number less than 90 per cent of all teachers. In New York State high schools about two thirds of the teachers are women. The same phenomenon is seen in foreign countries, but the increase in the number of women teachers there has in general been less rapid. In Great Britain and Ireland the increase has been from 54.3 per cent in 1870 to 75.3 per cent in 1900. If one may judge by the attendance at the normal schools, the number of men and women in French elementary schools is about equal. In Germany, as a whole, less than 20 per cent of all elementary teachers are women. In Italy, however, 93 per cent of the students of normal schools are young women, though the women form only about 58 per cent of the whole elementary teaching force. In the 11 State normal schools of Massachusetts there are 117 men, and 1,743, or 93.3 per cent, women students.

The large, almost exclusive, employment of women as elementary teachers is the newest thing in our civilization. It is difficult as yet to interpret its full significance. There is no doubt that society has been well served at very small expense. The economic motive constantly appealing to communities that do not like high taxes is that they can get better teaching from women for a small sum than they can from men. A first-class woman teacher, they say, is always to be preferred to a second-rate man at the same salary. The assumption is that vigorous, active, well-prepared men can do better financially out of than in the school, and that only second-rate men will accept women's salaries. Ultimately, if the feminization of the school should prove not to be for the best welfare of society, it is pretty evident that the additional cost will not prevent the employment of a suitable number of men. The public school system may be said to be now in its "brick and mortar" stage, for it is expending vast sums to house and equip the school. When this has been done, the resources of the community may easily be turned to the improvement of the teaching force. President



## PUBLIC WORKS—PUBLICANI

Eliot of Harvard University argues that the people ought not to spend less upon the minds of their children than they do upon their food. Were this standard attained, it is probable that school support would be quadrupled. So far as present experience teaches, it seems evident that for the first four or five years of school life women are the natural and the more efficient teachers. When it comes to the early years of puberty, society still holds theoretically that the influence of men is essential to the proper unfolding of the minds and characters of both boys and girls. It is this conviction which, for the most part, enables the non-sectarian private school to maintain its existence in the more wealthy communities. It is probable, notwithstanding the aforementioned theory that men are indispensable as teachers of youth, that the availability of women and the difficulty of holding the right type of men in such positions, will confirm the present custom of almost exclusively employing women for grade teaching.

*The Development of the Public School Curriculum.*—Down to 1837, when Massachusetts created her board of education and placed Horace Mann at its head, the curriculum of schools not fitting boys for college was limited to the bare acquisition of the school arts, spelling, reading, writing, ciphering, relieved by a trifle of geography and history. The discipline was always rigid and sometimes harsh; the school term was short and the years of schooling few; the path of learning was not strewn with roses; but the intellectual, like the moral, discipline did honor to the straitest notions of our Puritan forefathers. In his seventh annual report, Mr. Mann, who had visited schools abroad, especially in Germany, where the new philosophy of Pestalozzi was earnestly applied, attacked with great vigor the old curriculum, the old Puritanic ideals, and the old unsympathetic methods of teaching. He demanded new subjects more suitable to children, more humane and sympathetic treatment of pupils, and new ideals of the ends to be attained by education. These criticisms and demands led to a spirited battle between Mr. Mann and his admirers and the "Thirty-one Boston Schoolmasters," who defended the old-time rigorism in study and discipline. The result was a drawn battle. The reformers succeeded in getting their ideals and watchwords accepted, but the conservatives preserved the old curriculum practically unchanged. It was, however, a great advance to have the new ideals of character-forming accepted as a supreme end of education. Even if the school were to be confined to the acquisition of the school arts, it was a vast improvement to have the new methods everywhere put into practice, for now the concrete was made to precede the abstract, facts came before principles, and inductive reasoning enlivened and enlightened the old-time memory drills and mechanical application of rules. The school term was gradually lengthened, and with this there came a perceptible thought-enrichment of the studies by means of which the children were drilled in the use of the tools of knowledge.

This condition of things lasted until after the period of the Civil War, when the rapid development of the public high school, the still more remarkable expansion of the university curriculum, and the rise of all sorts of social

organizations for the moral and economic welfare of the community, forced upon the public school an amount of new subject-matter that is little short of astounding. As already explained, the old curriculum was mostly confined to the studies through which the child was drilled in the use of the school arts. The children learned to read, but they never read anything; they learned to spell and write and parse, but they produced nothing more than an occasional school essay. But now behold how this old course of study has been "enriched!"—(1) by copious amounts of literature suitable to every grade, not only in the elementary but in the high school as well; (2) by systematic "language lessons" throughout the full course; (3) by the occasional introduction of elementary algebra and concrete geometry in the seventh and eighth grades; (4) by four years of history and as many of geography; (5) by nature work in all the grades; (6) by a course in manual training or "occupations" throughout the whole elementary period; (7) by extensive acquisition in fine arts, such as drawing, painting, molding, and music; and finally (8) by an obligatory course in physiology and hygiene, accompanied by what is called scientific temperance instruction.

The foregoing may be called reform by addition. Heretofore the method of relief from a congested curriculum has been by subtraction. When the "reform" forces of a community have been in the ascendancy, the new subjects have been added; when, on account of complaints of taxpayers, parents and children, the wave of reform has receded, the new subjects, then called "fads," are dropped, and the curriculum assumes something of its old-time proportions. Obviously some method better than that of addition and subtraction is needed for overcoming this obtrusive dualism in the course of study. That of organization has been suggested by Prof. John Dewey, whereby the school arts shall be made to emerge from the acquisition of extensive bodies of life-giving knowledge. To effect this reform, however, teachers must be better trained, school facilities must be increased, and, most important of all, teachers must have smaller classes. The ideal public school of the future will not require one teacher to teach more than 20 children. Now the number often rises to 60.

For statistics of the public school, see EDUCATION, ELEMENTARY.

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**Public Works, School of.** See POLYTECHNIQUE, THE.

**Publicani**, pŭb-lĭ-kā'nī, Roman farmers of the public revenues. In ancient Rome the privilege of collecting revenues from foreign dis-



## PUBLIC OCCURRENCES

tricts dependent upon Rome was sold at auction by the censors for a period of five years. The security required by the state from these tax-gatherers was usually the price at which they had purchased the branch of revenue to be collected and frequently was far in excess of the wealth of any single bidder, which resulted in the formation of companies for the purpose, called *Socii*. Their business with the state was conducted under the name of one member designated the *manceps*. The farmers of the revenue were of the wealthiest classes. None but Roman citizens could be a member of the publicani and magistrates and governors of provinces were not eligible. The revenues were derived principally from tolls, tithes, mining duties, and *scriptura* (tax levied for the use of

the public pasture lands). The collections were made by an inferior class who were often freedmen or slaves in the employ of the company and were cordially detested by populace. The high price paid for the privilege and the greed of the publicani resulted in great injustice which together with the character of the collectors explains the bitterness with which they are mentioned in the New Testament. From about 150 B.C. they were usually of the equestrian order.

**Publick Occurrences**, the first newspaper published in America, though it can hardly be called a newspaper, as no second number appeared. It was issued at Boston in 1690 by Benjamin Harris and printed by Richard Pierce. See AMERICAN NEWSPAPERS.























